Learning in a changing climate: an ethnographic study from the Global South

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Doctor of Philosophy

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Certificate of original authorship

I, Raviro Chineka declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy degree in the School of Education, Faculty of Arts and Social Sciences at the University of Technology Sydney. This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis. This document has not been submitted for qualifications at any other academic institution.

This research is supported by the Australian Government Research Training Program.

Signature: Production Note: Signature removed prior to publication. Date: 9 April 2019

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This dissertation is my own work, but it would have not been possible to accomplish without the input of several individuals and organisations, too many to mention by name. However, I will name a few prominent contributors.

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Statement indicating format of thesis

This is a conventional thesis.

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List of acronyms

ABC-	Attitude Behaviour Choice
AEO-	Agricultural Extension Officer
Agritex-	Agricultural Research and Technical Services
AIDS-	Acquired Immuno Deficiency Virus
ATR-	African Traditional Religion
CC-	Climate Change
CD-	Compact Disc
CCE-	Climate Change Education
CCEL-	Climate Change Education and Learning
CHAT-	Cultural Historical Activity Theory
DA-	District Administrator
EE-	Environmental Education
EMA-	Environmental Management Agency
ESC-	Eco-Schools Club
ESP-	Eco-Schools Programme
ESD-	Education for Sustainable Development
GHG-	Green House Gas
GoZ -	Government of Zimbabwe
HIV-	Human Immuno Deficiency Virus
ICT-	Information Communication Technologies
IPCC-	Intergovernmental Panel on Climate Change
IUCN-	The World Conservation Union
MEWC-	Ministry of Environment Water and Climate
MoPSE-	Ministry of Primary and Secondary Education
NCCRS-	National Climate Change Response Strategy
NGO-	Non-Governmental Organisation

PUS-	Public Understanding of Science
SMS-	Short Text Message
STS-	Science Technology and Society
TV-	Television
UK-	United Kingdom
UN-	United Nations
UNEP-	United Nations Environment Programme
UNESCO-	United Nations Education Scientific and Cultural Organisation
UNFCCCC-	United Nations Framework Convention on Combating Climate Change
USD-	United States Dollar
UTS-	University of Technology Sydney
WWF-	World Wide Fund for Nature
ZIMSTATS-	Zimbabwe Statistics Office
ZPD-	Zone for Proximal Development
ZP'S'D-	Zone of Proximal 'Safe' Development

Abstract

Adaptation to climate change has become an undeniable reality intricately linked to human existence and the planet's well-being. Historically, climate change adaptation research has been dominated by the physical sciences typically modelled around Global North perspectives. This study investigates how people in the Global South, in a largely agricultural community in Zimbabwe learn to change and adapt their everyday practices in response to climate change.

An ethnographic approach involving fieldwork data from observations, narratives and photography from eight families purposively drawn from 30 families whose children belonged to a local school's Eco-Schools Club (ESC) provided the data. It was anticipated, based literature that intergenerational learning would be evident in these families as the children gained scientific knowledge about climate change mitigation and adaptation through the ESC.

The study drew upon Engeström's Cultural Historical Activity Theory to analyse the possibilities of expansive learning, that is learning leading to radical and sustainable change, by examining how disturbances to the socio-material configuration of existing practices are managed.

Contrary to reports from the Global North, the ESC was not a dominant source of learning because of the status traditionally ascribed to children within the community, and the criticality of the issue the knowledge would impact upon. Learning and change reflected in the families' everyday practices was motivated most profoundly by the threat of *Nzara* (food insecurity). Changes occurred not through ready adoption of the abundant advice available to them, including from technical experts; learning was incremental, precipitated by questioning and reflection of existing knowledge and practices and evaluating innovations within a collective zone of proximal development (ZPD). Community members collectively gained new knowledge eventually altering some stable elements within existing practices. The collective ZPD significantly influenced changes because individual households felt secure if others were willing to experiment with a different approach. Thus, the collective ZPD could be conceptualised as a zone of proximal 'safe' development (ZPSD).

As the driver for change, climate change, was itself intractable achieving any single sustainable practice is, unlikely; the likely future is a continuing cycle of learning and change. The study proposes a new way of approaching interventions. Interventions may be reconceptualised not as solutions but sources of learning where learning extends beyond community members to include technical experts in mutual settings where knowledge is co-produced and diverse perspectives negotiated.

Chapter 1: Introduction

1.0 Introduction

Chapter 1 outlines the aims and scope of this doctoral thesis which sought to investigate what propels people to change and adapt their everyday practices in response to climate change, and what learning occurs in this process. The study seeks to add to the body of knowledge in climate change education, learning and adaptation. The human-induced unprecedented rise in global temperatures and the consequent irreversible environmental damage has made it an imperative to reduce communities' vulnerability and increase their resilience to the impacts of climate change: if learning is not part of the adaptation process, it is doubtful that the adaptation will be sustainable.

I first provide the background to my study by reviewing key issues of concern in climate change learning and adaptation from a global perspective and then from the perspective of the situation in Zimbabwe, the location of my study. This leads me to presenting the rationale for the study and an articulation of my research questions and how they were investigated. This is followed by a brief analysis of the research context, an outline of the thesis and a conclusion.

1.1 Contextual background

The doctoral study investigated how people develop understandings about climate change as they adapt their everyday practices in response to impacts of climate change. The study focused on people's everyday social practices and how they changed, in a community in Zimbabwe largely dependent on farming. This community was one of the communities in Zimbabwe that had been grappling with the impacts of climate change. By everyday practices, I am referring to the shared, routine and everyday activities in which members of a given community routinely engage (Shove, Watson & Spurling 2015). The study then analysed what if anything people in this community were learning through adapting their everyday practices in response to the changing climate.

Through studying climate change *in situ*, the longer-term aim of the study was to gain insights into the design of climate change interventions. The more immediate goal

was to build knowledge on education's role in enhancing community members' resilience and reducing their vulnerability to the impacts of climate change. In the following section, I present an overview of the contexts of climate change adaptation studies, both globally and in Zimbabwe, before outlining the research questions.

1.2 Learning for climate change mitigation and adaptation

1.2.1 The global picture

While there have been considerable debates and controversy about the real causes and impacts of climate change, there is substantial scientific evidence suggesting climate change is real and its impacts are already being felt (Carr 2018; Cinner et al 2018; Intergovernmental Panel on Climate Change (IPCC) 2014; Miller & Sladek 2011; Peters 2018; Whitmarsh, Seyfang & O'Neil 2010). Climate scientists predict that global temperatures will continue to rise at an even faster pace than in the past century; although humans were to significantly reduce greenhouse gas emissions, we have reached a stage where the damage caused by the present is irreversible (Carr 2018; Peters 2018). Thus, the impacts of climate change, including but not limited to rising sea levels, increase in intensity and frequency of heat waves, droughts and floods may continue to be felt for some time (Abid et al 2016; Burandt & Barth 2010; Carr 2018; Cinner et al 2018; Eriksen et al 2011; Mal, Singh, Huggel & Grover 2018; Mortreux, de Campos & Adger 2018).

Compounding that, knowledge about the causes and the nature and extent of the impacts of climate change is still incomplete and difficult to assess; climate change is highly unpredictable and is marred with risk, uncertainty and controversy (Baer and Singer 2018; Carr 2018; Florian, Bruno & Sandrine 2018; Lacey, Howden, Cvitanovic & Colvin 2018; Peters 2018; van der Hel, Hellsten, & Steen 2018). It is often argued that climate change is something that we have to learn to live with because it is an exemplar of a wicked problem: intractable and possibly impossible to resolve (Head 2018; FitzGibbon & Mensah 2012; Lehtonen, Salonen, Cantell & Riuttanen 2018; Peters 2018). Consequently, there are calls to strengthen communities' resilience to reduce their vulnerability to the impacts of climate change (Bennet, Blythe, Tyler & Ban 2015; Carr 2018; Klockera, Head, Dunb & Spaven 2018; Mase, Gramig & Prokopy 2017; Mortreux et al 2018).

While the role of sound climate knowledge is acknowledged in informing appropriate action and policy formulation for climate change mitigation and adaptation, the process of integrating climate science knowledge into policies and actions is rather complex (Dodman & Mitlin 2015; Duckett et al 2014; Lacey et al 2018; Nidumoli, Lim-Camacho, Gaillard, Haymen & Howden 2018; Rose 2018; Steg 2018; Sword-Daniels et al 2018). The complexities emanate from the nature of climate change; it is often politicised, highly complex and marred with uncertainty and controversy, making issues of trust between users and producers of knowledge highly delicate (Albe and Pedretti 2013; Lacey et al 2018; Lorono-Leturiondo et al 2018). This is not helped by climate change deniers and climate miscommunication that has left information users, including policy makers, industry and the general public, confused (Cooper 2011; Freeman 2018; Nidumoli et al 2018; Pidgeon 2012; Poortinga, Spence, Whitmarsh, Capstick, & Pidgeon, 2011; Roozenbeek & van der Linden 2018; Whitman, Zhao, Roberts & Todd 2018).

Climate change adaptation research has been dominated by the tools and methods of the physical sciences, typically modelled along the perspectives of the Global North (Bhatasara 2017; Burch et al 2014). This assumed supremacy of Western science has been challenged because climate change has other dimensions that lie beyond the scope of the physical sciences (Adger et al 2009; 2013; Baer and Singer 2018; Cliford and Travis 2018; Head 2010; Holm et al 2013; Lacey et al 2018; Lehtonen, Salonen, Cantell & Riuttanen 2018; McLaughlin 2011; Shove 2010a; 2010b). There are calls for research that embraces the socio-cultural context across the disciplinary divide (O'Brien et al 2013; Fam, Palmer, Riedy and Mitchell 2017; Steg 2018) to create what Dedeurwaerdere (2014) called 'socially robust' knowledge (knowledge that bridges the gap between academic and practical knowledge) and Engeström and Sannino (2017) called socially impactful knowledge: 'knowledge that can be turned into transformative action' (p. 81).

However, it is not fully understood how sustainability transformations are triggered (Lotz-Sisitka, Mukute, Chikunda, Baloi & Pesanayi 2017; O'Brien 2012; Steg 2018). Compounding that, research from socio-cultural and sustainability perspectives has been predominantly conducted in the Global North. While a few studies have been conducted in the Global South (e.g. Lotz-Sisitka et al 2016; 2017; Lotz-Sisitka &

Kronlid 2009; Mukute, Mudokwani, McAllister & Nyikahadzoi 2018), climate change education and learning (CCEL) is a new and evolving field that is largely under-researched (Hess and Collins 2018; Linden, Leiserowitz, Rosenthal & Maibach 2017; Stevenson et al 2017), particularly so in the Global South. Moreover, while it has been widely acknowledged that learning leads to sustainability transitions, the degree to which learning can drive people to engage with climate change is not yet fully understood (Balsiger et al 2017; Filho, Pace & Monalas 2010; Filho et al 2018; Lehtonen et al 2018; Lotz-Sisitka et al 2016; 2017; O'Donoghue 2018; Olvitt, Lotz-Sisitka, Læssøe & Jørgensen 2018; Tschakert et al 2014; 2016).

For Zimbabwe, specifically, while government recognises the key role of education and learning in assisting individuals to learn to adapt to climate change through the national climate change response strategy (NCCRS) enacted in 2016, at the time the study was concluded, the country did not have a national climate change education policy and strategy to translate the bold vision of the NCCRS into actionable plans and strategies that inform the education sector's response to climate change. Climate change is still treated under the more traditional concepts of environmental education (EE) and education for sustainable development (ESD). Consequently, climate change education and learning is informed by policies that were developed to guide environmental and sustainability education. Despite efforts at reviewing curricular at all levels of education, climate change remained a peripheral topic, addressed mainly as a peripheral domain of science education and reflected in subjects such as geography and agriculture (B. Chabikwa, personal communication, February 23, 2017; Government of Zimbabwe (GoZ) 2016; Chineka & Chabikwa 2016; G. Motsi, personal communication, June 16, 2016).

Additionally, tertiary education, particularly teacher education and training, agricultural training and other agro-services advisers, and civil society organisations have been identified as key players in advancing climate change education and learning (GoZ 2016) and yet there is no nationally coordinated framework and strategy to guide how the different players ought to translate the bold vision of the NCCRS into tangible action plans. Previous studies have shown that climate change education and learning in Zimbabwe is piecemeal and largely uncoordinated (Chineka & Chabikwa 2015; GoZ 2016; Nhamo & Shava 2015). My study therefore

may contribute to informing the development of a climate change education and learning policy for Zimbabwe.

It is argued that if adaptation to the impacts of climate change were to be a transition to sustainability, learning must be transformative and transgressive, that is, radical, socially engaging and questioning the unquestioned norms and practices that perpetuate unsustainable life styles and patterns of production (Hart & Bell 2013; Lotz-Sisitka et al 2015; Mukute et al 2018; Olvitt et al 2018; Stevenson, Nichols & Whitehouse 2017). Sustainability transitions are enduring, multi-faceted fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption (Markard et al 2012). Often, such transformations are deliberately initiated. Key questions for education research which have been identified by previous studies (e.g. Balsiger et al 2017; Mochizuku & Brian 2015; Lotz-Sisitka et al 2017; O'Donoghue 2014; 2018) informed my study and include the following. How does learning trigger transformations and how can the transformations be sustained; what is learned and what knowledge is shared and how does the sharing occur as people adapt to climate change? Who within the community determines what is valued and worth learning and sharing? What are the barriers and affordances to learning and change? By studying the learning that occurred in real life settings as people made adaptations to climate change, my study yielded findings upon which future learning interventions might be built.

Until recently, climate change response strategies tended to be driven from a global perspective, where outside 'experts' would take centre stage in proposing solutions for communities affected by climate change. This was largely due to the influence of global partnerships such as the IPCC and the United Nations (UN). This approach to research has been argued to be influenced by the scientific, mechanistic and deterministic paradigm that regards science as a universal truth (Gonzalez-Gaudiano & Meira Cartea 2010; Wilbanks & Kates, Travis & Wilbanks 2012). There are calls for conducting more localised studies because although climate change is a global phenomenon, its impacts are localised (Cinner et al 2018; Granderson 2014; Wibeck 2014). Cognisant of the above, I adopted an ethnographic approach and a socio-cultural lens to study the informal learning that took place as people adapted their

lives to climate change in a largely farming community in Zimbabwe, a Global South context.

As I sought to create 'socially robust' knowledge, the study adopted a multidisciplinary approach as I drew on literature from the fields of climate change adaptation; socio-cultural studies of learning; environmental and sustainability studies; science, technology and society (STS); and the public understanding of science (PUS). As a science educator from Zimbabwe concerned to see communities make sustainable transitions to their changing environment, I sought to investigate the affordances for and barriers to people's learning about, and acting around, the impacts of climate change. As I sought to understand climate change adaptation from a sustainability transitions perspective, I was particularly interested in investigating the possibilities of adaptation in terms of what Engeström (2000; 2016) called 'expansive learning'; that is, radical and sustainable transformation of everyday practices, in response to climate change. Engeström's cultural historical activity theory (CHAT) provided a theoretical lens in the study for noticing and analysing processes of expansive learning. Over and above a CHAT lens, I analysed adaptation from a sustainability transitions perspective, because not all adaptations are sustainable. The study yielded findings which offer a new way of conceptualising climate change interventions, as discussed in Chapter 11.

In the next section, I discuss the imperative for studying climate change adaptation and learning in Zimbabwe.

1.2.2 Climate change: The Zimbabwean experience and responses

1.2.2.1 The changing physical environment and its consequences

> Southern Africa has been warming significantly over the last century. For the period 1961 to 2014, temperatures over the region have increased at a rate of 0.4 °C per decade. Historical rain patterns are characterised by strong inter-annual and inter-decadal variability and there is little evidence for a substantial drying or wetting over the region… (Davis-Reddy 2017, p. 6)

Situated in Southern Africa, Zimbabwe is a landlocked country located entirely in the tropics between the latitudes of 15° and 23° south of the equator and the longitudes of 25° and 34° east of the Greenwich Meridian (Government of Zimbabwe [GoZ]

2012). The study site is lies within coordinates 18° 40' 57" south, 17° 55' 24" north, 31° 23' 40" east and 30° 41' 52" west of the country. What I present here is not necessarily what is happening in the country now, but what has been regarded as the normal climate of Zimbabwe over a considerable period of time. Due to its location in the tropics, Zimbabwe's climate is sub-tropical with four seasons: summer, autumn, winter and spring (Bhatasara 2017; GoZ 2012). The facts and figures presented here are reported in the official GoZ (2012) publication. Ordinarily, winters are cool and dry and begin in mid-May and end in August. September to mid-November is the spring season and is usually hot and dry. Summer, the main rain season, begins in mid-November and stretches to mid-March. The post rain season, spring, spans from mid-March to mid-May.

Mean monthly temperatures range between 15°C in July and 24°C in November. The lowest temperatures are usually recorded in June or July (7°C) with the highest temperatures being recorded in October (29°C). The mean annual temperature, however, varies between 18°C on the Highveldt to 23°C in the Lowveldt. Overall, Zimbabwe is a semi-arid country characterised by low annual rainfall reliability.

Due to its geographical location, Zimbabwe is highly vulnerable to climate change; scientists have warned that although Africa contributes only 3.6% of greenhouse gases, Africa is at the greatest risk of climate change due to its geographical location and underdevelopment that weakens its ability to respond (Dahou, Kibuka-Musoke, Ngo & Pavarimi 2012; Davis-Reddy & Vincent 2017; King & Lacey 2011). Recent studies have shown significant warming over the African region (Kibuka-Musoke, Davis-Reddy 2017 & Vincent; Kamara, Wali, Agho & Renzaho 2018). Climate predictions '…are indicative of drastic increases in surface temperatures (in the order of twice the global rate of temperature increase' (Davis-Reddy 2017, p. 6). Climate data for the region indicate a decrease in rainfall and the number of rainfall days; increases in rainfall intensity, inter-annual rainfall variability and length of the dry season.

Recent reports suggest tropical storms and cyclones experienced in Africa are linked to warming sea temperatures consequence of climate change (Knight & Fitchett 2019; Fitchett 2019). The most recent cyclone to hit Southern Africa, *Cyclone Idai* in March 2019, left a trail of damage that left hundreds dead and thousands displaced in three

countries namely, Malawi, Mozambique and Zimbabwe (Fitchett 2019). Additionally, droughts have become more frequent and intense (Dahou, Kibuka-Musoke, Ngo & Pavarimi 2012; Davis-Reddy 2017; Kamara, Wali, Agho & Renzaho 2018). Drought in Southern Africa has been linked to El Nino weather, which of late has become common and more severe (Gogo 2018; Setimella et al 2018). The 2015/16 drought for example, was linked to El Nino weather and has been ranked among the worst three in Southern African history (Setimella et al 2018; Siderious et al 2018). El Nino refers to the 'large-scale ocean-atmosphere climate interaction linked to a periodic warming in sea surface temperatures across the central and east-central Equatorial Pacific' (NOAA 2010, online). El Nino weather alters rainfall patterns and in southern Africa, it commonly manifests as reduced rainfall (Siderious et al 2018).

Coupled with that, the existence of multiple stressors, such as disease, poverty and weakened governance, also increases the African continent's vulnerability to the impacts of climate change (Davis-Reddy and Vincent 2017; Mapfumo, Nhemachena, Mano, Mudombi & Muwanigwa 2014a; Shackleton, Ziervogel, Sallu, Gill & Tschakert 2015; Singh et al 2017). Weakened institutional responses present peculiar challenges for Africa's climate change response. Recent reports suggest one of the limitations of Africa's response stems from:

> … the limited availability of accessible, reliable and relevant weather and climate information. Despite continued investments in Earth System Modelling, and the growing provision of climate services across Africa and India, there often remains a mismatch between available information and what is needed to support on-the-ground decision-making" (Singh et al 2017, p. 389)

Like other places in Southern Africa and the world, Zimbabwe has not been spared the impacts of climate change (Bhatasara 2017; Chikozho 2010; Makate, Wanga, Makate & Mango 2016). Previous studies (Bhatasara 2017; GoZ 2016; Nyamadzawo, Wuta, Nyamangara, Nyamugafata & Chirinda 2015) as well as this study have found that agricultural regions in Zimbabwe have been experiencing more frequent droughts and floods, occurrences of extreme weather conditions and increased rainfall variability, resulting in reduced productivity (Chagumira, Rurinda, Nezomba,

Mtambanengwe & Mapfumo 2016; Davis & Hirji 2014; Marongwe et al, 2011; Makate, Wang, Makate & Mango 2016; Rurinda et al 2014). These climatic changes create serious planning challenges for farmers. Recent reports for the country suggest that 'in the past, rainfall may not have been necessarily perfect, but was more predictable and less variable. Smallholder farmers had a good understanding of when the rains begun and when they ended' (Gogo 2018, online). Changes in rainfall patterns are thus creating planning challenges for farmers, particularly so smallholder farmers.

Zimbabwe's economy is sustained among other things by agriculture, mining, forestry, commerce and tourism. However, most people's livelihoods depend on agriculture, but, climate change is rendering land increasingly marginal for rain-fed agriculture further threatening livelihoods of the vulnerable. Reports suggest 90% of the smallholder farmers in the country depend on rain-fed agriculture (Unganai and Murwira 2010). Like most rural communities in Zimbabwe, the research community's major economic activity is small scale horticulture, a venture highly sensitive to climatic variability, particularly dry spells and extreme temperature events.

In these farming communities, households are at a greater risk from the impacts of climate change as these are aggravated by multiple stressors that weaken the nation's ability to respond. These stressors include poverty, weakened governance and institutions and reduced access to human and material capital (Nhemachena, Mano, Mudombi & Muwanigwa 2014b). Of significant concern is the sole dependence on rain-fed agriculture by most people in rural areas, especially smallholder farmers, especially when rainfall of late has become erratic, resulting in persistent crop failure (Chagumira et al 2016; Muzari, Nyamushamba & Soropa 2016). Unlike large-scale farmers, who have access to greater financial and other resources, smallholder farmers cannot easily access such facilities due to lack of collateral. Consequently, smallholder farmers rely mainly on rain-fed agriculture, resulting in crop failure year in year out (GoZ 2012; 2016). Among my participants, only one family had the means to install irrigation infrastructure. As observed by previous studies, (Bhatasara 2017), I found that climate change worsens the plight of this marginalised community in Zimbabwe as it impacts on their major and sometimes sole source of livelihood.

1.2.2.2 Government responses

Following global trends to respond to the climate challenge, and to demonstrate its commitment to reducing human-induced climate change, the government of Zimbabwe ratified the Kyoto protocol in 1992 (GoZ 2015). To ensure a coordinated response to climate change, the Zimbabwe government established a Climate Change Office housed within the Ministry of Environment, Water and Climate (MEWC). Through the Climate Change Office, Zimbabwe developed a National Climate Change Response Strategy (NCCRS) which was commissioned in 2014 and ratified in 2016. The NCCRS was developed to ensure a contextual response relevant to the country's needs.

The NCCRS recognises that although climate change is a global phenomenon, its impacts tend to be localised. At the time this study was concluded, the government of Zimbabwe was working towards developing a national adaptation strategy (NAP) to inform locally appropriate adaptation strategies. The government of Zimbabwe through the NCCRS and the "The First National Initial Communication on Climate Change to the UNFCCC" recognise learning for climate change adaptation as key to building coping mechanisms among communities affected by climate change (GoZ 2016). Here I discuss three government departments that were instrumental in influencing climate change education and learning in the research community.

The Ministry of Agriculture and Natural Resources is the government arm implementing agricultural projects that help communities to adapt sustainably to climate change (GoZ 2013; 2015; 2016). The department of Agricultural Technical and Extension Services (Agritex) in the Ministry of Agriculture is responsible for community education and extension for farmers

Following recommendations from the United Nations Framework Convention on Combating Climate Change (UNFCCCC), the National Environmental Education Framework and the National Education for Sustainable Development Strategy and Action Plan for 2014 and Beyond, the government of the Republic of Zimbabwe through the NCCRS (2016) recognises education, communication and public awareness as key enablers for successful adaptation to climate change. The Environmental Management Agency (EMA), a unit in the MEWC, was the arm of

government mandated to spearhead climate change education, public awareness and communication. EMA ran several community outreach programmes to raise awareness and mobilise communities to act against climate change. They aired their climate change education, communication and awareness programmes on radio, as well as through print and electronic media, but they also reached out to communities through school clubs.

Formal education in Zimbabwe is mainly the responsibility of the Ministry of Primary and Secondary Education (MoPSE) and the Ministry of Higher Education, Science and Technology. The education system in Zimbabwe, is challenged at all levels to develop responsive curricula to 'create a new generation of youth whose behaviour will be climate compliant' (GoZ 2016, p. 58).

Over the years, the Ministry of Environment Water and Climate has been leading the two ministries of education in developing education and training programmes to ensure climate change is in-cooperated in the country's education system. These efforts have led to integration of climate change education and learning in some subjects of the formal school curriculum. Despite these efforts, there remain concerns that the formal education system in Zimbabwe has remained peripheral in as far as addressing climate change is concerned (G. Motsi, personal communication, September 26, 2016; GoZ 2016; F. Samanyanga, personal communication, August 23, 2016). One of the significant initiatives to increase awareness and knowledge about the environment, including climate change, has been the establishment of the Eco-Schools clubs, which the next section will discuss.

1.2.2.3 The Eco-Schools programme

In Zimbabwe, like other parts of the world, programmes on climate change education and learning target children because they are easier to reach (Chineka & Chabikwa 2015; Mukoni 2013; Williams, McEwen & Quinn 2017; Ryan 2017). The assumption is that these children will influence their parents' decisions, leading parents to adopt pro-environmental climate action, an assumption that underpins the Eco-Schools concept. Operating in 67 countries across the world (Dzerefos 2018), Eco- Schools has been running in Zimbabwe since 2008. As of August 2016, 270 out of the estimated 8 750 schools in Zimbabwe were affiliated with the National Eco Schools

programme in Zimbabwe (A. Chimanikire, personal communication, August 16, 2016). In the school in question, the programme had been running since 2012 with membership standing at 30 students out of the estimated 581 student population (G. Motsi, personal communication, September 26, 2016).

The aim of the Eco-Schools programme is to empower children to act as environmental stewards by engaging with environmental and sustainability issues in the communities they live in (Cincera & Krajhanzl 2013; Dzerefos 2018; Goldman, Ayalon, Baum & Weiss 2018). The programme runs on the think locally act globally concept premised on the idea that people must consider the health of the entire planet and act to solve environmental sustainability issues in their local communities. The analysis in Chapter 9 examines how children through the Eco- Schools club contributed to environmental sustainability through addressing local issues of global concern.

Eco School assumes a bottom-up, hands-on-minds-own project-based approach where learners are initiators of their own learning; the teacher simply serves as a guide (Copsey 2018; Dzerefos 2018; Goldman, Ayalon, Baum & Weiss 2018; Pauw & Petegem 2011, Ringdahl 2012). The programme was designed to assist countries to meet the UN Chapter 36 of Agenda 21's vision of using learning as a tool for achieving sustainable development following the UN Conference on Environment and Development, also known as the Rio Summit/Conference or the Earth Summit, held in Rio de Janeiro in 1992 (Ringdahi 2012; Ryana 2017). Eco- Schools provides feasible pathways through which learning can assist communities to transition towards sustainability (Cincera & Krajhanzl 2013; Copsey 2018; Dzerefos 2018; Goldman, Ayalon, Baum & Weiss 2018; Pauw & Petegem 2011, Ringdahl 2012), placing much of the responsibility of moving society towards more sustainable trajectories on children. Chapter 9 analyses the effectiveness of the Eco- Schools programme in influencing climate change adaptation decisions in the wider community.

Success stories of the Eco- Schools programme in enhancing children's agency for positive social transformation are documented in several studies both in the Global North and the Global South (see for example Cincera & Krajhanzl 2013; Dzerefos 2018; Goldman, Ayalon, Baum & Weiss 2018; Pauw & Petegem 2011, Ringdahl

2012; Ryana 2017). Previous studies have shown that the programme improves school management and status. A study conducted in Ireland for example revealed that schools participating in the Eco-Schools programme scored higher in terms of waste management and recycling as compared to non-participating schools (Cincera & Krajhanzl 2013. Additionally, the programme helps develop environmental competencies such as recycling, energy saving (Cincera & Krajhanzl 2013) and growing own food (Dzeferos 2018). Research has shown that Eco-Schools improves the quality of the curriculum including teacher competencies and school management (Cincera & Krajhanzl 2013; Copsey 2018).

While there are success stories linked to the programme, there are concerns from some scholars that the nature of relationships between Eco- Schools and wider society must be strengthened for improved intergenerational learning (Copsey 2018; Wheeler et al 2018). In a study that sought to investigate the effectiveness of the Eco- Schools programme in the Indian Ocean islands, Copsey observes that:

> At the end of the day the change we want to see is not in the school, it is outside the school, so the indicators that we want to build is not in the school. There are things that happen at the school, but if the change happens only inside the school it is not sufficient (2018, p. 135).

Although the success of Eco- Schools in influencing positive changes among children and within the school has been acknowledged, there are concerns that the programme is still limited in terms of making a wider societal impact (Copsey 2018). Eco-Schools is expected to create linkages between formal and non-formal education systems as well as provide lifelong learning opportunities. There is an expectation that the knowledge and skills learnt in school will be transferred to the wider community. Schools are thus expected to form partnerships and wider collaborations with their surrounding communities (Copsey 2018; Dzerefos 2018; Wheeler, Guevara & Smith 2018).

In the Zimbabwean context, Eco- Schools is run and managed by a local non-governmental organisation in partnership with the ministry of education, business, universities, individuals and civic society organisations. The Environmental Management Agency discussed in 1.2.2.2 above serves as the partnerships broker.

The analysis in Chapters 8 and 9 examines how tensions, contradictions and knowledge - power relations manifested and how they shaped the adaptations taking place within the community.

In a study of 16 school-community partnerships for sustainability in the state of Victoria in Australia, Wheeler et al (2018) found out that while such relationships existed, they simply addressed the here and the now. Wheeler et al criticised such arrangements and argue instead that for effective school-community linkages to be established, the partnerships should not be viewed as '…merely a transactional arrangement that addresses the identified challenges of time, funding, skills and personnel…*'* (2018, p. 313). They concluded that school-community partnerships for sustainability may benefit from the use of what they call 'partnership brokers' who in the context of their study included the local government authorities and non-governmental organisations.

The same study by Wheeler et al (2018) concluded that for meaningful collaboration, there is need for joint goal formulation and activity implementation. While having common goals sounds ideal, in reality this was rarely the case in the 16 cases Wheeler et al studied. Emphasising the importance of joint goal formulation, Wheeler et al contend that:

> What makes these relationships partnerships is the presence of characteristics such as the school management's willingness to consult and listen; to be responsive and welcoming; to nurture an open, inclusive culture; and to discover the real needs of students rather than making assumptions. (2018, p. 321).

Given the mandate of the Eco-Schools, and the existence of Eco-Schools in a number of communities in Zimbabwe, I chose to locate my study in Mutema (pseudonym), a community which had established an Eco-School in 2012. Basing my study in this community enabled me to examine the extent to which intergenerational learning played a role in the learning and adaptation experienced by community members.

1.3 Research aims, questions and overview of approach

The study sought to understand how people in a largely agricultural community in the Global South in my own country, Zimbabwe, learn and adapt their everyday

practices to mitigate the impacts of climate change on their lives. As mentioned already, I was particularly interested in investigating the possibilities of adaptation in terms of what Engeström (2000; 2016) called 'expansive learning', and the affordances for and barriers to people's learning about, and acting around, the impacts of climate change**.**

The study focused on informal learning in people's negotiation of the impacts of climate change because of my interest in the learning that occurred through the changing practices in people's everyday lives. The community in which the research was conducted was a site of climate change education intervention known as the Eco-Schools Club, described above, in which children voluntarily participated in activities that expanded their knowledge about the environment. Thus, the research site afforded an opportunity to explore whether intergenerational learning was a feature of the informal learning in the community.

My overarching research question was:

How are everyday practices changing in response to the impacts of climate change**?**

Contemporary scholars who study everyday social practices (Rogers & Street 2012, Shove & Spurling 2013, Spurling and McMeekin 2015; Engeström 2010; 2016; Engeström & Sannino 2017; Haapasari, Engeström & Kerosuo 2016) advocate for the use of ethnographic methods in order to generate 'thick description' (Geertz 1973; Hammersley 2018) of what is occurring in the research site. For this reason, this study employed methods including an extended period (five months) of observations, in-depth interviews and focus groups in the Mutema. These methods, detailed further in Chapter 4, were able to provide insights into the research gap identified by those advocating for socially-just adaptation and learning in the Global South, namely an investigation into those social, political and psychological factors that can emerge as barriers (Schakleton et al. 2015). As a researcher from Zimbabwe whose mother tongue was the community's local language (Shona), I had the advantage of being able to conduct the research without an interpreter, and without the need for a 'translator' of some of their distinctive cultural practices.

1.4 Organisation of the thesis

Chapter 1

In Chapter 1, I introduce the study. I give a contextual background to the problem of climate change adaptation as it happens globally and in Zimbabwe, the location of my study. I articulate the research questions and locate the questions in the context within which learning, and adaptation took place.

Chapter 2

This chapter captures and locates the current study in the existing research literature. As my study draws from several disciplines, the review draws on literature from the fields of climate change adaptation; intergenerational studies of learning; environment and sustainability studies; socio-cultural studies of learning; science, technology and society (STS) and the public understanding of science (PUS).

Chapter 3

In this chapter, I present an analysis of the theoretical tools that guide my study. I conceptualised climate change adaptation as a possibility for sustainability transitioning and I was particularly interested in investigating the possibilities of adaptation in terms of what Engeström (2000; 2016) called 'expansive learning'. The chapter explains the concepts of sustainability transition and expansive learning.

Chapter 4

This chapter presents the methodology that was employed for the study. As I was informed by socio-cultural theories which underscore the value of the socio-cultural context in influencing learning and change, I adopted an ethnographic case study. This approach allowed me to step outside of the confines of the physical sciences and read into the participants' lifeworld and give more authentic voice to the participants.

Chapter 5

In this chapter, I introduce the key community informants of the study: the eight families in the Mutema community: the Mhere, Dzoro, Chimoto, Dehwa, Makwara, Mabasa, Gwenzi, and Mapani families (not their real names) who participated in the

research. The perspectives of the families, both collectively and individually, guided my analysis of learning and change for climate change adaptation in the community. Climate change impacted on the everyday practices of each of these families, but each family's everyday practices and their response to the impact of climate change were intertwined with the family's distinctive histories in, and relationship with, the larger community.

Chapter

Chapter 6 presents an analysis of what motivated members of the Mutema community to adapt to climate change. The analysis in this chapter focuses on the object(s) for adaptation. In CHAT terminology, the term object(s) has been used to mean several things including the goal of an activity, the motives for participating in an activity and the material products participants in an activity system seek to gain (Yamagata-Lynch 2010). For purposes of this study, object shall be used to refer to the motives as well as the material products participants seek to gain through an activity. I argue in this chapter that there is a strongly shared overarching *object* in community members' adaptations of their everyday practices at the hands of climate change: the exigency to evade food insecurity, known as *nzara* in the local context.

Chapter 7

This is the first of three chapters that examine what and how learning has been taking place as members of the Mutema community adapted their everyday practices in response to climate change. I limit my analysis in this chapter to community-based learning and conclude that everyday farming practices were changing as community members questioned and critically reflected on what they have taken for granted as normal farming practices.

Chapter 8

While Chapter 7 examines the learning that occurred within community members' everyday practices, this chapter examines the learning that occurred through injection of technical and scientific knowledge from external experts. Learning and change were found to take place as a combination of authoritative silencing, self-critical evaluation of people's own practices, observing and reflecting on legislative requirements, informal experimentation, and blindly following authority. This

learning has led to changes in traditional practices (e.g. how crops are grown, for example adopting conservation farming technologies) and adoption of new tools for adaptation (e.g. adopting new maize cultivars).

Chapter 9

In this chapter, I analyse the extent to which children's learning had been influencing the ways adults were adapting to climate change. I conclude in this chapter that while the ESC developed children's agency, it was not found to be a dominant source of adults' learning due to cultural conventions that position children as peripheral sources of knowledge.

For structural clarity of the thesis, Chapters 7 to 9 were presented separately. However, the boundaries between community innovations, technically driven interventions and children's agency were permeable. The permeability of the sources of learning is acknowledged at the beginning of Chapter 7 and is illustrated in Chapter 10.

Chapter 10

In this chapter I summarise the key findings from the study. The study has found that the community had diverse ways of understanding the concept of climate change. Climate change learning was developed in and through community members' negotiation of disturbances to their everyday practices, most notably, practices to achieve food security; climate change was synonymous with the local term *nzara*, a word signaling hunger due to crop failures. Thus, learning and change to adapt to the impacts of climate change was most noticeable around innovations to sustain food security in light of continued crop failures as rainfall patterns changed in unpredictable ways.

Chapter 11

In this closing chapter, I review the aims of my research and the research questions, and argue for the contributions my findings make to climate change education, learning and adaptation research. I also highlight implications for educational interventions, and while acknowledging the limitations of my study, make some recommendations in my concluding remarks.

1.5 Conclusion

In this chapter I introduced my study and reviewed the issues of concern in climate change learning and adaptation globally and in Zimbabwe, the location of my study. I justified the research questions informing my study and gave an outline of the structure of the study.

In the next chapter, I present an analysis of the literature I reviewed.

Chapter 2: Climate change learning and adaptation: Barriers and affordances

2.0 Introduction

This chapter captures and locates the current study of how everyday practices in a largely agricultural community in the Global South are changing in response to the impacts of climate change in the existing research literature. It discusses the dominant discourses and key tensions in the field of climate change learning and adaptation that are relevant to my study**.** As my study draws from several disciplines, the review draws on literature from the fields of climate change adaptation; intergenerational studies of learning; environment and sustainability studies; socio-cultural studies of learning; science, technology and society (STS) and the public understanding of science (PUS).

Adaptation to climate change has become an undeniable reality that is now intricately linked to human existence and the health of the planet. Against a backdrop of a human-induced unprecedented rise in global temperatures and the consequent irreversible environmental damage, it has become imperative to reduce communities' vulnerability and increase their resilience to the impacts of climate change (Campbell et al 2016; Carr 2018; Davies & Vincent 2017; Peters 2018; Abid et al 2016). In the context of this study, the impacts of climate change mainly manifested in the form of changed rainfall patterns which of late had become unpredictable and erratic. The analysis in Chapters 6 to 8 discusses how such changed rainfall patterns created planning challenges for the largely agricultural community. The learning that emerged as community members managed these changes to evade food insecurity, *nzara* in the local context forms the centrality of this study. I therefore, begin this review by examining the interactions between climate change and farming.

2.1 Impact of climate change on agriculture

Global climate- induced changes, particularly so changed rainfall patterns and temperature extremes have profound effects on farming (Abid et al 2016; Som Castellano & Moroney 2018; Challinor et al 2016; Fisher et al 2015; Makate et al

2016; Simotwo, Mukalitsa & Wambua 2018). In Zimbabwe, like other parts of Southern Africa, climate-induced disasters, especially droughts and floods have increased in severity and frequency and continue to wreck havoc on livelihoods as they make agricultural land marginal (Fitchett 2017; 2019; Kamara et al 2018). Changed rainfall patterns and temperature extremes linked to climatic changes have been blamed for exacerbating already threatened livelihoods as crops fail leading to food insecurity. Increased temperatures accelerate crop growth leading to early maturity and reduced biomass hence reduced yields (Challinor, Koehler, Ramirez-Villegas, Whitfield & Das 2016)

Research conducted in parts of Southern Africa has shown that although great strides have been made in seed technologies, the newly developed seeds cannot cope with the rate at which the climate is changing (Challinor et al 2016). Compounding that adoption of new seed technologies is low because most smallholder farmers cannot afford them (Fisher et al 2015). In Chapter 8, I analyse the intractability of climate change and the limitations of technical scientific knowledge in solving the climate crisis.

As discussed in Chapter 1, smallholder farmers are at a greater risk to rainfall variability as they cannot afford the installation and mantainence costs of irrigation. Smallholder farmers mainly depend on rainfed agriculture, a venture that is highly climate sensitive. Additionally, climate prediction institutions are incapacitated to provide timely and accurate climate data to help both farmers and decision makers to plan (Davis-Reddy & Vincent 2017; King & Lacey 2011). Adaptation to climate change is therefore, compromised by the existence of multiple stressors including poverty and weakened insititutions.

A research review by Roncoli (2006) on the state of climate change adaptation in Africa concluded that the way farmers make sense of climate change is not the same as the way scientists do. Additionally, what influences farmers' responses to climate change largely depends on their experiences and cultural notions of what they believe to be true and trustworthy (Roncoli 2006; Som Castellano & Moroney 2018). In the context of my study, such cultural notions included but were not limited to the kinds of crops people preferred to eat and grow and when to begin and to end planting. In

Chapter 6 and 7, I discuss how participants' cultural beliefs influenced how they conceptualised climate change and responded to its impacts.

This takes me to the section where I examine the interactions between concern and the willingness to act to combat climate change.

2.2 Climate change concern and human agency

What drives people to engage with pro-environmental behaviour has been the subject of research since time immemorial and continues to evade researchers and policy makers alike (Braun, Cottrell & Dierkes 2018; Kollmussnm& Agyeman 2002; Lorenzoni et al 2007; McCaffey & Buhr 2008; Siegel, Cutter-Mackenzie-Knowles & Bellert 2018; Visschers 2018). Research has shown that while public awareness of and concern about climate change have increased in the recent past, there is a mismatch between concern and the willingness to act to combat climate change (Burandt & Barth 2010; Hess & Collins 2018; Lorenzoni et al 2007; Mitchel & Laycock 2017; Ottoa & Pensinib 2017; Salonen, Siirilä & Valtonen 2018; Visschers 2018). Several reasons have been put forward to explain the complexities around peoples' responses to the climate crisis. These will be discussed further in ensuing sections, but what stands out among them is a belief that climate change is too abstract, complex, controversial and futuristic (Burandt & Barth 2010; Dryzek, Norgaard & Schlosberg 2011; Lacey et al 2018; Peters 2018; Ungar 2000; Whitmarsh et al 2010). More importantly, climate change affects groups of people disproportionately depending on several factors, including but not limited to geographical location, gender and economic status (Cinner et al 2018; Granderson 2014; Kumar, Tokas, Kumar, Lal & Singal 2018). Compounded with that, those who contribute most to climate change are not necessarily those who suffer the greatest impacts (Cinner et al 2018; Kagawa & Selby 2010; Lotz-Sisitka 2010; Selby and Kagawa 2018).

Further to that, climate change presents benefits for some while disadvantaging others (Eriksen et al 2011; Granderson 2014). For example, warmer winters may be appreciated in very cold places as they may mean reduced energy bills. Increased temperatures also improve agricultural productivity in certain high latitude places (Mendelsohn et al 2006). On the other hand, warmer temperatures increase the

frequency and severity of fires and intensify the spread of deserts in some places (Carr 2018; Kumar et al 2018).

Another challenge emanates from the fact that climate change is marred with controversy and uncertainty and this complicates how the issue is perceived by the public. The issue has been heavily politicised (Kahan et al 2012, Leiserowitz 2006; Zajko 2011) and some argue that the mass media has been sending mixed messages to the public (Freeman 2018; Nidumoli et al 2018; Pidgeon 2012; Poortinga, Spence, Whitmarsh, Capstick, & Pidgeon, 2011; Whitman, Zhao, Roberts & Todd 2018) creating further confusion and apathy.

2.3 Beyond knowing

A key question that has eluded researchers over the years is an understanding of what drives people to actively engage with the issue of climate change (Burch et al 2014; Etzion, Gehman, Ferraro and Avidan 2015; Hess and Collins 2018; Lorenzoni et al 2007; Visschers 2018). Several theoretical models have been developed to explain the gap between possession of knowledge, awareness and the adoption of behaviours that consciously seek to minimise damage on the environment (pro-environmental behaviour). Numerous studies have been conducted to determine what influences engagement with climate change, but no definitive explanation has been put forward (Head 2010; 2018; Hess and Collins 2018; Lotz-Sisitka et al 2017; Wibeck 2014) to explain this value-action gap.

It is worth highlighting that, historically, climate change adaptation research relied on cognitive or linear models which are wrongly premised on the simplistic idea that acquiring knowledge will lead to awareness, which will translate into action (Gonzalez-Gaudiano & Meira-Cartea 2010; Hess and Collins 2018; Shove 2010a). There is an assumption that once individuals are better informed and incentivised, they will act responsibly towards the environment. However, Shove (2010a) argued that being knowledgeable (in a purely cognitive sense) about the science of climate change does not guarantee engagement with climate change. Besides, adaptation is not just an intellectual shift; it must manifest in a shift in what people do in everyday life.

Critics of the ABC and other linear models argue that they are wrongly premised on the idea that science can fix all problems regardless of their complexity. This in turn promotes the simplistic, deterministic and mechanistic assumption that treats science as an objective truth, hence leading to a focus on teaching more and more science with the hope that once people acquire the relevant knowledge, they will adopt more sustainable lifestyle that promote environmental sustainability (Cutter-Mackenzie & Rousell 2018; Sinatra et al 2014; Steg 2018).

Current thinking in the field, however, dismisses such frameworks of thought, arguing instead that what influences environmental behaviour is complex, and cannot be construed outside the broader socio-cultural context (Hargreaves 2011; Hoffman 2011; Lotz-Sisitka et al 2016; Roystona, Selbya and Shove 2017; Selby & Kagawa 2018; Spaargaren 2011; Spurling 2018). Researchers on the sociology of scientific knowledge have argued that cognitive models fall short of achieving behaviour change because '…interpretations of science by the public are mediated by societal values, personal experience, and other contextual factors' (Lorenzoni et al 2007, p. 446). Additionally, climate change can no longer be regarded as a purely scientific phenomenon (Adger et al 2009; 2013; Baer and Singer 2018; Freeman 2018; Lotz-Sisitka et al 2015;2016).

Research conducted by Lorenzoni et al (2007) in the United Kingdom (UK) for instance, sought to uncover perceived barriers to engagement with climate change with a focus on behaviour change by individuals. Their research used a mix of quantitative and qualitative approaches spanning a period of five years. They concluded that despite the existence of information on climate change and knowledgeability on the causes of climate change, there was a general reluctance to act to reduce carbon emissions by adopting more sustainable lifestyles that consume less energy. The researchers argued that reducing carbon emissions implied radical social changes at the levels of both individuals and society. Information provision should therefore be backed with policy and structural changes that enable individuals to adapt their practices and adopt more sustainable lifestyles.

2.4 Technical fixes, wicked problems, knowledge plurality and moving towards a post-normal science

Researching how people learn to adapt their everyday practices in response to climate change through a socio-cultural perspective is supported by theories in science technology and society (STS) studies. While climate change could be regarded purely as a scientific phenomenon and studied using the tools and methodologies of the physical sciences, STS scholars since the 1970s have argued that science cannot be studied in isolation from the socio-cultural context (Aikenhead 1996; 2001; 2005; 2015; Aikenhead and Michell 2011; Meyer & Crawford 2011; Carlone, Johnson & Eisenhart 2014; Sarewitz 2004; Zajko 2011).

Aikenhead (2015) talked of cultural border crossing between the student/public's life-world subcultures and the subculture of science. When that happens, learning becomes a form of cultural acquisition, a process Aikenhead refers to as acculturation. Anthropologists have argued that cultural border crossing '…can be smooth, manageable, hazardous or virtually impossible…' (Phelan et al 1991 in Aikenhead 1996, p. 40). In other words, there are times when scientific information fails to make a real impact on human behaviour because such knowledge has failed to 'resonate with easy to understand bridging metaphors derived from the popular culture' (Ungar 2000, p. 297). The argument is that students, or more generally the public, possess world views that may not accord with the explanations that science offers. STS is thus concerned with communicating scientific knowledge in ways that promote public understanding of science so as to promote learning for responsible citizenship (van der Linden et al 2017).

STS departs from the scientific determinist view of science and appreciates that expertise is not restricted to academic circles and formal education settings (Ratcliffe 2001; Bennett et al 2006; Mansour 2009). Such thinking is, however, problematic as it is associated with the illusion that science can solve all of society's problems regardless of the social, cultural and political complexity that surrounds environmental issues (Gonzalez-Gaudiano & Meira-Cartea 2012). Moreover, the nature of scientific knowledge itself is uncertain and subject to revision. Compounded with that, knowledge of the causes and impacts of climate change is far from complete

(Stevenson, Nichols & Whitehouse 2017). Against this backdrop, there is no consensus on what adaptation choices should be adopted because some adaptation measures may not be sustainable (Eriksen et al 2011; Ammous & Phelps 2015; FitzGibbon & Mensah 2012).

STS scholars who study risk point to how, over time, many human endeavours to manage their environment have manufactured new risks, some of which are so intractable that traditional risk analysis and methods are rendered obsolete (Hart & Bell 2013; Kates et al 2012; Wynne 2007, 2010). There is also a growing recognition among social scientists that certain problems that confront humanity are too complex to be solved through conventional scientific approaches (Lehtonen, Salonen, Cantell & Riuttanen 2018; Wainwright 2010; Sword-Daniels et al 2018). Back in 1973, working in the field of planning and design policy, Ritell and Webber observed that science had been designed to deal with tame problems. They argued that certain problems tend to evade traditional solutions and lie outside the scope of science. They described such problems as stubborn and wicked. Climate change is one complex issue that has been regarded as not just a wicked problem, but super wicked (Carr 2018; Head 2018; Lehtonen et al 2018; Peters 2018; Sword-Daniels et al 2018). In certain circumstances, adaptation can even threaten livelihoods, while in others, it causes more harm to an already threatened environment (Ammous & Phelps 2015; Eriksen et al 2011; FitzGibbon & Mensah 2012).

Thus, climate change is no longer regarded as a strictly scientific issue. It has social and political dimensions whose scopes lie outside the realm of 'normal' science (Adger et al 2009; Hulme 2013; Lotz-Sisitka et al 2017). Consequently, climate change adaptation is not a purely technical cognitive process but entails social change (Carr 2018; Pelling 2011; Peters 2018; Pettenger 2017). Therefore, regarding scientific solutions as the only viable option can be misleading.

There are calls to move towards a post-normal science, an acknowledgement that due to its reductionist nature, 'normal' (traditional) science is necessary but inadequate in resolving the complex challenges facing contemporary society (Blewitt et al 2014; Mukute & Lotz-Sisitka 2012; Sword-Daniels et al 2018). The complexities emanating especially from the intractability of risks presented by climate change necessitate moving towards a post-normal science (Bremer et al 2018; Engeström

2016; 2018; Fazey et al 2018; Rose 2018) and rejecting the belief that worthwhile knowledge is only that which is generated by the intellectual elite (Fagan 2009; Funtowicz & Ravertz 1993; 2018; O'Donghue 2018).

Post-normal science has been defined as 'a new conception in the management of complex science-related issues…that focuses on aspects of problem solving that tend to be neglected in traditional accounts of scientific practice: uncertainty, value loading and a plurality of legitimate perspectives' (Funtowicz & Ravertz 1993, p. 1). At the heart of post-normal science, therefore, is an acknowledgement of knowledge plurality (Allain, Plumecocq & Leenhardt 2018; Funtowicz & Ravertz 2018; and a redress of epistemic injustice, that situation where some knowledge systems are elevated, to the exclusion of others (Geels 2011). Post-normal science acknowledges the challenges confronting contemporary society; for example, climate change is contextual, complex, contested and marred by uncertainty and yet demands urgent solutions (Funtowicz & Ravertz 1993; 2018; Turnpenny, Jones & Lorenzoni 2011). There is therefore a greater and urgent need to work across disciplines in mutual settings where knowledge is hybridised and co-created. Sometimes, the layman's perspective provides the desired solutions.

2.5 Moving beyond adaptation and transitioning towards sustainability

Some scholars have urged thinking beyond adaptation if the goal is to create resilient and more sustainable communities (Burch et al 2014; O'Brien et al 2013). Sustainability transitions scholars claim that adaptations result in changes that do not alter the super-structures of society, which typically contribute to unsustainable practices, and argue instead that the goal should be to challenge the status quo and that research should aim to establish feasible pathways through which society can transition towards sustainability (Balsiger et al 2017; Burch et al 2014;Michael and Wals 2016; Moore et al 2014; Roystona, Selbya and Shove 2017; Seidel, Chandra Kruse, Székely, Gau, & Stieger 2018; Shove & Spurling 2013; Shove 2015; Spurling et al 2013).

The next section discusses the works of Elizabeth Shove and Nicola Spurling as examples of social theorists who have applied practice theory to understanding

sustainability transitions around consumption patterns and lifestyles in view of climate change and related sustainability challenges. The two scholars have also worked on several transdisciplinary projects with scholars from fields such as consumer research studies, business administration and design studies. Central to their research are questions of why contemporary life has become so resource intensive and how practices emerge, are sustained and can be influenced towards a more sustainable trajectory (Shove 2010b; Shove et al 2015; Shove & Spurling 2013; Spurling et al 2013; Spurling 2018). The thesis of their work is a belief that, over and above behaviour change and technological innovations, climate change and related sustainability challenges can be resolved by transforming the superstructures of society that have led to the current resource-intensive lifestyles that are typically unsustainable (Spurling et al 2013; Spurling 2018). The focus on consumption patterns is motivated by the belief that consumption, especially energy consumption, is a major contributor to anthropogenic climate change (Shove & Spurling 2013; Spurling 2018).

In climate change studies, social practice theory offers a way of understanding what drives people to engage with climate change by shifting the unit of analysis from the behaviours of individuals as isolated from their socio-cultural environment to socially shared practices (Hagreaves 2011; Miettnen, Paavola and Pohjoba 2012; Shove et al; 2012; Shove & Spurling 2013; Spurling et al 2013). The argument behind practice theory is that social phenomena are bundles of practices and material arrangements and must be studied within these bundles (Roystona, Selbya and Shove 2017; Shove et al 2012; Shove & Spurling 2013; Spurling 2018). Resource-intensive lifestyles have increasingly become ordinary and embedded in social life (Shove & Spurling 2013; Shove et al 2015). Using energy demand as an example, Shove et al (2015) argue that in the UK the practice of driving has become socially embedded in people's lives. People drive not just for the sake of driving, but in order to perform their day-to-day activities; driving is closely bundled up with other practices such as leisure and shopping which normalises driving into an ordinary, everyday practice.

Although driving contributes significantly to greenhouse gas emissions, any radical changes to driving practices entail reconfiguring the practices that constitute everyday life (Shove et al 2015). Shove et al (2015) argue that energy demand is

therefore intricately linked to and reproduced through the interplay between existing infrastructures and practices that define car dependence. In other words, transitioning to new practices requires a social process. This then sets limits on what individuals can achieve with the choices they make. Transitioning into new social practices goes beyond reconfiguring personal lifestyles to demanding a paradigm shift in defining what constitutes normal practice as well as the superstructures that define such practices (Shove & Spurling 2013). Thus, from this perspective, individuals may know that driving contributes to global climate change but may continue to use cars because there are a few if any viable alternatives, and it is the normal thing to do.

Using the freezer as an example of a material artefact, Shove and Southerton (2000) explain how devices that contribute to greenhouse gas emissions become normalised. Their research involved observations in freezer retail outlets, document analysis and 35 in-depth interviews with freezer suppliers and consumers in the UK. Their research traces the normalisation of freezers in British households, and the factors leading to this. Firstly, freezer manufacturers have managed to entice people to embrace freezing as a food preservation method in place of traditional methods such as salting. In this way, it can be argued that food preservation practices have been transformed to accommodate the freezer. Secondly, in terms of both design and function, the freezer spoke to the moral welfare of the family and dominant cultural meaning of home in the post -war period and was easily accommodated with the '… existing domestic technologies and the ideologies that they embodied' (Shove & Southerton 2000, p. 306). Lastly, freezers were promoted in such a way that it came to be identified with convenience, flexibility and easy management of time.

In short, the freezer has come to be viewed as a tool that helps people to manage the demands presented by modernity. The use of the freezer has been seen to be intricately linked to changing social structures such as the increase in numbers of women who work. Consequently '…freezers are presented as necessary rather than optional appliances for the modern household' (Shove & Southerton 2000, p. 308). It has thus become normal to own a freezer. Arguing along similar lines, Janks (2014) explains how routine social phenomena are regarded as natural and never questioned in the same way that people see the rising and setting of the sun. Practices such as driving, mechanical cooling, freezing food and air travel have been naturalized and

normalised in contemporary society. However, several critical theorists and sustainability thinkers have argued that if the goal is to achieve sustainability, certain practices that are considered part of normal life must be questioned (Hand & Shove 2007; Janks 2014; Moloney and Strengers 2014; Shove et al 2015; Shove & Spurling 2013; Shove & Southerton 2000).

Considering that practices are linked to the acquisition and use of materials artefacts and taking cognisance of the fact that contemporary society has experienced a material turn, social theory is challenged to unbundle how practices can be modified towards low consumption and less resource-intensive lifestyles (Marechal and Holzemer 2015; Mylan 2015; Shove 2010; Shove & Spurling 2013; Spurling et al 2013; Warde 2005; Hagreaves 2011). Using the freezer as an example, Shove and Southerton (2000) illustrate how seemingly different social practices are related and how they interlock. For example, their research shows how the introduction of superstores and the increase in car ownership has increased the need to own a freezer, and how the increased use of freezers has led to increased ownership of microwave ovens in British homes. The challenge for practice theorists in sustainability studies is therefore to use social practices as sites of interventions through which society can be transformed towards sustainability.

While there have been some studies of climate change adaptation drawing on a social practice perspective for example, Marechal and Holzemer 2015; Mylan 2015; Shove 2010; Shove and Southerton 2000; Shove et al 2013; Shove & Spurling 2013; Spurling et al 2013; Spurling 2018; much of this work has been confined to the Global North, undertaken by scholars from the Global North arguing from a predominantly Western perspective. Although these studies may provide useful insights for the Global North, their relevance in the Global South cannot be assumed. While climate change is a global phenomenon, its impacts are localised. Moreover, critics have argued that in the context of climate change, one-size-fits-all solutions do not work (Granderson 2014; Strengers and Maller 2015). For people in the industrialised economies, adaptation may mean reducing their energy consumption or using more efficient technological devices. However, the problems faced by the community I studied are not the same problems as those faced by the industrialised world, nor are they afforded with the same options. Thus, the scientific and technological knowledge

and solutions around climate change also take different meanings in different local contexts.

Taking heed of the desire to gain insights from alternative ways of knowing, the next section discusses how climate change adaptation research might be enriched through the incorporation of local knowledges.

2.6 Acknowledging non-Western ways of knowing

One of the important criticisms levelled against science education in general and climate change education in particular is their tendency to disregard alternative ways of knowing. Current thinking in educational research seeks to challenge the dominance and supremacy of Western ways of knowing (Balay-As, Marlowe, & Gaillard 2018; Emeagwali and Shizha 2016; Jarvis 2007; Lotz-Sisitka et al 2017; O'Donoghue 2018; Merriam et al 2007; Pagano 2014; Pesanayi 2016). Society continues to face challenges that could possibly be addressed through learning, and there is an increased demand to strengthen education systems across the world to respond to such challenges (Mochizuki & Bryan 2015). In the context of climate change, it has been acknowledged that science (as conceived in Western culture) alone cannot solve the climate crisis (Anderson 2012; Lotz-Sisitka et al 2017; McRight et al 2013).

Consequently, there is a greater need to explore and position alternative ways of knowing. Some scholars have argued that climate change adaptation entails rethinking assumptions about knowledge generation and transmission and ownership (Anderson 2012; Edwards 2014; Fagan 2009; Kahn 2010; Lotz-Sisitka et al 2016; 2017). It means moving away from the belief that worthwhile knowledge is only that which is generated by the intellectual elite. Fagan argued that those people grappling with distinct kinds of sustainability challenges are the best sources of knowledge available. The way they 'balance and define priorities, protect the powerless, problem solve and share knowledge are lessons that have their location in everyday living' (Fagan 2009, p. 200).

Unfortunately, such knowledge is often regarded as inferior and unauthentic, particularly in formal education settings. Some scholars have referred to this as 'othering' of other knowledges (Hoppers 2002; Jarvis 2007; Merriam et al 20067),

while some have referred to it as epistemic injustice (Fricker 2007; 2010; Kidd, Medina & Pohlhau 2017; Saul 2017). This disregard of 'other' peoples' knowledge creates tensions that set the debate on the politics of epistemologies in motion. Issues of knowledge–power relations become crucial as questions of what counts as knowledge and who defines what is worthwhile knowledge are raised. Such debates are critical because they advance the development of knowledge. However, the playing field is not level but is heavily tilted towards those who control the super structures of society (Fricker 2007; 2010; Kidd, Medina & Pohlhau 2017; Saul 2017). Consequently, this control has resulted in the loss of other knowledges that are potentially valuable (Jarvis 2007; Naess 2013; Pesanayi 2013).

Previous studies in adaptation research (Harvey et al 2012; Naess 2013; Pesanayi 2016) have shown that adopting a specialist approach subjugates the role of indigenous knowledges in adaptation; when local knowledges are trivialised, they lose their value and integrity and eventually get lost. In a study that investigated the interactions of institutions and indigenous knowledge in influencing adaptation among rural communities in Tanzania, Naess (2013) concluded that, often, local knowledge is treated as if it is not a knowledge system in its own right, but a supporting act. In separate studies with farming communities in Zimbabwe, Pesanayi (2016) and Mukute et al (2018) observed how the valorisation of Western ways of knowing has over the years resulted in loss of local knowledges that could potentially help communities to sustainably adapt to climate change. There is a growing understanding from research in the developing world that acknowledgement and leveraging of knowledge pluralism are critical to achieving learning and agency for sustainable adaptations to climate change (Makondo & Thomas 2018; Restrepo, Lelea & Kaufmann, 2018; Tschakert, Coomes & Potvin 2007; Tschakert et al. 2016; Tschakert & Dietrich 2010).

This study investigated the tensions that exist between climate change science and contextual knowledge held by the members of the local community where I conducted the research and how such tensions ought to be mediated if the goal is to create what Sannino & Engeström and Sannino (2017) called socially impactful knowledge: knowledge that can potentially lead to transformation. Taking cognisance of the richness that local knowledge could possibly offer to the climate crisis, the

current investigation studied climate change in situ. Of particular importance was an understanding of the role that local knowledge plays in assisting the community to adapt to climate change. I also investigated whether and how science could be used to complement the role of local knowledge in facilitating learning for climate change mitigation and adaptation.

Next, I discuss the role of children's agency in influencing adult adaptations.

2.7 Climate change and Intergenerational learning

> While climate change education is increasingly identified as essential for all children and young people, their actual voices on environmental issues have often been taken for granted in the broader field of environmental education research (Cutter-Mackenzie & Rousell 2019, p. 93).

Intergenerational learning may be defined as bi-directional learning that happens between generations (Boström & Schmidt-Hertha 2017; Istead & Shapiro 2013).

> Intergenerational learning…enables the intergenerational transmission of knowledge, skills, competencies, attitudes, and habits in both directions—from the younger generations to the older ones and the other way round…opens up a space for generations to learn more about each other, to understand perspectives of other generations without necessarily adopting… (Boström & Schmidt-Hertha 2017, p.1)

Although intergenerational studies of learning have been conducted before, much of that research focuses on the role that adults play in influencing children's learning and not vice-versa (Baily 2009; Fielding 2011; Istead & Shapiro 2014). Children's agency in climate change learning and adaptation research is generally an under-researched area; the pervasive discourse perceives children as vulnerable and needing to be protected (Haida, Chapagain, Rauch, Riedea, & Schneider (in press); Williams et al 2017). Against this backdrop, in Zimbabwe, as in other parts of the world, children are the main targets of climate change interventions, because they are easier to reach (Chineka & Chabikwa 2015). There is a belief that children will grow into responsible adults while at the same time influencing decisions that adults make (Cutter-Mackenzie and Rousell 2019; Damerell, Howe & Milner-Gulland 2013; Duvall & Zint 2007; Istead & Shapiro 2014; Williams et al 2017). While a few studies

have investigated children's agency in climate change education, many of those studies focus on formal education settings in the Global North (Cutter-Mackenzie & Rousell 2019; Haida, Chapagain, Rauch, Riedea, & Schneider (in press); Sutherland & Harm 1992; Williams et al 2017); in contrast, my study focuses on informal and non-formal contexts in the Global South. I studied how one programme, Eco -Schools (discussed in Chapter 1) influenced intergenerational learning between children and their parents/guardians. The analysis in Chapter 9 captures the affordances and barriers to intergenerational learning resulting from the Eco- Schools programme.

The limits of children in influencing adult decisions in environmental learning were captured in an ethnographic study by Sutherland and Harm (1992) who investigated ideological transfers between children and their parents in Costa Rica. The study concluded that while children may pass information to parents, the information so shared is generally vague and unreliable. While Sutherland and Harm worked with sixth graders, in my study the children were between the equivalents of grades 8 to 11. However, several studies (Cordero et al 2008; Cutter-Mackenzie & Rousell 2019; Damerell, Howe, & Milner-Gulland 2013; Istead & Shapiro 2014; Lee 2017; Williams et al 2017), document success stories of the ability of children to actually influence adult decisions and household environmental behaviours.

Cutter- Mackenzie & Rousell (2019) drew upon a project titled 'Climate change + me' to analyse children's' agency in climate change education. They worked with 135 children and youths drawn from different schools and universities across the Northern New South Wales region of Australia. Children represented their knowledge of climate change through creative works including pictures, paintings and poems. The findings from the study suggest that children and young people are not to be treated as lacking in the scientific understanding of climate change. What emerged from the study was a picture of children as '…insightful, creative and politically active young people capable of producing finely tuned research outputs' (Cutter-Mackenzie & Rousell 2019, p. 97). The authors suggest that it is not enough to simply listen to children's ideas. Rather, children must be seen as creative and capable co-producers of knowledge with potential to make an impact on the social and political scenes.

In a controlled trial with children from the Seychelles, Damerell et al (2013) demonstrated that parents' knowledge about wetlands expanded and their water management behaviours improved following their children's participation in a wetlands education programme by the Seychelles Wildlife club. In another study that employed action-based participatory methodologies on flood education and preparedness and involved 68 children from the UK and their families, Williams et al (2017) found that including a take-home component and running an intervention over an extended period improved intergenerational outcomes.

In their study, Williams et al (2017) observed evidence of intergenerational communication as some children talked to parents, friends, classmates, siblings and members of the extended family. Either children told their parents about what they had learned, or parents asked questions based on the take-home activity. However, Williams et al (2017) claimed that some parents did not see relevance in their children's projects; they assumed that children's learning from their school projects and their everyday practices in and out of school could not inform each other. Additionally, some parents were disconnected as they dissociated themselves from flooding risk. Consequently, valuable opportunities for learning from children were lost. Williams et al (2017), found that the relationships that existed between children and their parents were a precursor to the success of intergenerational learning; if children were empowered to talk about what they had learned in school within families, they might catalyse change.

However, many of these studies were located in the Global North where children have voice; on the contrary, my study was located in a traditional community in the Global South where the socio-cultural arrangements are different. As some scholars have hinted, while children's agency is acknowledged, it is critical to locate children's agency within the socio-cultural context in which it occurs (Duval & Zint 2007; Malone 2013). While reverse mentoring works in contexts where children have voice, in contexts where cultural values suppress children's voices, the approach may not work.

This takes me to the section where I discuss the key terms that I use in this study.

2.8 Conceptual analysis of key terms

This section will the clarify meanings of key concepts underpinning the study. The terms *adaptation*, *mitigation*, *resilience* and *vulnerability* mean different things to different people. For purposes of this discussion, I adopt definitions simple enough to be understood by non-technical readers but complex enough to cover the essential conceptual details. The terms mitigation and adaptation are often confused and conflated. Although their desired goals tend to overlap, the two concepts are not the same. The Intergovernmental Panel on Climate Change (IPCC) define *mitigation* as '…human intervention to reduce the sources or enhance the sinks of greenhouse gases' (2014, p.4). Mitigation is therefore concerned with measures that humans take to reduce the incidence and severity of climate change. The desired goal of mitigation is to keep human interference in global climate change at a minimum. The term *adaptation* on the other hand refers to 'initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects' (IPCC 2014, p. 76). Adaptation also involves taking advantage of the opportunities that climate change may present.

In the general use of the term, vulnerability means being open to or susceptible to being hurt, or injured, or harmed. In the context of climate change, the term *vulnerability* has been defined as the degree to which geophysical, biological and socio-economic systems are threatened by and unable to cope with climate related hazards (IPCC 2012; 2014). Vulnerability thus refers to reduced capacity to deal with, withstand, predict, assess and recover from the impacts of climate change. On the other hand, *resilience* is concerned with the ability of a system to anticipate, absorb, recover from and withstand stress and change caused by climate related hazards and challenges in a timely and efficient manner (IPCC 2014).

The term *sustainable lifestyle* or *sustainable living* derives its meaning from the concept of sustainable development: meeting present human needs while giving special consideration to future generations, other species and environmental well-being (Kates et al 2001). Sustainable lifestyle therefore means adopting lifestyles that cause minimal damage to the environment by living within the boundaries of the natural systems and ensuring that human needs are satisfied without compromising

the needs of other living creatures or those of future generations (The World Conservation Union [IUCN]), United Nations Environment Programme [UNEP] and The World-Wide Fund for Nature [WWF] 1991).

It is also important to make a distinction between *climate change* and *climate variability*. Although the two terms are often used interchangeably, they are not the same thing. The IPCC define climate change as '…a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observable over comparable time periods' (2014, p.4).

Climate variability on the other hand has been defined as the yearly stochastic fluctuations in the elements of climate. Mean temperatures or rainfall may deviate from the average in specific seasons or years. For instance, some winters are warmer than others, while some summers are drier than average.

Food security has been defined as having '…access at all times to enough food for an active healthy life for all household members' (Coleman-Jensen, Gregory & Singh 2015). On the other hand, *food insecurity* is the situation of a household not having access to adequate food. This could be due to lack of money or resources. In my study context, food insecurity was mainly a result of reduced access to food due to diminishing yields as a consequence of climate change compounded with a lack of money to buy food.

Environmental education (EE), education for sustainable development (ESD, and Climate change education (CCE)

The potential for education to contribute towards achieving the creation of a just and ecologically sound society was first identified by Schumacher 1973 (Tilbury & Fien (2002). However, it was not until 1992, when the concept was widely adopted through the United Nations (UN) General resolution 57/254. As a field of study, climate change education emerged as a result of the realisation that education offers a viable pathway to addressing climate change (Cutter-Mackenzie & Rousell 2019; Mochizuki & Bryan 2015, Monroe, Plate, Oxarart, Bowers & Chaves 2017; UNESCO 2012). Article 6 of the UNFCCC in particular, challenges governments to

incorporate education, training and public awareness as possible approaches to climate change mitigation and adaptation.

Climate change education (CCE) is a new and evolving concept still in its infancy. It has not emerged as an independent discipline, but is rather an offshoot of environmental education (EE) and education for sustainable development (ESD). Because the disciplines intersect, in this dissertation the terms CCE, EE and ESD are sometimes used interchangeably. Considering that climate change education emerged as offshoot of environmental and sustainability education, I begin by reviewing the two concepts.

Environmental education is expected to be lifelong and to prepare individuals to cope in a rapidly changing world. It is an expectation that environmental education should equip individuals with knowledge, skills and attitudes to contribute meaningfully to the creation of a healthy environment. Environmental education places emphasis on teaching values and changing behaviours (Wals et al 2014). In his analysis of the relationship between civic engagement and environmental literacy, Hill (2012) concludes that the ultimate goal of all environmental education is 'the production of an environmentally literate citizenry' (p. 43). According to this view there is an intricate relationship between quality of the environment and quality of life. Environmental education should therefore enable humans to recognise this relationship and strive to adopt those attitudes and behaviours that seem to promote quality living. One of the criticisms levelled against environmental education and research is this simplistic and wrongly premised assumption that knowledge translates into proenvironmental behaviour in some linear fashion. Next, I discuss the concept education for sustainable development (ESD).

Education for sustainable development has been described as '…social, collaborative, multi-disciplinary learning approaches which promote discourse, debate and reflection…' (Copsey 2018, p. 130). ESD challenges traditional top-down approaches to learning where learners are passive recipients of information from an expert knower. The overall aim of education for sustainable development is to empower learners to act for positive environmental and social change, implying a participatory and, action-oriented approaches (Copsey 2018; Mochizuki & Brayan 2015; Lotz-Sisitka et al 2015). ESD implies including sustainability issues such as

global warming and climate change, poverty, pollution and peace into the curriculum (Mochizuku & Bryan 2015). In this regard, ESD is thus expected to develop critical and creative thinking, communication, conflict management, and problem solving. It is also expected to foster respect for self and others as well as respect for the environment. Additionally, ESD is expected to foster democracy, peace and tolerance. ESD thus envisions a world where everyone stands a chance to benefit from quality education by learning values, skills and behaviours and, making lifestyle changes necessary for positive social transformation for a sustainable future.

Education for sustainable development has however, been met with mixed feelings among researchers and policy makers alike. One of the criticisms levelled against ESD is that it is an '… open and contested' concept (Læssøe, Schnack, Breiting, & Rolls 2009, p.10). According to this view, education is expected to perform a multiplicity of different and sometimes conflicting roles in society. Education for sustainable development has often been criticised for placing too much emphasis on the social and economic aspects of the environment that has led to a neglect of the biophysical environmental concerns (Sinatra et al 2018).

The term sustainable development is arguably controversial and there seem to be no consensus among the academia on what it exactly means (Blewit 2009; Blum, Nazir, Breiting, Goh & Pereditti 2013; Jickling 1994; Læssøe et al 2009; Schroeder 2018; Sinakou, Boeve-de Pauw & Petegem 2018; Tilbury & Fien 2002). There are arguments by some scholars that combining the individually controversial terms makes the term education for sustainable development even more complex because '…the phrase education for sustainable development… epitomizes a conceptual muddle... ' (Jickling 1994, p. 5). In fact, that the term sustainable development is an 'oxymoron' and the logic of teaching a concept that has not been well defined and is subject to manipulation has been questioned (Jickling 1994).

The possibility of achieving sustainable development through education has also been questioned and likened to some infinity search of a treasure hunt. 'In the field of environmental education, we appear to be witnessing a treasure hunt for an infinitely illusive abstract concept (Jickling 1994, p. 6). There are propositions to suggest that the terms education, sustainable development and education for sustainable development are mere concepts and it would be myopic to treat them as if they were

some concrete truths (Jickling 1994). According to this analysis, environmental education has been marred by a history of failure by its advocates to 'reconcile definitions of environmental education with an a priori conception of education' (p.5).

This implies that environmental education has used concepts without putting them through enough academic rigour. Use of the terms sustainable and development is problematic as the two lies on extreme ends of the continuum and tend to contradict each other. The use of the term sustainable development, let alone education for sustainable development thus becomes problematic. Critics have argued that 'sustainable development is nothing more than a vague slogan susceptible to manipulation and deception' (Læssøe et al 2009, p. 10). Compounding that, '…sustainability requires meaning schemes and perspectives that are holistic, multi-vocal and pragmatic, and we are not there yet. At present we just don't think like that…' (Blewit 2009, online); sustainability demands from us skills and competencies that we do not currently have (Burch et al 2014) and this tends to be problematic.

While acknowledging the ambiguity of the term sustainable development, Tilbury & Fien (2002) maintain that being ambiguous makes it flexible and accessible to different interest groups in society. The two scholars warn of what they call 'paralysis by analysis'; the failure or derailment of action that happens when focus is shifted from action to definitions. Whether academics are able to provide precise definitions or not, the bottom line is that we live in a world faced with potential collapse, hence must act to ensure continued existence of the planet earth and its support systems. (Blewitt & Tilbury 2014; Cutter-Mackenzie & Rousell 2019; Kocsis 2018; Mal et al 2018; Mortreux, de Campos & Adger 2018). My study departs from this problematic scenario and argues that the problems of contemporary society will not go away simply because we have not been able to find universally accepted definitions. Whether or not we are able to precisely define sustainable development, humanity still faces the devastating impacts of a warming earth and climate change. Not to downplay the value of academic rigour and not to say the debates are insignificant, but, education research and scholarship is expected to design interventions for such controversial and complex challenges.

While, the role of education in creating sustainable societies is emphasised, efforts to create such societies have proved futile (Burch et al 2014; Mochizuki & Bryan 2015; Spurling 2018; Stibbe & Luna 2009). Climate change education as a field of study was therefore, born out of this pressing and seemingly elusive demand to create resilient and more sustainable societies. Several conceptualisations of the term have emerged; for example, Stevenson et al (2017) restricted their conceptualisations of climate change education to children and youth, arguably in formal education settings, as they posited that:

> …climate change education is about learning in the face of risk, uncertainty and rapid change climate change…demands a focus on the kind of learning, critical and creative thinking and capacity building that will enable youth to engage with the information, inquire, understand, ask critical questions and take what they determine are appropriate actions to respond to climate change….climate change education involves creatively preparing children and young people for a rapidly changing, uncertain, risky and possibly dangerous future. (p. 67–8)

Thus, Stevenson et al 2017 envision climate change education as creating opportunities for children and youth to be flexible and reflexive thinkers who act as change agents for mitigating climate change while they develop resilience to its known and unknown impacts. The justification for climate change education stems from the fact that adaptation to climate change is now intricately linked to survival; since the impacts of climate change are not certain, adaptations demands learning to analyse and deal with risk and uncertainty. Climate change education is about:

> …people understanding their connections to climate change in order to reduce the human dimension of climate change…is intended to link climate change science research with education and bring about a change in attitudes and behaviour that develop agency for reducing the human dimension of climate change. (Chineka & Chabikwa 2015, p.262–3)

Another definition, by Mochizuki & Bryan (2015), proposes that climate change education and learning is concerned with improving the capacity of an education system to respond to climate change. In the context of this study, I synthesise the

above definitions and adopt the term climate change education and learning (CCEL), a term that shall be used to mean inquiry-based learning that questions the taken-for-granted practices and leads to radical transformation of the unquestioned unsustainability practices. Such learning not only helps people build resilience and reduce vulnerability to climate change, but also drives society towards more sustainable trajectories. Thus, climate change education and learning cover both mitigation and adaptation as individuals act singly and collectively. However, one of the greatest criticisms levelled against approaches that centre on individual changes and behaviour change is that such changes do not alter the super structures that perpetuate the sources of unsustainability (Burch et al 2014; Cutter-Mackenzie & Rousell 2019; Spurling 2018).

This takes me to the concluding remarks.

2.9 Conclusion

In this chapter, I analysed the dominant discourses informing my study and the key tensions and gaps in the field of climate change learning and adaptation. I argued in this chapter that while climate change adaptation research is ongoing, climate change continues to present challenges that seem to evade solutions. Climate change research has been dominated by tools and methodologies of the physical sciences. However, while climate change could be regarded as a scientific phenomenon, it has other dimensions that lie beyond the scope of physical science. Considering the complexity and intractability of climate change, discipline-specific approaches have been rendered obsolete. It thus becomes imperative to acknowledge alternative ways of knowing and moving towards a post-normal science where knowledge pluralism is acknowledged. While the desirability of acknowledging alternative ways of knowing is eminent, alternative knowledges are subjugated and lost as they are trivialised. There is therefore need for more research that crosses the disciplinary divide in mutual settings where all views are acknowledged as legitimate perspectives.

While learning and change are acknowledged as critical components in moving society towards more sustainable trajectories, how such learning occurs and what compels people to learn is still an area needing further research. Although studies that explore intergenerational learning have been conducted, these mainly focus on

children in formal education settings in the Global North. More research is needed to study adults and nonformal settings in the Global South. Cognisant of these gaps in knowledge, my study adopted a multidisciplinary approach and used a sociocultural lens to study the informal learning that took place as people in a community in the Global South adapted to climate change.

In the next chapter, I discuss the theoretical tools informing my study.

Chapter 3: Theoretical perspectives informing climate change learning and adaptation

> Unlike a normal science that involves a specific discipline, climate change science straddles many biological, social and physical science disciplines … understanding the processes and causes, impacts and solutions with respect to climate change requires looking at the phenomenon of climate change in ways that creatively integrate perspectives from multiple disciplines. (Anyanwu, Grange & Beets 2015, p.1)

3.0 Introduction

In this chapter, I present an analysis of the theoretical tools that guide my study. My study focused on climate change adaptation and learning in a community in Zimbabwe where serious climate change-induced threats to livelihoods and food security have been observed. I sought to understand how everyday practices were changing due to the impact of climate change. This question was supported by the two sub-questions:

1. What are barriers to and affordances for expansive learning?
2. To what extent is there evidence of expansive learning, that is, learning leading to a radical and sustainable transformation of everyday practices?

I sought to understand how everyday practices were changing due to the impact of climate change. I was particularly interested in investigating the possibilities of adaptation in terms of what Engeström (2000; 2016; 2018) calls 'expansive learning', that is, radical and sustainable transformation of everyday practices, in response to climate change.

As I was considering my choices for a theoretical framework, I was mindful that although climate change could be regarded purely as a scientific phenomenon and studied using the tools and methodologies of the physical sciences, social science research has shown that climate change has social and political dimensions whose scope extends beyond the realm of natural science (Baer & Singer 2018). Due to the multifaceted nature and complexity of climate change, social scientists are

increasingly advocating for a shift in paradigm when conducting climate change research, particularly with communities in non-Western contexts (Abson et al 2016; Lotz-Sisitka et al 2017; O'Brien et al 2013). Scholars who frame climate change adaptation as integral to a transition to environmental sustainability advocate for knowledge plurality and the creation of a level playing field where no one source of knowledge is privileged at the exclusion of others (Lotz-Sisitka et al 2016). There is also a greater need to look beyond academia and to incorporate knowledge from communities (Fagan 2009; Head 2010; 2018 O'Donoghue 2018). Thus, from this perspective, the goal for research should be to draw connections between abstract, scientific knowledge and context-specific knowledge to generate practical knowledge that addresses problems of mutual concern.

As my research uses a multi-disciplinary approach to understanding climate change adaptation, no single theory sufficed on its own. A typical challenge for this kind of research is that there is no single conceptual framework (Thompson et al 2001). Consequently, I drew on a few theoretical perspectives.

3.1 Sociology of science and technology and the public understanding of science

I was interested in what people in communities could do to mitigate and adapt to the impacts of climate change. Consequently, the overarching framework for my study is informed by the scholarship in the areas of science and technology (STS) and the public understanding of science (PUS) which acknowledge the diverse ways in which lay people make meaning of changes in their natural and the technological environment compared to the ways in which technical experts approach the same issues. Through acknowledging the influence of the socio-cultural context, this scholarship offers an appropriate way of understanding how lay people in communities negotiate changes in their lives brought about by climate change.

It has been argued that the science associated with climate change is complex. There are calls to de-code scientific knowledge so that it is more accessible to the public (Filho et al 2018). Ungar (2000) argued that climate change science has to be communicated in ways that people can identify with. It has to be aligned with the popular culture in order to create what he calls a 'hot crisis', an issue that demands

attention. According to Ungar, unless and until climate change science manages to create a 'hot crisis', it will continue to be treated as a farfetched abstraction, distant in space and time warranting no action.

While climate change could be regarded purely as a scientific phenomenon and studied using the tools and methodologies of the physical sciences, STS scholars since the 1970s have argued that science cannot be studied isolated from the socio-cultural context (Aikenhead & Michell 2011; Meyer & Crawford 2011; Swyngedouw 2015). It is against this backdrop that my study endeavours to understand climate change adaptation from a socio-cultural perspective. There exist several theories informed by socio-cultural perspectives, but I drew on three that were critical for guiding my study. I discuss the theories in detail in the next section but suffice to say I draw on sustainability transitions perspectives as summarised by Elizabeth Shove and Nicola Spurling and Yrjo Engeström's third generation cultural historical activity theory (CHAT).

In the next section, I discuss climate change adaptation as a sustainability transition.

3.2 Framing climate change adaptation as a sustainability transition

Before I locate climate change adaptation within this framework, I briefly discuss the concept of sustainability transitions.

From a sustainability transitions perspective, systems such as energy and food supply systems can be conceptualised as socio-technical systems. They comprise (networks of) actors and institutions (regulations, societal and technical norms, standards of good practice) as well as material artefacts and knowledge (Markard, Raven & Truffer 2012). As these different elements interact, they give service to society. A sustainability transition may be conceptualised as a fundamental and radical shift in a socio-technical system. The changes thus involve fundamental changes in institutional and technological structures, changes in consumer perceptions and changes in user practices. Thus socio-technical transitions do not simply change structures of existing systems, but also alter related societal domains. In other words, sustainability transitions are enduring, multi-faceted fundamental transformation processes through which established socio-technical systems shift to more

sustainable modes of production and consumption (Markard et al 2012). Often, such transformations are deliberately initiated.

Sustainability transitions thinkers contend that addressing contemporary environmental and sustainability issues such as climate change requires such deep changes in the socio-technical systems. Existing systems which may be unsustainable are stabilised through lock-in mechanisms (Geels 2018; Spurling et al 2013; Spurling 2018) which create path dependency making it difficult to dislodge existing systems. Additionally, unsustainable systems are stabilised by institutions, commitments, shared beliefs, discourses, power relations, political lobbying, consumer lifestyles and preferences (Geels 2018). Climate change mitigation and adaptation thus needs to be conceptualised as a socio-technical transition because making incremental adjustments to existing modes of production and consumption patterns will not achieve the recommended cuts in global emissions (Burch et al 2014). Adaptation, therefore, compels humans to dislodge existing systems by adopting new ways of living, working, leisure and consumption patterns in order to drive society towards a more sustainable trajectory (Burch et al 2014; Shove 2010a; 2010b). There is an argument for going beyond mitigation and adaptation to transform, replace or reconfigure existing patterns of living, leisure and working (Geels 2018; Spurling 2018).

It thus becomes imperative to question the taken-for-granted value and belief systems that form the current superstructures that are perpetuating unsustainability (Burch et al 2014; O'Brien 2012; O'Brien et al 2013). There is a perception that apportioning blame for anthropogenic climate change sorely to individuals is problematic because certain activities that contribute to greenhouse gas emissions are unavoidable as they are inherent in the nature and use of particular infrastructures (Van Villet et al in Shove 2010b). Established technologies are intricately linked to user practices and lifestyles, business models and value chains. Calls are therefore made for conceptualising climate change from an alternative perspective that de-centers individuals and their behaviours to a more holistic approach.

This field of study has been explored by a number of scholars, but I focus on the work of Shove and Spurling because of the relevance they have to my study; they have placed emphasis on human agency and social institutions, a major focus of what my

study seeks to investigate. As some scholars have argued, there is a greater need to "…develop alternative understandings of shifts between transition pathways, which depend less on external landscape pressure and more on shifting actor coalitions, struggles, and adjustments in formal rules and institutions" (Geels et al 2014, p. 897). Shove and Spurling have worked independently and in teams and have used a social practices approach to understanding climate change adaptation within a sustainability transitions context. The rationale of their work is informed by the belief that on a day-to-day basis, people engage in practices; they do things: for instance, people shower, go to work, cook, eat and play. Social practices in daily life are the outcomes of actors who combine and reproduce different elements (e.g. technology, skills, meanings) which themselves circulate among practices (Geels 2018; Geels et al 2014). Thus, people consume things as they fulfil their everyday practices (Mylan 2015; Shove & Spurling 2013; Shove et al 2015; Spurling et al 2013;). In other words, people indirectly and unconsciously use resources as they perform practices (Mylan 2015; Roystona, Selbya & Shove 2017). Consequently, it would be myopic to lay the blame for consumption or rather overconsumption squarely on individuals and their lifestyle choices. Instead, the focus should be on understanding how everyday practices emerge, how they are sustained, how they relate to each other and how they can be influenced towards more sustainable trajectories. Before I delve into the details of how practices can be changed, I discuss the principles of social practice theory.

3.2.1 Origins of practice theory

Practice theory owes its philosophical origins to the work of Heidegger and Wittgenstein, while its social scientific roots can be traced to sociological works by Giddens and Bourdieu (Halkier & Jensen 2011; Reckwitz 2002). More recently, several scholars, such as Reckwitz (2002), Schatzki (1996; 2002;2006; 2013), Warde (2005), Shove & Spurling (2013) and Spurling et al (2013) have synthesised and elaborated on the work of these earlier scholars. What I present therefore is an interpretation of this synthesised practice theory. I focus on those elements of practice theory that help me to understand how practices change as people adapt to climate change.

Practice theory emerged because of dissatisfaction with existing models to explain action and social order (Reckwitz 2002). However, practice theory is not a coherent

theory as there is no unified approach to research practice (Feldman & Orlikowski 2011; Halkier et al 2011; Hargreaves 2011; Miettinen et al 2012). Despite these variations, practice theory has central ideas that seem to converge across the diversity of scholarship in the field. These include the emphasis on routines, the collective, technique and competence. Another common feature for practice theory is an acknowledgement of the fact that practices are performances which are realised and reproduced through regular enactment of the practice (Shove & Pantzar 2005; Schatzki 1996; 2002; 2013; Warde 2005).

3.2.2 Conceptualising practices

Reckwitz (2002) defines a practice as:

> …a routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, 'things' and their use, background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge. (p. 249)

Social practices are, therefore, concerned with the shared, routine and everyday practices that members of a given community typically engage in on a day-to-day basis (Holtz 2014). Practices are therefore conceived of as the building blocks of social phenomena. Typically, social practices are about the everyday and the life-world, about looking at how and why people live the way they do. Examples of social practices include ways of farming, shopping, showering, cooking and washing. Such activities become social by being collectively acknowledged.

Many practice theorists converge on the idea that practices are made up of three elements, namely, materials, competencies and meanings (Reckwitz 2002; Shove et al 2012; Schatzki 1996; 2002; 2013; Spurling 2018). Materials include objects, tools or 'things' and infrastructures. Competencies are knowledge and skills while meanings refer to cultural conventions, expectations and socially shared meanings (Spurling et al 2013). According to Spurling et al (2013), 'socially acceptable individual behaviour – or the successful performance of a social practice –…rests upon the use of objects, tools and infrastructures, of knowledge, skills and of cultural conventions, expectations and socially shared tastes and meanings' (p. 9).

There is an assumption that social life is populated by practices and that individuals become the bodily and mental agents through which practices are carried out. Practices are therefore activities and individuals are the agents (practitioners) who perform the activities (Mylan 2015; Spurling 2018). While practice theory decenters attention from individuals to practices, the existence and sustenance of any practice depends on its successful performance and reproduction through continued enactment by individuals (Shove & Spurling 2013; Spurling et al 2013; Schatzki 2013; Mylan 2015). My study draws on practice theory to examine how practices have been changing and why in some cases change is resisted, to decipher how unsustainability is perpetuated through lock-in mechanisms that define normal practice.

In the performance of a practice, individuals use objects, materials, tools or things; for example, people use cars to commute. People do not consume things just for the sake of it; they do so as they fulfil the performance of practices. Consumption patterns or behaviours are therefore not conceived of as consequential of individual choice. Rather, they are a result of the conventions of a practice (Mylan 2015; Shove et al 2015; Spurling et al 2013). From a practice perspective, consumption is thus viewed as socially constructed (Shove & Pantzar 2005; Shove & Spurling 2013; Spurling et al 2013). In my study, I seek to broaden understanding of climate change adaptation by examining the material infrastructure and tools available to community members and how they influence adaptation choices. A practice lens offers a broader perspective because practice theory goes over and above understanding the influence of individual choices to incorporate the influence of social structures that may be contributing to unsustainability.

3.2.3 Implications for sustainability research

Spurling et al (2013) challenged the dominant discourse in sustainability research and policy that framed sustainability in terms of shifting technological innovation, behaviour change and shifts in consumer choices. Rather, they proposed a novel way of framing sustainability within a practice perspective as shown in table 1.

Table 1: Different framing of sustainability

Problem framing of the sustainability challenge	Target of intervention
Common framings in current policy interventions	
1. Innovating Technology	Reduce the resource intensity of existing patterns of consumption through technical innovation.
2. Shifting Consumer Choices	Encourage consumers to choose more sustainable options.
3. Changing Behaviour	More broadly, encourage individuals to adopt more sustainable behaviours and discourage them from less sustainable behaviours.
Framings drawing on a practice perspective	
4. Re-crafting Practices	Reduce the resource intensity of existing practices by changing the components, or elements, which make up those practices.
5. Substituting Practices	Replace less sustainable practices with more sustainable alternatives. How can new or alternative practices fulfil similar purposes?
6. Changing how Practices Interlock	Social practices interlock with each other—for example: mobility, shopping and eating. How can we harness the complex interactions between practices, so that change ripples through interconnected practices?

Adapted from Spurling et al 2013, p. 5

According to practice theory, practices are interlocked (Shove & Spurling 2013; Spurling et al 2013); moving society towards sustainability goes beyond individual agency; the totality of the range of practices that constitute social life must change. While shifting technological innovation, patterns of behaviour and consumer choices towards more sustainable choices is eminent, there is need for a paradigm shift of what constitutes normal social practice, and the infrastructures that sustain them (Shove et al 2015; Shove & Spurling 2013). The challenge for sustainability transitions research thus becomes uncovering how practices and the relationships between the elements that make up practices can be replaced or rearranged to address climate change and related sustainability challenges facing contemporary society.

Practice theorists contend that, all practices contain some inbuilt component of change (Shove & Spurling 2013; Spurling et al 2013). However, in some cases change may be resisted, particularly if the innovations introduced fail to align with existing practices (Burch et al 2014; Shove & Pantzar 2005). From an environmental perspective, the question is whether the changes in practices would identify with the tenets of sustainable development.

In their search for the implications of practice theory on sustainability (see for example Shove et al 2012; Shove & Spurling 2013; Spurling et al 2013; Spurling 2018), sustainability transitions scholars have raised several questions. These include an analysis of how practices are defined, how they evolve and what constitute their material components. Questions have also been asked about how practices propagate and how they are linked up. There are questions about power relations within the practices. What counts as valuable and who within society determines what is worthwhile and sustainable; who and what triggers socio-technical shifts? There is an assumption that sustainability transitions involve learning new practices while unlearning dominant discourses that perpetuate unsustainability (Spurling 2018). Considering that society comprises actors with different priorities, it becomes imperative to align and re-align the visons and priorities of different interest groups (Burch et al 2014). Thus, central to this research initiative is an analysis of how practices can be re-crafted (changing the elements of existing practices) and substituted (a search for alternatives) and changing how practices interlock

(unbundling how different practices connect and relate to each other) (Spurling et al 2013).

The framework developed by Spurling and her associates provides a useful theoretical framework on which to build my study, in terms of understanding how and why the community members are adapting their everyday practices in some instances and resisting change in others. What factors within the community are creating path dependence and hence locking in unsustainability? What is stabilising such practices? Are the changes taking place indicative of socio-technical transitions?

As discussed in Chapter 2, sustainability transitions research from a practice perspective is largely located in the Global North, conducted by northern researchers mainly focusing on overconsumption. While they talk about adaptation and social transformation, they do not focus so much on what learning is taking place through these processes. In fact, Shove and Spurling's work has not meant to directly address issues of education and learning. Rather their focus has been to influence large scale and radical social change through policy changes that draw from the practice perspective as opposed to focusing solely on consumer choices, behaviour change and technological innovation (Shove et al 2015; Shove & Spurling 2013; Spurling et al 2013).

My study diverted slightly and used the sustainability transitions lens to understand how practices change in a Global South context. Influencing radical policy change was not my primary and immediate goal. Rather, I endeavoured to understand the learning that takes place as practices change to develop insights upon which climate change interventions could be developed. This research, though still in its infancy, is emerging in southern Africa and other parts of the Global South, as a formidable discourse that seeks to understand learning and change in complex environments at the nexus of climate change, food security, energy, water and social justice (see for example efforts by Mukute et al 2018; O'Donoghue 2018; Pesanayi 2016; Restrepo, Lelea & Kaufmann 2018; Tschakert et al. 2014.). While the desirability of radical transformations precipitated by learning is acknowledged, such learning is not yet fully understood (O'Brien et al 2012; Lotz-Sisitka et al 2017; O'Donoghue 2018; Peters & Wals 2016), and less so reflected in practice. Tschakert et al. (2016) argue that notwithstanding the growing awareness of the limitations of intervention by

technoscientific experts in effecting sustainable transitions in the face of climate change, there remains the need to develop understanding of the local micropolitics as possible barriers to change, and the iterative processes of learning and reflection within the sites of any intervention. However, there seems to be convergence among sustainability scholars that due to the complexity of climate change and related socio-technical transitions, the learning that is required to trigger socio-technical shifts must be radical and transformative and must be analysed from a systemic perspective (Burch et al 2014; Lotz-Sisitka et al 2016; 2017).

One such approach that sustainability transitions scholars, particularly those from southern Africa (the location of my study), have used to analyse learning in changing and complex environments is Engeström's version of cultural historical activity theory (CHAT) (see, for example, Lotz-Sisitka et al 2015; 2017; O'Donoghue 2014; 2018; Olvitt et al 2018; Mukute et al 2018; Pesanayi 2016). CHAT offers a way of analysing radical and transformative learning that takes place in complex, multi-faceted and continuously changing systems, where what is to be learned is not known (Engeström 2016; Haapasari et al 2016; 2018; Sannino & Engeström 2017). Considering that climate change is highly unpredictable, complex, contested and multi-faceted, CHAT offers a useful lens through which to analyse the learning that takes place as people adapt to climate change.

However, CHAT in its present form 'seems to exclude common good and ecological services that are important in transformations to sustainability. This appears to be a fundamental present-day CHAT methodology contradiction inviting resolution' (Mukute et al 2018, p. 245). In my study, I combined CHAT and sustainability transitions to offset this inherent limitation in CHAT. On the other hand, I could not entirely depend on sustainability transitions to analyse the learning that took place because CHAT works best for analysing complex, continuously changing systems where solutions are not guaranteed. Both theories, however, converge on the propensity to question the taken-for-granted and to radically transform the existing system through a reflexive process.

3.3 Engeström's cultural historical activity theory (CHAT)

Engeström's (1987) activity theory provided a useful framework for 'examining human activity or practice' (Miettinen et al 2009, p. 1317) and an understanding of learning that occurs under changed circumstances (Engeström 1987; 2000; 2001). The notion of an activity system has given me a lens for analysing the socio-cultural, political and historical dimensions of everyday practices in an analytical manner.

Engeström's CHAT built on the work of cultural-historical psychologists Lev Vygotsky (1978), and its further development by Alexei Leont'ev (1978; 1981). CHAT first evolved around Vygotsky's socio-cultural theory and concept of mediated learning which is foregrounded in the belief that interactions of the human agent and the world are culturally mediated. Vygotsky thus viewed learning as meaning-making, which acknowledges the role of the socio-cultural context in activity systems (Engeström 2010). According to Engeström, the source of the limitation of Vygotsky's theory was its focus on individuals as the unit of analysis. This was however overcome by the work of Leont'ev who made a decentred analysis from individual action to collective activity. Engeström thus combined and extended the ideas of Vygotsky and Leont'ev.

3.3.1 Principles and components of activity system

Activity theory expands the unit of analysis of learning beyond the individual and instead focuses on the collective (Engeström 2018; 2016; 2011; 2010; 2008b; 1999). Activity systems are thus regarded as the primary unit of analysis. According to Engeström (1987), an activity system can be conceived of as a fluid system made up of human actors (subjects) interacting with each other (community) and their environment as they fulfil specific tasks (objects). Engeström (1999) drew attention to the fact that action is not performed in vain; there is always a motive. Activity systems are therefore driven by motives which are inherently embedded in objects. Motives are, however, communally driven, and there are set norms (rules) that govern human action. As individuals endeavour to fulfil the objects, (subject–object interaction) they rely on certain tools (mediating artefacts). Mediating artefacts are not restricted to physical instruments but also include symbols and representations such as rules and language.

Activity systems are defined by division of labour which results from the differing standpoints and positions occupied by individuals within the system. Consequently, activity systems are multi-faceted and multi-voiced systems. Activity systems are kept alive through acting on objects. In any activity system, the objects keep shifting because of internal contradictions. Contradictions, however, do not manifest themselves directly, but rather appear in the form of disturbances. In Engeström's (2008; 2010) terminology, contradictions are regarded not as problems, but as opportunities for learning and transformation. As objects are transformed, the environment also changes, resulting in the formation of new objects and hence continuous transformation of the entire system.

The activity system thus reconstructs itself. According to Engeström, activity systems travel through zones of proximal development (ZPDs) defined as '…the distance between the present-day actions of the individuals and the historically new form of the societal activity that can be collectively generated as a solution to the double bind potentially embedded in the everyday action' (Engeström 1987, p. 174).

As participants encounter disturbances, they question the rules governing their actions, leading to a reconceptualisation of both the object and motive of the activity. This results in new and expanded objects that have potential to transform existing forms of activity. Engeström refers to this scenario as expansive learning, the focus of my next discussion.

3.3.2 Expansive learning

'The theory of expansive learning puts the primacy on communities as learners, on transformation and creation of culture, on horizontal movement and hybridization, and on the formation of theoretical concepts' according to Engeström & Sannino (2017, p.102). At the core of learning is expansion and the collective creation of new objects to address problems of mutual concern. While traditional theories of learning regard learning outcomes in terms of cognition, 'in expansive learning, outcomes are the expanded objects … are assessed in historical terms, it is about people being able to go beyond their limits and change their own history' (Engeström & Kerosuo 2007, p. 339). Learning outcomes are therefore measured in terms of what people are able to do. The point of departure in expansive learning is critiquing the taken-for-granted

knowledge and practices. The second stage involves examining the current scenario, which leads to the creation of a new solution. This will then be examined and adjusted accordingly before the new model can be implemented. The entire process is reflected upon before the new idea is consolidated. As novel solutions are proposed and implemented, this opens up possibilities for renewed contradictions requiring reconceptualisation, opening up opportunities for a new cycle of expansive transformation (Engeström 1999).

Cycles of expansive learning are therefore continuously driven by the existence of contradictions, dissatisfaction with the status quo and the desire to transform: 'The process of expansive learning should be understood as construction and resolution of successively evolving contradictions in the activity system' (Engeström & Sannino 2010, p.7). In the context of climate change education, expansive learning becomes a useful tool because we are dealing with an issue that is complex, changing and beset with contradictions. Additionally, current thinking in the field proposes a desire to transform the superstructures of society through questioning the underlying assumptions that constitute normal practice (Shove et al 2013; Spurling 2018).

3.3.3 Disturbances

Engeström's concept of disturbances was a useful tool to work with, considering that the community I worked with had to deal with disturbances emanating from the changing climate. Engeström (2008a) defined disturbances as '…deviations from the normal scripted course of events…normal being defined by plans, explicit rules and instructions, or tacitly assumed traditions…Disturbances appear in the form of obstacles, difficulty, failure, disagreement or conflict' (p. 24). According to Engeström, disturbances vary in form depending on the context; they could manifest due to technical failure or communication breakdown or may emanate from environmental constraints. Like practice theorists, Engeström used the term 'discursive disturbances' to refer to disturbances associated with talk. Disturbances typically occur between people and instruments or among different people. More importantly, an anticipated disturbance has the same effect as an actual disturbance; '…when a potential problem is anticipated and made manifest, it typically leads to a break in the normal flow of work…in a very similar fashion to the case in which the anticipated disturbance actually takes place' (Engeström 2000, p. 25). Managing

disturbances can take a variety of forms including silent disengagement and deliberate efforts to remedy the situation. Argyris and Schon (1978) in Engeström (2008) talked of single-loop learning and double-loop learning as two possible ways of managing disturbances. Single-loop learning involves adjusting within the acceptable norms while double-loop learning is more radical. Single-loop learning has thus been referred to as adaptive learning while double-loop learning may be likened to transformative learning that questions the status quo (Engeström, 1995, Garrat 1990 in Engeström 2008). In the context of my study, I examined how people managed disturbances emanating from climate change and evaluated the kinds of learning taking place during the process.

A full review of the study context is discussed in Chapters 5 but suffice here to mention that, the Mutema community is an intergenerationally constituted, multi-voiced entity comprising people with diverse socio-cultural backgrounds. The community was a site of climate change intervention from technical experts, children and the Eco-Schools Club as well as from community members themselves. Despite the differences found among community members, there is a strongly shared overarching object in community member's adaptation of their everyday practices at the hands of climate change; the exigency to evade food insecurity, known as nzara in the local context. The informal learning that took place as community members pursued this object of evading *nzara* lies at the core of this study.

A CHAT analysis of the research context is summarised in fig 1 below.

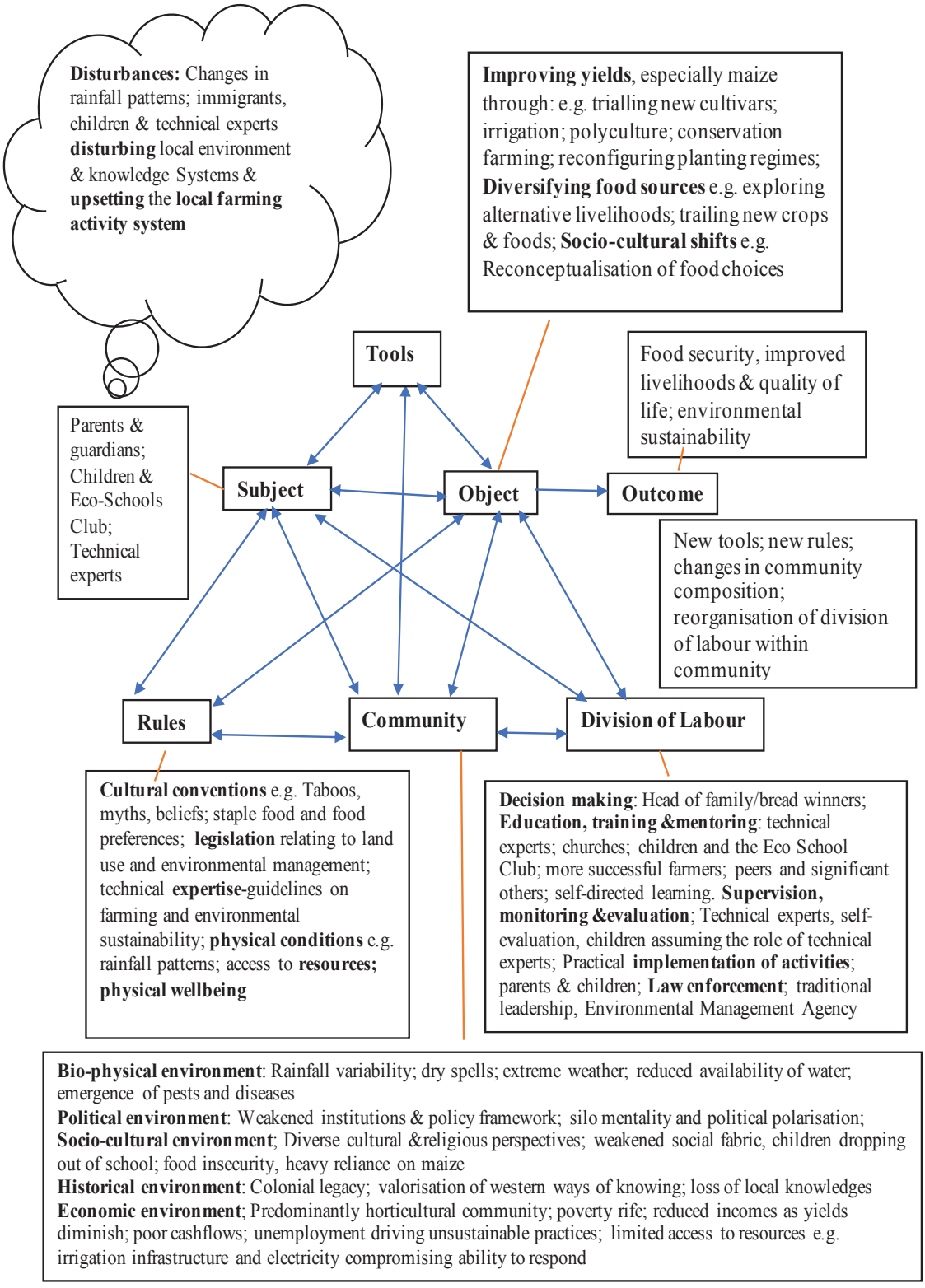


Fig 1: CHAT analysis of the study context (Adapted from Engeström 1987 p. 78)

Engeström (2008a) identified seven ways through which disturbances could be managed.

3.3.3.1 Managing disturbances

1. Negotiating: Individual or joint resolution of a problem results from compromise and modification of one's views
2. Accepting responsibility: Players take ownership of the problem.
3. Using authority: Those occupying a higher rank, those with expertise and the more experienced dictate solutions (power relations).
4. Complaining: Expressions of dissatisfaction are ignored.
5. Avoiding confrontation: Problem is acknowledged but resolution is shelved.
6. Engaging in open conflict: Clashing views are debated.
7. Attempting or completing an innovation: Novel solutions to the problem are proposed.

Engeström's framework for managing disturbances therefore provides a useful analytical tool to examine how the history, power relations and values of the community come into play as community members learn to negotiate their adaptation to the changing climate. Through documenting and analysing sources of resistance, and sources of strengths and resilience that the community can draw on, I identified possibilities of expansive learning that may help the community adapt to the challenges of climate change.

In addition, CHAT is useful for my study, as Engeström's model of the activity system has a focus on 'tools' or 'mediating artefact' and so directed my gaze to those tools and resources the people were using to make meaning of how to adapt to climate change. CHAT does not have to leave out the significant role that science can play; it enables us to consider science as a part of the socio-cultural milieu of the community and the tools for mediating meaning. CHAT thus broadens our understanding of the mediating artefacts by expanding the horizon of possibilities to include the cultural context within which the science of climate change is made sense of by the community under investigation.

3.3.4 Managing interactions

The underlying aim in conducting this study was to generate knowledge that might inform the design of future climate change interventions. It thus became critical to analyse the nature of interactions between community members and technical expert groups who introduced formative interventions. Over and above generating their own local innovations, community members also depended on externally driven interventions from various government departments and interest groups. Considering the public does not necessarily understand climate change in the same ways that technical experts do and cognisant of the diversity of interests of various expert groups, Engeström's (2008a) three Cs typology of interaction became useful for analysing the nature of interactions that could potentially create what Engeström & Sannino (2017) called socially impactful knowledge: 'knowledge that can be turned into transformative action' (p. 81).

Engeström (2008a) formulated a typology of interactions: coordination, cooperation and communication. He drew from the works of Raethel (1983) and Fichtner (1984) to understand the limitations and affordances of expansive learning that can emerge through each of these forms of interactions. In any activity system, the subjects assume a role which comes with a way of interacting, or a 'script' for interacting with others in the community. With coordination, Engeström (2008a) referred to interactions in which individual actors follow their scripted roles while concentrating on the successful performance of their assigned tasks. The script coordinates their actions but are not the result of any discussion or critical examination. The second category of interactions, cooperation, refers to interactions in which actors take a more active role in how they would interact. It takes place as actors focus on a shared problem while trying to find mutually acceptable ways of conceptualising and solving it. Although participants transcend the confines of their roles, they do so without explicitly questioning or reconceptualising the script that guides their everyday interactions.

Engeström (2008a) defined reflective communication as those interactions in which actors focus on reconceptualising their own role within the community, and what have been assumed as their shared objects. When both the script and the objects are reconceptualised, so are the interactions between participants, thus potentially

changing the dynamics and division of labour in the activity system. However, Engeström (2008b) explained that although transitions from coordination to cooperation are common, transitions to reflective communication are rare. However, expansive learning, that is, a radical transformation of the activity system, can only occur through reflective communication. Thus, a focus on the type of interactions between community members and the technical experts provided insight into the possibilities of expansive learning in the way the community responded to the impact of climate change on their livelihoods.

When dealing with complex issues requiring probabilistic reasoning, Engeström (2004; 2016;2018) argued for the emergence of new forms of work organisation requiring collaboration across disciplinary boundaries seeking to merge the seemingly incompatible worlds of technical expert knowledge and the everyday knowledge of the grassroots. He argued for interactions where teamwork transcends organisational bureaucracy and the possibility for deprofessionalisation, with grassroots views acknowledged as legitimate perspectives.

3.4 Limitations of CHAT in informing sustainability transitions research

While CHAT offers a useful lens for analysing learning in changing contexts, its inadequacies in informing sustainability transitions research has begun to emerge (see for example Mukute et al 2018; Lotz-sisitka et al 2017). Based on their analysis of sustainability transformation research with farming communities in Zimbabwe, Mukute et al argued for:

> …embracing and tackling life issues that matter on the planet and contribute to sustainability transformations … in a manner that goes beyond current CHAT affordances to take into account the production and distribution of risks, ecological services, and common good. These considerations are likely to require a reframing of the capitalism-driven definition of use value and exchange value in activity systems—starting with the second generation (2018, p. 16-17).

The argument by Mukute et al (2018) is that due to the complexity and contestation of sustainability issues, multi-layered contradictions tend to emerge. Consequently,

there seems to be a compulsion to add reflexivity to the change laboratory method so it could better contribute to sustainability transformations. While CHAT analysis is premised on learning that leads to radical transformations, CHAT is blind to challenging the superstructures that perpetuate unsustainability. The CHAT lens is blind to the fact that capitalism is the root cause of unsustainability (Mukute et al 2018), hence fail to acknowledge that not all radical transformations will drive society towards a more sustainable trajectory. Cognisant of these limitations, I combined CHAT with sustainability transitions theoretical perspectives to examine whether the adaptations taking place were indicative of a well adaptive community.

This takes me to the chapter conclusion.

3.5 Conclusion

In this chapter, I outlined the theoretical perspectives guiding my study. Overall, my study is informed by studies in STS and the PUS which argue that science cannot be studied outside of its socio-cultural context. Additionally, lay people do not necessarily understand science in the same way that scientists do. I made a case for examining climate change adaptation as a socio-cultural transition and argued that for adaptation to yield radical and transformative changes, current discourses that perpetuate unsustainability must be questioned. In view of this, I discussed how adaptation to climate change can be framed as sustainability transitions.

Research and scholarship in sustainability transitions, particularly by Shove, Spurling and their colleagues, were reviewed, and showed how they highlight the importance of treating social practices – *what people do in their everyday social contexts* - rather than individuals and their attitude or behavior, as the unit of analysis. In particular, they call for a focus on the role of fundamental questioning of the normalised practices as a necessary stage in sustainability transitions. To study learning and adaptation with such a focus, I argued a rationale for employing Engeström's CHAT. From a CHAT perspective, learning is precipitated by questioning and reflection, and is continuously driven by contradictions as the objects of learning keep shifting. Additionally, learning is not construed as a technology of the mind, but as what people are able to do in the everyday.

I summarise how the theoretical concepts work together in responding to the research question in fig 2 below.

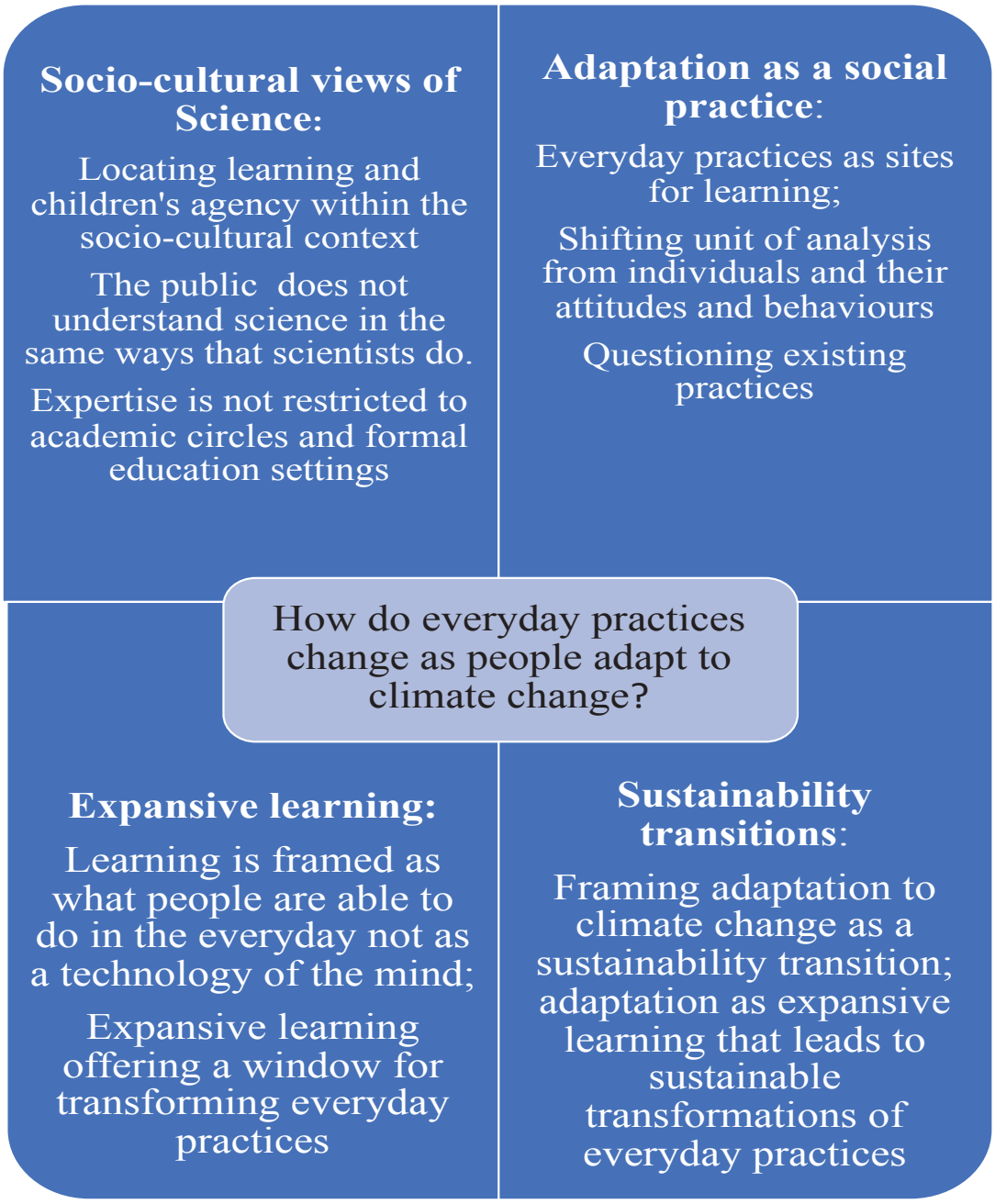


Fig 2: Model demonstrating theoretical framework

CHAT pays particular attention to the possibilities of *expansive learning* - learning that reconfigures the activity system in focus in some fundamental way, thus providing a useful lens for examining possibilities of sustainable transitions.

The next chapter details the research methods and methodologies employed.

Chapter 4: Ethnographies of climate change

4.0 Introduction and overview of chapter

This chapter presents the methodology that was employed for the study. It sets the plot and tells the captivating story of my journey through this study. I give a detailed account of the substantive thesis for my study and take the reader through the research questions already introduced in Chapter 1 to situate the reader in the broader context of my study. I reiterate why climate change adaptation is a prominent issue for education research and present a sketch of how my ideas fit together in this research. Following that, I present a detailed discussion of how and why I recruited the research participants before I evaluate the tools and methods I employed to collect and analyse the data and wrap up with a conclusion.

I focused on just one practice; how the farming practices have been changing because of climate change. Before I entered the field, I was not sure what to focus on, but that emerged from a preliminary analysis of what mattered most to my research participants. I used Shona, the local language of the participants which also happens to be my first language, for several reasons. First and foremost, using the participants' language is a sign that I respect and value their culture, which was important to establish trust and rapport with my research community (Stacey, Shuning & Sejung 2018). Additionally, there are arguments to suggest that language plays a critical role in creating self-identities and in how we view others (Tabouret-Keller 2017). Language thus significantly contributes to how researcher–participants power relationships play out.

In this study, it was important for me to access thick descriptions of data. I therefore needed to create spaces where participants could identify with me. Speaking their language was one way I accessed the participants' lifeworlds in ways that made them feel I was one of them. Even more important, I needed to avoid misconceptions that could potentially arise from miscommunication that is typically associated with using a foreign language. I needed to be confident that participants expressed themselves freely. An overview of the research phases, key informant groups, data collection methods and data analysis methods is summarised in table 2 below. These are discussed in detail in ensuing sections.

Table 2: overview of the research process

Research phases	Key informant groups	Data collection methods	Data analysis methods
Phase 1: Conceptualising the study and ethics clearance	Researcher	Documental analysis	In the initial stages of the study, I relied on abductive analysis, allowing the reality on the ground to lead me to the data (Timmermans & Tavory 2012). As I framed the interview questions, I relied on theoretical perspectives, mainly Engeström's (2000) CHAT and Shove and Spurling's (2013) sustainability transitions perspectives, to direct my gaze to the issues emerging from the focus groups. However, I kept moving back and forth between inductive and abductive analysis as I stepped in and out of the data to allow for the development of new theories while also acknowledging the value of using established theories to structure my ideas.
Phase 2: Negotiating access	Children in the Eco School Club	In-depth individual interviews	
Phase 3: Negotiating informed consent	Teachers in the Eco Schools Club	Focus group discussions	
Phase 4: Baseline study	Parents/Guardians with children in the Eco Schools Club	Participant and non-participant observation	
	National patron of the Eco Schools programme in Zimbabwe	Photography	
Phase 5: Focusing the study and recruiting participants	Traditional leadership and more successful farmers	In-depth individual interviews	
	Local Agricultural Extension Officer		
Phase 6: Data collection	Subject Manager for Geography and Environmental Science in the Curriculum Development Unit		
	Officer in charge of climate change project in the Environmental Management Agency		
Phase 7: Data analysis & draft chapters			
Phase 8: Thesis submission and examination			

The chronology is given for purposes of clarity but the steps were not as linear as they are presented.

As part of the ethical considerations of my research, the names of participants and institutions I worked with have been withheld to protect them from risk and harm associated with disclosure of sensitive information. All names used here are pseudonyms.

4.1 Situating the methodology within the broader context of the study

In this section, I present a summary of the study aims and rationale to situate the methodology within the broader context of the study.

4.1.1 Substantive thesis for my study

Adaptation to climate change has become an undeniable reality that is now intricately linked to human existence and the planet's well-being. I sought to understand what propels people to change and adapt their everyday practices in response to climate change, and what learning occurs in this process. Against a backdrop of human-induced unprecedented rise in global temperatures and the consequent irreversible environmental damage, it has become an imperative to reduce communities' vulnerability and increase their resilience to the impacts of climate change (Campbell et al 2016; Davies & Vincent 2017; Abid, Schilling & Scheffran 2016). I was interested in investigating the possibilities of adaptation in terms of what Engeström (2000; 2016) calls 'expansive learning', that is, radical and sustainable transformation of everyday practices, in response to climate change.

My overarching research question was:

How are everyday practices changing in response to the impacts of climate change?

This question was supported by sub-questions:

1. What are barriers to and affordances for expansive learning?
2 To what extent is there evidence of expansive learning, that is, learning leading to a radical and sustainable transformation of everyday practices?

The next section examines the philosophical assumptions that guided my study.

4.2 Research approach

In broad terms, the research approach of a study is concerned with the conceptualisation, planning, designing and execution of the study. It involves making decisions about the kinds of questions the researcher must ask and the methods and procedures to employ to generate the kinds of data that are being sought. In other words, the approach is concerned with the *what* (purpose), *how* (methodology), *with what means* (tools, strategies, theoretical assumptions), and the *so what* (analysis and interpretation) of the study. The approach or strategy of inquiry thus can be conceived of as 'a flexible set of guidelines connecting theoretical paradigms to strategies of inquiry and methods for collecting empirical data' (Denzin & Lincoln 2000, p. 21). The research approach reflects issues the researcher would take account of with regards to the nature of reality, the relationship between knowledge and the inquirer, and the process of getting to know the world (Cohen, Manion & Morrison 2013; Cresswell 2014; Denzin & Lincoln 2000; Glasser & Strauss 2017). For my study, I adopted a qualitative case study approach using the tools of ethnography.

Below, I justify my choice of a qualitative approach.

4.2.1 Arguing for a qualitative approach to researching climate change adaptation

Although there is more than one approach to conducting research in education, I focus my discussion on examining the tenets defining qualitative research, the approach informing my study. Qualitative research has been defined as:

> ... an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. … involves emerging questions and procedures, data typically collected in the participant's setting, data analysis inductively building from particular to general themes, and the researcher making interpretations of the meaning of the data. … honors an inductive style, a focus on individual meaning, and the importance of rendering the complexity of a situation. (Cresswell 2014, p. 4)

Qualitative research involves an interpretive, naturalistic approach to the world. It is premised on the ontological assumption that social meaning is best understood

through studying social life in its natural context with no deliberate attempt to manipulate the context. Cognisant of these characterisations, qualitative research is often referred to as naturalistic, hermeneutic and interpretive inquiry (Brewer 2000). For these reasons, a qualitative approach best fits my argument for studying learning rooted in the everyday, as previous studies have shown that more significant learning takes place informally as people experience life (Street & Rogers 2012).

My justification for adopting a qualitative approach is that what influences climate change adaptation is complex and cannot be construed outside the broader socio-cultural context (Nye & Hargreaves 2009; Shove 2010a; 2010b). Researchers on the sociology of scientific knowledge have argued that '…interpretations of science by the public are mediated by societal values, personal experience, and other contextual factors' (Lorenzoni et al 2007, p. 446). For that reason, I adopted a research approach that recognises the complexities of climate change and an approach that creates spaces for me to interpret climate change adaptation from the participants' point of view. A major argument this study makes is acknowledging knowledge pluralism in climate change adaptation research; a qualitative approach has an inbuilt component of accommodating knowledge pluralism.

Qualitative researchers refute positivist assumptions about the existence of an objective reality that is external to the knower. Reality is socially constructed, and all research involves interpretation. Qualitative research is value-laden and characterised by multi-realities that typically depend on the nature of the filters through which observations are made (Cresswell 2014; Denzin & Lincoln 2000; Ritchie et al 2013). Qualitative research thus aligns with my theoretical orientation, as the cultural historical activity theory (CHAT) acknowledges multi-voicedness. A consequence of the existence of such multi-realities is that qualitative research relies on multiple methods of data collection because each method of inquiry depicts reality in a unique way. However, use of multiple methods (triangulation) in qualitative research does not serve to validate the findings in the same way it does in quantitative research. Instead, multiple methods improve the quality of findings by adding rigour, breadth, depth, and complexity to the study (Denzin & Lincoln 2000). In my study, I adopted multiple methods of data collection to obtain thick descriptions of data (Hammersly 2018).

4.2.2 In defense of ethnographic-style research

The question of which research approach to adopt in social science research continues to be debated among social scientists (Cresswell 2014; Denzin 2010; Hammersly 2018), but for my study, I was guided by the social constructivist paradigm that is informed by relativist ontologies (existence of multiple realities), subjectivist epistemology (knower and respondent co-create understandings) and naturalistic (in the real world) inquiry. I investigated a real problem affecting real people in real settings. Heeding what I intended to achieve, I adopted the approaches, methods and techniques of ethnographic research.

Anthropologists concede that for interventions to succeed, researchers and development workers alike need to create a 'moral economy' (Nyong, Adesina & Elasha 2007) by acknowledging participants' local ways of knowing (Pink, Tutt, Dainty & Gibb 2010); if a participant's knowledge is valued people easily identify with the solutions. However, to understand what participants know, researchers must pay attention to the context within which the knowledge is generated, used and shared. Researchers, therefore, must pay attention to participants' everyday practices, their customs, value-belief systems and discourses within which the knowledge is generated (Pink et al 2010). Cognisant of these views, I adopted an approach that is consistent with socio-cultural theory and that allowed me to observe the performance of practices. As some scholars have argued, 'social practice theory directs research attention towards the practical accomplishment or "doing" of everyday practices…it implies the use of methodological techniques capable of observing what happens in the performance of a practice…' (Hargreaves 2011 p.84).

For this reason, I adopted ethnography. However, my study is not a pure ethnography in the way anthropologists traditionally use the term. Rather, I drew on the tools and methods of ethnography. A purely ethnographic study involves going native, which in a practical sense, may not always be feasible (Hammersly 2018; Pink et al 2010; Rogers & Street 2012). Considering that this was a PhD study that had to be completed within a limited timeframe, it was not possible for me to stay in the community for extended periods of time. Notwithstanding those limitations, my study was guided by the following ethnographic principles: studying things in their natural

setting, collecting data in multiple ways, participant observation, in-depth interviewing and thick descriptions of data (Hammersly 2018; Pink et al 2010).

One concern of this study was a search of how people made sense of climate change. Ethnographic research was the approach of choice for my study as it involves an attempt to engage with people's social meanings (Brewer 2010). I wanted to understand climate change from the participants' point of view, to pry into the 'other's' world. I solicited participants' perspectives and tried to understand the meanings they attached to the issues under investigation. I was guided by the belief that 'we need the tools of ethnography to observe…question…explore people's worlds from their point of view, to try and get into their living environment…' (Rogers & Street 2012, p. 18). I intended to see through the community's life-world; an ethnographic approach provided opportunities for more engaged and deeper interactions with the community that helped me to document the accepted and habitual practices among the participants (Hargreaves 2011; Hammersly 2018; Pink et al 2010; Rogers & Street 2012).

There is also a growing recognition among social scientists that certain problems that confront humanity are too complex to be solved through conventional scientific approaches (Hart & Bell 2013; Lotz-Sisitka et al 2017). Climate change falls within this category of intractable problems that evade traditional approaches. A research review by Roncoli (2006) on the state of ethnographic and participatory research in climate application research concluded that the way farmers make sense of climate change is not the same as the way scientists do. Additionally, what influences farmers' responses to climate change largely depends on '…cultural notions of what is true and trustworthy' (Roncoli 2006, p. 84). Other researches with a similar focus are those conducted for example by Hart & Bell (2013) and Wynne (2002; 2007; 2010). Ethnographic approaches thus allow for researchers to step out of the confines of physical science and read into the participants' lifeworlds.

Additionally, ethnography allows researchers to observe the omitted and undocumented knowledge (Pink et al 2003). Ethnography gives researchers access to hidden meanings and invisible ways of knowing (Hammersly 2018; Pink et al 2010; Street & Rogers 2012). Considering that the science behind climate change is complex, I endeavoured to access the not so apparent and hard to verbalise ways of

knowing to broaden my understanding of climate change learning by studying the meanings entrenched in practices. My approach was motivated by the belief that some kinds of knowledge are not easily articulated verbally; sometimes people fail to explain that which they know (Pink et al 2010; Street & Rogers 2012). Additionally, from a CHAT perspective, learning is viewed not as a technology of the mind, but as what people are able to do.

Although ethnographic research approaches provide rich sources of data, they have been criticised on the basis that the findings cannot be generalised to wider contexts outside the research sites. The debate on the desirability of generalisability as opposed to depth in research has not yet been resolved, but researchers inclined to the qualitative paradigm are more concerned with the richness of the data as opposed to its generalisability (Cresswell 2014; Hammersly). Quantitative researchers, on the other hand, are concerned with generalisability of findings to a wider context (Cresswell 2014). I was more concerned with depth because, although climate change is a global issue, its impacts are localised (Granderson 2014); hence the need to study the issues in context.

4.3 Researcher positioning

In qualitative research, every researcher is a philosopher (Denzin & Lincoln 2000; Cressswell 2014) because all research is interpretivist; it is heavily dependent on the researcher's ontological, epistemological and methodological assumptions. The researcher's philosophical orientation thus guides the research topic, the questions the researcher will ask, the methodologies adopted, and the kinds of analysis employed (Denzin & Lincoln 2000; Silverman 2017). Within the qualitative research paradigm, the centrality of the researcher as the main instrument for data collection and analysis is emphasised (Silverman 2017). Further to that, qualitative research contends reality is socially constructed and the relationship between the researcher and the researched is highly intimate (Denzin & Lincoln 2000; Silverman 2017). It thus becomes imperative for the researcher to be aware and critically conscious of their personal biases and preconceived ideas and learn to manage them. This process of questioning researcher assumptions and the taken for granted and how they affect the research process is generally referred to as reflexivity. Researcher subjectivity

needs to be managed to improve the merit, legitimacy and integrity of the research findings (Denzin & Lincoln 2000; Gearing 2004; Silverman 2017).

Before I describe the model I used to manage my biases, I give a synopsis of who I am and how that might have influenced my research approach.

4.3.1 About me and my influence on the study

I am an early career researcher and scholar in the field of science education with a specialty in physics. My background in the field of education and learning is the reason I chose to investigate the learning that takes place as people adapt to climate change. My study was informed by socio-cultural theory because my past and present research interests lie in sustainability science and an understanding of science from a socio-cultural perspective. Having been exposed to an education system that was highly decontextualised, I have a strong urge to demystify science as a preserve for specialists and science as removed from the ordinary person. My desire is to study the interactions of science, technology, society and the environment and how they influence each other. For this reason, I adopted an ethnographic approach to the study to enable me to see things from the participants' perspectives.

I am not claiming to be an expert in climate change science, because I did not specialise in climate change science as a field of study. However, I have participated in national, regional and international training programmes, symposia, conferences and workshops that sought to interrogate the dynamics of climate change and the role the education sector could play in helping countries and communities to adapt to climate change. Dating back to 2007, I have worked independently and in teams in conducting research with a focus on empowering communities to transform their circumstances and improve their conditions of living. I also engaged with research focusing on how education at distinct levels can be reoriented towards sustainability and how to develop more responsive curricula with the goal of creating resilient and more sustainable communities through the provision of education that is transformative and empowering.

Making specific reference to the area of climate change, I worked on several projects with a focus on curriculum innovations for climate change mitigation and adaptation. I formed part of the group of experts drawn from the United Nations Education,

Scientific and Cultural Organisation, UNESCO Africa region to give recommendations on how education at various levels ought to respond to climate change. My past research experience thus strongly influenced the choice of focus of my PhD. I was drawn to realise that education provision in its current form falls short of addressing the challenges presented by climate change. This is what drove me to pick on my research topic and focus.

The community I worked with was not known to me except that I was familiar with its geographic location. However, I knew one of the ESC patrons through our interactions with the various environmental sustainability networks we both participated in. Also, the community was not dissimilar to the rural community I grew up in. I am familiar with most of the local cultures and traditions in the community as well as the local language, Shona, which also happens to be my first language. I therefore assumed a dual identity of insider/outsider. I assumed multiple identities to suit the specific groups of participants I dealt with. My participants included children, not so educated parents and professionals. The way I dressed, the way I spoke and the language I used varied accordingly.

However, having racial commonality with your research participants does not necessarily translate into research egalitarianism, as power relations still play out (Olive & Thorpe 2013; Pillow 2003). My research participants were privileged as they owned the local knowledge I sought to reproduce; it was entirely up to them to share that knowledge with me. On the other hand, I was privileged in terms of class and Western ways of knowing. I also directed the study to meet some preset criteria of what I intended to achieve. In addition, there were variations in age, gender, marital status, and religion. More details of how the power relations were managed will be given in the data gathering section but suffice it to say that the research process was informed by a process of dialogic inquiry where participants were empowered to make some of the decisions.

The next section discusses how I managed researcher subjectivity.

4.3.2 Managing researcher subjectivity

Managing subjectivity is not an easy and straightforward process as there are no prescribed methods that qualitative researchers strictly adhere to; one technique for

managing researcher subjectivity is bracketing; that process where researchers become conscious of and take stock of their beliefs, assumptions and biases (Gearing 2004; Silverman 2017). The objective is not for the researcher to abandon such biases but to be conscious of them, so they may approach the research honestly. For my purposes, I adopted the four strategies to reduce bias:

Firstly, lived experiences of participants were investigated by holding in abeyance my own theories, values, beliefs, scientific knowledge but without disengaging from the research context.

Secondly, I kept stepping in and out of the bracketing process through an iterative process that allowed me to see things from the participants' perspectives but at the same time not losing focus of the object of my study.

Thirdly, in my write-up, I made my assumptions explicit and I chronicled how my history, values, experience, and viewpoints influenced the choice of my research focus and methodology.

Lastly, the bracketing process spanned the entire research process from the time the project idea was muted until the stage when the data was analysed and conclusions were drawn. However, I established loose boundaries that enabled me to step in and out of the brackets to facilitate reintegration of data in an iterative process.

Now that I have made my beliefs and preconceived ideas explicit, the next section discusses the research participants and their recruitment.

4.4 Research participants and their recruitment

In this section, I spell out the inclusion and exclusion criteria to justify the choice of my participants. The primary research participants were all members of the Eco-Schools Club (ESC), their parents/guardians and the three club patrons.

4.4.1 Justifying the choice of research site

As already discussed, climate change education and learning (CCEL) in Zimbabwe is largely informal, is still in its infancy and has not yet established itself as a discipline (Chineka & Chabikwa 2015; GoZ 2016). Due to lack of a national blueprint to guide its implementation, CCEL is largely uncoordinated and mainly exists in the form of school clubs and awareness campaigns under the broader framework of

environmental education (EE). In view of these considerations, I chose to work with a school that was proactive in terms of EE with a focus on climate change as an environmental and sustainability issue. My study sought to investigate whether and how the school club influenced the ways the community adapted to climate change. The school I studied was affiliated to a local not for profit organisation's EE programme known as Eco-Schools Programme, a programme that endeavours to promote environmental awareness leading to the adoption of more sustainable lifestyles by engaging learners in activities meant to address environmental issues within their school community.

The school thus provided a suitable research site for a handful of reasons. The prime reason was that this school was a model for advancing environmental awareness. Secondly, working with a school could potentially increase the chances of the research being mainstreamed in the formal curriculum. There are opportunities to interface community education with the formal school system. Lastly, schools naturally serve as safe and convenient centres for information dissemination for most of the social activities that take place within rural communities in Zimbabwe. When I entered the field, the ESC had been in existence for five years.

I also needed to work in a community where the impacts of climate change were manifest. My study was a qualitative case study; hence my choice of research site was influenced by the potential for a site to be a rich source of data (Denzin & Lincoln 2000). As I desired to study climate change from a socio-cultural perspective, I was looking for a community with a fair blend of cultures. As the changes posed by climate change happen over extended periods of time, I was compelled to work with a community that is stable in terms of mobility of people across places (Pink et al 2010). In addition, I considered the feasibility of my study in terms of accessibility to the research site.

The next section discusses Miombo Environmental Education Centre (pseudonym), here referred to as Miombo, the not for profit organisation championing climate change education and learning and why this organisation was included in the study.

4.4.2 Miombo Environmental Education Centre and the Eco-School Programme

Miombo runs an EE Resource Centre and several EE programmes with schools and communities. One of the issues their programmes seek to address is climate change. I included Miombo in my study because they worked closely with government departments, including the Ministry of Primary and Secondary Education (MoPSE), the Environmental Management Agency (EMA), and the Climate Change Office, that seek to address climate change through education and awareness. Miombo also forged partnerships with United Nations agencies, other civil society organisations, industry, business, individuals and higher education institutions that work in climate change.

I was interested in studying Miombo's Eco-Schools Programme. I sought to understand the expert views vis-à-vis the grassroots views. What do experts have in mind as they design and deliver climate change education and learning programmes for communities and what role(s) do the communities play in the design and development of such programmes? How are these programmes received by the communities? What is the structure, focus and rationale of Miombo's Eco-Schools Programme and to what extent is climate change education a component of the programme? What information is made available to schools, how accessible is the information and how is the information communicated? I was keen to interrogate the key message(s) being spread and what contradictions and controversies existed. My study solicited for Miombo's epistemological and ontological assumptions about how climate change education ought to be modelled and delivered if the focus is to enable sustainable adaptation among communities. I reviewed Miombo programme documents and held informal discussions and interviews with programme personnel to get insights into the nature and structure of the programme, challenges and success stories.

4.4.3 Children in the Eco-Schools Club

The ESC showcased how they were addressing climate change and related environmental and sustainability challenges during focus-group discussions and practical activities. As I conceptualised the study, the initial plan was for club

members to participate in focus group discussions jointly with their parents and teachers. However, the lead club patron hinted that due to cultural conventions children would not talk when put in a group with their parents. Hence, separate meetings were arranged to allow children to express themselves freely.

My involvement with the club ranged from non-participant observer as I observed some of their activities to participant observer as I participated in some of the club activities and focus-group discussions. Sometimes I joined the club as they performed their routine activities; for instance, on one occasion I took part in the planting of herbs and vegetables. On one occasion, I followed the club on their out of school activities as they participated in the national World Environmental Day commemorations. Each time I visited the school, I passed through their herb and vegetable garden just to chat with the club members and to learn how they interacted as they performed their activities. I was eager to learn how and what learning took place as members engaged in club activities. I needed to establish who was active and why, what drove people to become members and in what ways, if any, did their being members of the Eco-Schools Club influence their climate change learning and adaptation. One important aspect the study sought to investigate was whether and how children could effectively drive the change that is required to promote sustainable adaptation to climate change.

I became a part of the learning community and was accepted as a team member to such an extent that students approached me asking about the day's programme and activities. I engaged in non-club talk with ESC members to establish the rapport that I desperately needed to allow me to get thick descriptions of data. That kind of data you get because someone trusts you enough to divulge personal and confidential information. Some of the information I solicited, such as how people were coping with climate change and the kinds of challenges they faced, called for participants to divulge private and sensitive information. Considering I was working with teenagers, issues of identity and belonging were especially important. It was therefore essential for me to be able to create an environment in which participants felt I was one of them.

4.4.4 Teachers leading the Eco-Schools Club

Another group of informants was the three teachers who acted as club patrons. I needed to solicit their perspectives on the club's history, rationale, vision and mode of operation. I sought to examine their perspectives on the design and delivery of climate change education and learning (CCEL) programmes now and in the future, how to scale up learning for climate change adaptation and how to improve school–community links for improved CCEL. The club patrons were instrumental in organising meetings with both parents and children. I relied on their support as catalysts and trusted brokers between children and their parents.

4.4.5 Families with children in the Eco-Schools Club

Parents/guardians took part in focus group discussions, interviews and observations in their social, home and work environments. They were the primary sources of data. It is the daily practices of the adults that I studied and documented. However, to generate thick descriptions of the local practices (as is the aim of an ethnographic approach), children, as part of the adults' social sphere, could not in my opinion be ignored. I interviewed club members to obtain further perspectives on the accounts provided by the parents to generate thick descriptions of the local practices. Children became key informants because I needed to understand whether and how their participation in the ESC had influenced their parents' climate change learning and adaptation. I looked at whether and how children's influence, if any, was shaping parents' interpretations of climate change and their response to it.

It was useful to co-opt one member of the School Development Committee (SDC), as they formed an important link between the school and the community. SDCs are made up mainly of parents and hence represent the parents in the governance and management of schools. The SDC member served as a trusted broker between parents and the researcher. What made this SDC member even more important for my study was that they had a child in the ESC. One role of SDCs is ensuring the provision of quality education in schools (Sango & Boonstoppel 2015; Mupindu 2012). If properly utilised, the SDC platform may work to harmonise community education with the formal school system. SDC parents, therefore, have potential to build links between

the club, the home and the formal school system that improve the provision of quality learning as they are capacitated to argue from an informed position.

Previous studies (e.g. Duvall & Zint 2007; Williams, McEwen & Quinn 2017), have shown that intergenerational learning in EE can be improved on if parents actively participate in children's learning, particularly so where the focus is on addressing local issues. They observe that most interventions target children because they are easier to reach and will influence their parents' decisions, leading parents to adopt pro-environmental behaviour. However, Duvall and Zint argued that such programmes have not been very successful. Instead, they propose intergenerational learning settings where children and adults learn from each other in mutual settings.

Since I intended to study how people's everyday practices had been changing over time in response to climate change, it was crucial to work with people who had lived in the area for a considerably extended period. I set as the lower limit a period of ten years. All participants except for two families met this criterion. The two families had moved into the area about eight years earlier, and I felt eight years was long enough to appreciate the changes taking place in the participants' environment because of climate change. More importantly, I needed to interrogate what Brandt and Clinton (2002) called the transcontextualised and transcontextualising potential of literacies: the view that while literacies are socially embedded in the local context, literacies can travel, integrate and endure. The value of immigrant knowledges in climate change adaptation has been acknowledged by previous studies (e.g. Klockera et al 2018; Shava et al 2010); I needed to understand whether being foreign to the community mattered in as far as the adaptations they made. I deliberately included the elderly as they presumably possessed rich contextual knowledge of how the climate had been changing and the adjustments people had been making in response to these changes.

4.4.6 The dominant voices

One of the issues my research sought to investigate was how voice and power influenced the way people adapted to climate change within the given locality. It thus became important to capture the dominant and powerful voices, and analyse how such dominant voices could be mobilised to steer the community towards adopting more sustainable practices. As I interacted with my participants, names of certain

people and organisations kept recurring and I extended my investigation to include such people. Examples included local Agricultural Extension Officers (AEOs), the EMA, traditional leadership and farmers who were more successful. I interviewed two traditional leaders, one AEO, the officer in charge of climate change projects in the EMA and one more successful farmer. In their discussions on CCEL, teachers constantly referred to the formal school curriculum and how it ought to be improved to complement the ESC efforts. Consequently, over and above documental review, I interviewed the officer in charge of climate change education and learning in the national Curriculum Development Unit.

4.4.7 Negotiating Access

Once I obtained ethics approval, my first point of contact was Miombo. I held formal and informal meetings with the Programme Manager of the Eco-School Programme (ESP) to get a clearer view of what their climate change education programme involved and we discussed the modalities of operation.

The next step was to negotiate access to the research site. The letter I used to obtain ethics clearance from the Ministry of Primary and secondary Education's (MoPSE) Head Office categorically stated that before I could access the school in question, I must seek clearance with the appropriate MoPSE sub-offices. Thus, I approached the relevant Provincial and District offices in the MoPSE who in turn granted me permission to access on condition that the school administration approved of my project.

Armed with the clearance letters from the MoPSE, my research instruments, evidence of my university ethics clearance and a letter of support from my supervisor, I approached the school leadership for approval to access the school. I was received by Zvisineyi, the lead Eco-Schools Club patron. We held an informal meeting to clarify the nature and purpose of my study. When she was convinced my paperwork was sound, Zvisineyi formally introduced me to the deputy principal, who also doubled as the founder and one of the patrons of the ESC. I call the deputy principal Thomas to protect his identity. After going through my paperwork, Thomas was satisfied I had observed all protocols as per MoPSE guidelines, and I was granted access to the school.

I held a formal meeting with Zvisineyi and Thomas explaining the nature and purpose of my research in order to seek their informed consent to participate in the study and for them to facilitate my access to children in the Eco-Schools Club and their parents. We discussed the club's constitution, mandate and mode of operation and the activities they were planning for the current school term. We deliberated on how to mobilise parents to participate in the study and we drafted a rough schedule of the meetings I would hold with ESC members and parents. The two patrons pledged their support to facilitate my contact with both students and parents and another club patron, Samantha (not her real name).

With the support of Zvisineyi, the next step was to obtain informed consent from students and their parents. I was introduced to ESC members, distributed the information sheets to all club members, briefed them about my study and asked them to share the information with their parents to interest them in participating in the study. Since I was working with children below the legal age of consent, it was crucial to get parental consent. Parents who wanted to know more about the study were asked to come for a meeting later.

4.4.8 Sampling and sample size

Since this was a qualitative study, sampling was purposive, as I sought to work with rich sources of data that would yield thick descriptions. To identify potential informants, I held a meeting meant for all thirty families with children in the ESC to brainstorm on the issues of concern with regards to climate change and to obtain their informed consent to participate in the study. I solicited the help of ESC patrons to convene the workshop. Five parents representing five of the 30 families turned up and all five agreed, through a long and engaged informed consent process that took more than three hours, to be part of the research. The rest of the participants were identified using the snowballing technique. Snowballing is when a researcher relies on participants to identify further informants through some chain referral process (Sadler et al 2010).

The issue of sample size in qualitative research has always been a bone of contention as theorists differ on what makes a good sample size (O'Reilly & Parker 2012). From a theoretical position, sample size in qualitative studies is quite difficult to

predetermine because it is not the size of the sample that really matters, but the quality and amount of data that can be generated from it. Some theorists advise that instead of focusing on sample size, a more useful concept to consider in qualitative studies is data saturation (O'Reilly & Parker 2012; Saunders, Sim & Kingstone 2018), the point at which further researching will no longer yield any new insights. Cognisant that, typical of qualitative studies, my study yielded large volumes of data, I settled for eight households, which I researched in depth until I reached data saturation.

4.5 Data collection procedures

The research process followed a series of steps as described below. The chronology is given for purposes of clarity, but the steps were not as linear as they are presented. Several data collection methods were used.

4.5.1 Baseline

Once access to the school had been granted, the next step was to familiarise myself with the history, culture and power relations of the research site. Socio-cultural theory stipulates that risk perception and concern about environmental issues are socially and culturally mediated and solutions to societal problems are developed collectively (Engeström 2016; 2018; Granderson 2014; Kilgore 2010). I conducted a baseline survey of the Vagoni school community to map out the sustainability issues around climate change adaptation that the club was addressing. I discussed with Zvisineyi and Thomas the sustainability issues in the school community, paying special attention to those issues the ESC was addressing, had addressed before and planned to address in the future.

However, to get a broader perspective into the climate change related sustainability issues in the community, I needed to engage with the research participants in a more structured format. With the help of Zvisineyi, I organised focus groups that served as points of entry into the community's life-world. I held three separate focus groups: one for parents and two for students.

I deliberated with teachers, students and parents through focus group discussions to map out the climate change related sustainability issues within the community. We spoke about how such challenges emerged, what was being done and what needed to

be done to address them. We spoke about how the climate in the community was changing, what was causing the changes and what needed to change to enable the community to adapt. The discussions touched on how climate change related sustainability issues could possibly be resolved. Coincidentally, all three groups concurred that the object of the study should center around how farming practices in the community have been changing due to climate change.

I used the baseline to test the feasibility of my study and to map the focus of my study. The meetings served to clarify the research process and to document opportunities, constraints, best practices, unsustainable practices, tensions and contradictions, consensuses and gaps in knowledge. The focus groups illuminated the issues of most concern, identified potential key informants and those participants with potentially higher levels of participation. It was important to identify such people because they were more likely to stay involved through the life cycle of the study. Considering this was a lengthy and involving study for which participants were not paid, it was crucial to keep attrition rates to a minimum (Zweben, Fucito & O'Marlley 2009)

With my key informants on board, the next stage involved conducting individual interviews with participants to obtain personal narratives.

4.5.2 Participant narratives of climate change

The major thrust of the study was to document and analyse the everyday practices of community members to get some sense of the local climate change practices rooted in context and experience. To gain a holistic view of the stories, I interviewed participants in their homes, fields, gardens and places of social networking so that I could directly observe some of their practices. I listened to their stories and observed their daily practices. I engaged participants in conversation in some instances, while in other instances, I engaged them in semi-structured interviews. My visits lasted on average two hours per session. The interviews typically lasted on average one hour; the rest of the time was spent on non-research talk just to break the ice and to allow participants to engage with some of their daily routines. I deliberately avoided creating rigid, formal interview situations, to minimise disruptions to the participants' natural settings. For instance, I would allow my participants to attend to their visitors, family members and other chores as the interviews progressed.

In line with dominant cultural views in the community, I carried small gifts, such as bread, sugar, milk and soap each time I visited my participants. Typical of the dominant culture, my participants offered me food each time I visited. Depending on my schedule, I either shared the food with my participants or carried it for consumption later. As a way of basic courtesy, I accepted the food and other gifts my participants offered me. Due to my privileged social status, refusal would be interpreted to mean I looked down on or despised my participants. To create a sense of acceptance among my research community I behaved like one of them where I could. I dressed like them, used their language and ate what they ate as I listened to stories of how they coped with the impacts of climate change and what shaped their adaptation choices. To minimise disruptions to my participants' daily routines, I booked them in advance and I would phone them before I visited to make sure my visit would not interfere with their other schedules.

In view of ethical considerations regarding research with minors, my interviews with students took place in open spaces on the school grounds and in the school garden. I used spots that were normally used for ESC activities. The same spots were used for interviews with the three club patrons. We sat either on a mat or at a desk depending on venue and availability of furniture. I created an environment where students freely expressed their views as I guaranteed them anonymity and confidentiality of issues discussed.

Part of the study involved an understanding of how practices develop, how they are sustained and how they could be influenced to change. I arranged focus group discussions that created spaces for the community members to reflect on their current practices through engaging them in discussions that sought to unearth what they were currently doing, what they wanted to change, what they hoped to change, what they had been trying to change but failing and why. My role was to create spaces for the community members to meet, network, deliberate and reflect on their practices. I moderated discussions to ensure they remained focused, clarified issues and made information available, but did not prescribe solutions.

Although focus groups may not be consistent with naturalism because they are subject to enabling the creation of an artificial environment, it is not uncommon for community members to meet and deliberate on issues of mutual concern. In this

community, members met regularly to discuss school-related and other developmental issues such as the construction of the local health centre. Considering there were several interventions targeting climate change awareness such as those organised by the Environmental Management Agency within the community, it was not entirely artificial to arrange focus group discussions related to climate change. In this kind of study, focus groups were particularly useful as they created opportunities for people to explore and clarify their views in ways that were not possible in one-on-one interviews (Guest, Namey & McKeena 2018; Kitzinger 1995). This was critical, considering there are a lot of controversy and myths surrounding climate change. Focus groups created platforms where people deliberated on the basics of climate change and created opportunities for reflection and learning from each other. The method is particularly useful for exploring people's knowledge and experiences and can be used to examine not only what people think but why they think that way (Conway, Doherty & Carcay 2018; Guest et al 2018).

Focus groups thus provided additional opportunities for examining what shaped and sustained people's everyday practices, created opportunities for people to build on one another's responses and developed ideas they may not have thought of in a one-to-one interview. Part of what this project aimed to find out was how community members could learn from each other about climate change. Additionally, the study endeavoured to examine whether climate change learning and adaptation might be a collectively produced practice. The use of focus groups thus had a defensible rationale.

All interviews were audio-recorded while focus groups were both audio- and video-recorded to create a record of what transpired that I could review and analyse in detail. Field notes of observations were also made. I captured the notes in my diary, reflecting on and expanding them, soon after my meetings with participants.

4.5.3 Observation

Social scientists contend that talking to people does not suffice if the goal is to understand everyday practices. We need to employ the tools of ethnography to observe the habitual and invisible practices (Rogers & Street 2012; Pink et al 2010); 'the strength of ethnographic work lies in how it allows researchers to understand the

otherwise invisible ways of knowing…' (Pink et al 2010, p. 653) because not all kinds of knowledge are easily articulated verbally (Pink et al 2010). Sometimes people fail to articulate what they know, but that does not mean they are illiterate. Consequently, I augmented oral stories with the observation of peoples' everyday activities as they performed their daily routines in their homes, work and social spaces. While it was desirable to observe how practices changed as people adapted to climate change, it was not feasible for me to observe any significant changes in the participants' daily practices because of the limited amount of time that I spend in the field. Change can be a slow process; I relied on participants' narratives of how their practices had been changing over time.

4.5.4 Photography

I used photography both as a methodological tool and as a way of communicating my research findings. The use of photography in ethnographic research is justified based on its power to create spaces for participants to visualise and reflect on their practices. (See for example Engeström 1996; 1999; 2000; 2001 on change laboratory research; Wyer et al 2017) on research on visualising healthcare improvement). As a methodological tool, photography is believed to reproduce the reality of scenes and objects, and as an analytical tool, images present an argument (Bryne, Daykin & Coad 2016). I took both motion and still photographs of events, objects and people. However, as a data presentation tool, photography is highly subjective, because how one interprets a photograph depends on the filters one uses (Wyer et al 2017). In my study I wanted to tell a story of the lived experiences of my research participants and share it with the readers in ways that would recreate the scenes and consume them in the setting. Cognisant that this was a qualitative case study where researcher biases could have easily tainted what was being photographed and where I chose to focus the camera, I used photography as a reporting tool to allow readers to create their own impressions.

4.5.5 Documental analysis

Cognisant that there was intervention in the community in the form of education campaigns run by the Eco-Schools Club, I examined how the intervention had influenced adaptation in the community's everyday life. National programme

documents, including but not limited to annual reports and progress review reports, were analysed to get an impression of the focus of the Eco-Schools Programme and its mandate, philosophy, outputs and outcomes. I also investigated how members of the community interacted with climate change information that was available to them through channels such as the media, civil society and government publications. Additionally, I reviewed public policy documents guiding climate change education and learning in Zimbabwe.

4.5.6 Other sources of data

Since this was an ethnographic study that sought to understand climate change adaptation from participants' lived experiences, it was crucial to engage with some of the prominent activities, programmes, and forums through which people interacted with climate change information. I admit that it was not possible for me to study each of these activities, but I picked a few that participants constantly referred to during interviews and other informal discussions.

Some of my participants indicated they learned about climate change by subscribing to the EcoFarmer programme, a local microfinance insurance programme designed to insure crops and inputs against adverse weather conditions (https://www.econet.co.zw/ecofarmer). Over and above providing insurance to farmers, EcoFarmer gives advice on weather conditions, markets, and general farming tips to subscribed farmers via the short message service (SMS). To get insights into how this programme works, I subscribed to the programme for the period I was in the field and I received the same updates that my participants were receiving.

Almost all the parents belonged to a social grouping meant to mobilise people and resources and help each other in time of need. Although these groups were not formed to directly address the impact of climate change, people discussed livelihoods and ways of improving the quality of their lives. Through such forums, information about knowledge on how to adapt was shared. Generally, such groupings were formed along bloodlines, religious affiliations, geographical proximity and intersecting areas of interests, for instance participating in green shows and installing piped water in households. One of my participants invited me to a grouping she was affiliated with, so I could interact with the group during some of the weekly meetings. I participated

in two of these meetings in which women from a bloodline met every Wednesday at 14:00 to discuss the welfare of their club as well as share insights on how to improve their livelihoods in the context of food insecurity as a direct result of climate change.

Typical of qualitative studies, the design of my study did not follow some rigid preset criteria even though I had a draft framework of what I intended to do. Some of the sources of data emerged as the research unfolded, some were accidental. I gave people in the community rides in my car and engaged them in non-formal conversations. On one occasion, I gave a ride to one of the local Chief's aides. I did not know him, but it was a beautiful coincidence that he was on his way to a meeting at the Chief's residency and I happened to be going in the same direction. I spoke with him about the role of traditional leadership in environmental stewardship and climate change. We spoke about his personal encounters with climate change and the mechanisms for adapting to climate change that government, through the traditional leadership, has implemented in the community.

On other occasions, circumstances placed me in places off plan. For instance, one of my participants lost her sister and I ended up at the funeral. I did not go to the funeral for purposes of research, but I could not help but listen to people's conversations at the funeral wake as they shared their thoughts about changed rainfall patterns. I learned a few things about the community's value-belief systems simply by listening to people's conversations at that funeral.

4.5.7 Member checking

After five months of engagement with the participants, I held member checking sessions with all key informants. I recreated the scenes and took the participants through the research journey by replaying tapes and reading interview transcripts aloud. Besides checking on the authenticity of my findings I also checked whether any new insights would emerge. I was convinced that not much was emerging as new insights, because participants acknowledged that their views were captured correctly and, in most cases, had nothing to add. Participants kept referring to issues discussed earlier and for me, that was a sign to say my study had reached some level of data saturation. Before I exited the field, I organised an exit workshop to consolidate and communicate the preliminary findings to my research community. Besides member

checking, the exit workshop gave participants access to the research data in a decoded format. Where needed, follow-up interviews were conducted with participants over the phone.

In the next section, I discuss the steps I took to ensure the integrity of the findings.

4.6 Ensuring quality

Although qualitative researchers contest the use of the terms validity (generalisability of the research findings) and reliability (replicability of findings and consistency of research instruments), they still need to demonstrate that their research is trustworthy and can be defended with confidence (Houghton, Casey, Shaw & Murphy 2013; Noble & Smith 2015; Morse 2015; Shenton 2004). Accordingly, I put in place nine measures to guarantee quality. I did not adopt any specific framework for ensuring quality in my study. Rather, I relied on guidelines offered by several scholars and picked those most relevant to the nature of my study context and what I sought to achieve. Since my study was informed by the naturalistic paradigm, I adopted approaches suitable for naturalistic inquiry.

First and foremost, I referred to work done by previous scholars to guide the design of my study (Shenton 2004). I referred to Chenail's (1997) framework of keeping things plumb in qualitative research, and Shenton's (2004) framework of ensuring trustworthiness in qualitative research and Mays and Pope's (2000) criteria for assessing quality in qualitative research.

Secondly, I presented my research proposal and subsequent stage assessments before a supervisory review panel to ensure rigour and academic integrity (Kelly 2014).

Thirdly, I made my biases, preconceived ideas, and assumptions explicit (Gearing 2004), (see 4.3).

Fourthly, I used multi-methods of data collection, not to compare data across methods, but to obtain thick descriptions of the data and to overcome method boundedness, where weaknesses inherent in one methodology are offset by the other (Mays & Pope 2000).

Fifth, I documented every step of the research process to keep an audit trail of what transpired (Mays & Pope 2000; Shenton 2004) to allow the reader to ascertain

whether the claims I made were supported by evidence (Mays & Pope 2000). I kept records of all the notes, audio and video recordings and pictures of the data collected (Gearing 2004; Mays & Pope 2000) which are available to other researchers for verification.

I discussed the limitations of my study to allow the reader to evaluate the dependability of my findings (Shenton 2004). Additionally, I held feedback sessions with all participants to ensure participants' views were correctly captured (Golafshani 2003; Shenton 2004).

The seventh strategy was that I researched a community whose culture I am familiar with (Pink et al 2010), allowing me to bring more than external researchers' perspectives to the study. Further to that, I used the participants' language, Shona, which also happens to be my own language, to ensure elimination of conceptual errors that are a direct result of using a foreign language.

Even more significant, my study rested on the belief that different pieces of knowledge make different things visible (Chalmers 2017; Pink et al 2010); I adopted an interdisciplinary approach and incorporated the community's local knowledge in the research design, paying attention to the community's epistemological, ontological and axiological assumptions (Chlamers 2017; Pink et al 2010; Sukarieh and Tannock 2012).

Lastly, I sought to understand climate change adaptation from the community's perspectives instead of imposing Western imperialism on them (Ndlovu-Gatsheni 2017; Smith 2012). I gave the participants voice; they decided on the research focus, while data collection techniques allowed them to express their opinions. My report captured participants' direct quotes and pictures of exhibits, allowing the data to speak for itself (Silverman 2017; Walker, Fredericks, Kyly Mills & Anderson 2014).

This takes me to the point where I discuss how the data were analysed.

4.7 Data analysis

Since this is an ethnographic and participatory study, data analysis commenced the moment I entered the field. In the initial stages of the study, I relied on abductive analysis, allowing the reality on the ground to lead me to the data (Timmermans &

Tavory 2012). The main reasoning behind abductive analysis is an acknowledgement that unfamiliar theoretical formulations and categories may emerge from the data. In my case, I was mindful of clouding the research process with my preconceived ideas. The focus of my study, for example, changed from studying children's agency in influencing adult adaptations to studying other sources of learning with a wider impact on adult adaptations, because this is where my preliminary data analysis led me.

The first focus group discussion provided a means through which to enter the participants' life worlds. As I listened to participants during discussions, and later as I listened to the recordings, I figured how climate change was impacting on them, what they were doing, what they were not willing to do and how they were learning to adapt. This preliminary analysis helped me to focus my study and to develop my research questions for the individual interviews. While most of the questions were similar, some questions were unique to specific individuals as I followed up on issues that were raised by specific individuals or issues where specific individuals held views that were seen to be divergent.

However, as I framed the questions, I relied on theoretical perspectives, mainly Engeström's (2000) CHAT and Shove and Spurling's (2013) sustainability transitions perspectives, to direct my gaze to the issues emerging from the focus groups. I needed to establish the following:

- Who are the learners? Where are they located within the community, what is the material and social infrastructure they have that might influence their adaptations? What are their conceptualisations of climate change and how do they interpret the changes around them?
- What practices are changing (what are they learning)? What has been changing and what is the nature and extent of the changes?
- Why are practices changing/not changing (why do they learn)? What is it that people valued most, what is it that people were willing to trade? Where are the barriers and where are the opportunities for change?
- How does the learning occur (how do changes in practices emerge)? What sources of learning are available and how are they utilised, what sources are authentic and what considerations does one make before change can be

adopted? Who is facilitating change and how? I specifically asked about the learning that happened due to the influence of children because one of my major assumptions was that the Eco-Schools Club was making an impact on how adaptations were taking place.

- What are the sustainability issues of concern and are the changes taking place indicative of transitions to sustainability? How do culture and beliefs influence the dominant practices, how do practices emerge and how are they sustained? In this community people, for example, spoke of maize as if it was the only crop, so I followed this up to establish the historical and cultural factors around maize farming and the possibility of shifting from maize farming, as it was a major source of unsustainability as it kept failing due to climate change. What factors were enabling and constraining transitions to sustainable adaptation? What tensions existed between environmental sustainability and the adaptations taking place?

However, I kept moving back and forth between inductive and abductive analysis as I stepped in and out of the data to allow for the development of new theories while also acknowledging the value of using established theories to structure my ideas. When I emerged from the field, I transcribed all video and audio recordings verbatim. I started by analysing data from one household to determine emergent themes. I used that household as a template through which to look into the data from the rest of the families, building up of course from themes emerging from each of the households. Table 3 captures with illustrative examples the framework I used to analyse how learning and change occurred. From a CHAT and sustainability transition perspective, a critical stage precipitating learning involves questioning what has been taken for granted as normal practice; I also directed my gaze towards what in the community was being questioned.

I depended mainly on participants' expressions to determine the sources, processes and outcomes of learning. I read and re-read interview transcriptions and repeatedly listened to recordings as I tried to capture each participant's views without clouding them with my personal biases.

Table 3: Analytical framework: Sources, processes and outcomes of learning

Sources of learning/Disturbance management techniques	**Who within the community is initiating change?** **(examples)**	**What is being questioned?**	**Processes of learning**	**Examples Outcomes of learning/Changes in practices**
Using authority	Technical experts	e.g. Viability of traditional maize cultivars	e.g. informing and modelling solutions through authoritative silencing	e.g. adopting new maize seeds
Negotiating				
Complaining				
Avoiding confrontation				
Accepting responsibility				
Engaging in open conflict				

I constructed a table like Table 4, in which I highlighted examples of participants' expressions of transformative agency. As discussed earlier, I bracketed out my preconceived ideas and allowed the data to speak. My data presentation captures lots of participant narratives as I sought to give voice to the participants.

I deduced meanings from participants' expressions, as demonstrated in Table 4.

Table 4: Analytical framework: Examples of expressions of transformative agency

Sources of learning	**Actions and processes of learning**	**Examples of expressions and actions**	**Examples of Outcomes of learning**
Innovating	e.g. Critically evaluating own practices Learning incidentally	*…hapana kwatakambozvidzidziswa kuti kudiridzira kunobatsira… takangodzidza toga isu…mushure mokunge tamborohwa nenzara yakaomara.* [… We were never taught that irrigation helps…it was something we learned on our own… after we experienced severe hunger] (Ranganayi)	Irrigation adopted
Negotiating			
Complaining			
Avoiding confrontation			
Engaging in open conflict			
Accepting responsibility			

I referred to literature in sustainability transitions (Geels 2018; Shove & Spurling 2013) to analyse the sustainability of the changes taking place and to determine whether the changes taking place are indicative of a well adaptive community. To

analyse the nature of interactions (subject–object) that enabled learning and change, I drew on Engeström's three Cs typology outlined in Chapter 3. In this community where views about climate change were diverse and where interventions were driven by several expert groups, it was especially critical to analyse the objects from the different standpoints and how the alignment and misalignment of objects led to change or lack thereof.

In the next section, I examine the problems encountered in data collection.

4.8 Limitations of the research design and methodology

This section captures an analysis of the data collection limitations. The study was carried within limited time and resource frameworks. I was mindful of the fact that this is a PhD study that must be completed within set time limits. Although I received Faculty research funding to support my fieldwork, it was not enough to allow me to engage a bigger sample over an extended period. Considering that I worked with a small sample, the results cannot be generalised to the larger population. However, ethnographic research approaches provide rich sources of data. For this particular study, I was more concerned with depth because while climate change is a global issue, its impacts are localised and even within the same community, it affects people differently (Granderson 2014; Lorenzoni et al 2007; Wibeck 2014,); hence the need to study the issues in context.

Conducting the study in the local language of the participants offered several advantages as outlined in earlier sections. However, theorists have warned that climate change science is explained in terms of heavily loaded technical jargon not easily accessible to the ordinary person and in common usage language (Nerlich, Koteyko & Brown 2009; Ungar 2000). Of significant concern is the apparent inadequacy of vocabulary in Shona, the local language of the participants, hence the language of the data to explain some of the climate change science terminology. The term climate change itself has no equivalent Shona terminology and is described as "*kushanduka kwemamiriro ekunze pasi rose mushure menguva refu*". This usage creates conceptual barriers as *nguva refu* (long time) is a relative term. More so, concepts are often mixed and conflated as some participants tended to liken climate change to weather, locally known as *mamiriro ekunze* and climate variability also

locally known as *kuchinja kwemamiriro ekunze*. So, when you talk of *kuchinja kwemamiriro ekunze,* it could mean climate change it could mean weather changes and could also mean climatic variability. More often than not, participants referred to weather and climatic variability and not to climate change.

While I conducted my research in Shona, the participants' language, I presented my data in English, except in instances where I quoted participants directly, to accommodate my examiners and other non-Shona readers. Even where I quoted participants directly, I translated participants' excerpts to English for the same reasons. Over and above the lack of equivalent terminology, translation almost always entails the application of a theoretical framework (Temple 1997 in Srivastava 2006). Thus, over and above the methodological theoretical framework, the data I presented has also been subjected to another theoretical framework based on my subjective thoughts. I was conscious of this and to minimise analytical challenges, I analysed the data in its raw form.

However, I used my knowledge of the local language to analyse meanings hidden in texts. My proficiency in the local culture and language enabled me to notice and explore, as part of the research, cultural significance embedded in certain expressions and words.

This takes me to the chapter conclusion.

4.9 Conclusion

In this chapter, I have articulated a coherent description of how the study was conducted. I studied everyday practices in a Zimbabwean community grappling with the impacts of climate change to understand how practices were changing and what people were learning through these changes. Data were gathered through observation, interviews, documental analysis and photography. I drew on sustainability transitions to examine whether the changes were indicative of transitioning to a well adaptive community. Engeström's cultural historical activity theory (CHAT) provided the framework for identifying possibilities of expansive learning that may help the community to adapt to the challenges of climate change. It is my conviction the study yielded authentic evidence on which to build future climate change interventions.

This takes me to the first chapter to present key findings from the study.

Chapter 5: Defining and locating the key informants

5.0 Introduction

In this chapter, I introduce the key community informants of the study, the eight families in the Mutema community who participated in the research: the Mhere, Dzoro, Chimoto, Dehwa, Makwara, Mabasa, Gwenzi, and Mapani families. However, to orient the reader, I begin by developing a contextual profile of the Mutema community to inform a more nuanced analysis that locates climate change adaptation within an evolving culturally historical activity system to be discussed in Chapters 6 to 9.

5.1 Locating the Mutema community

Formerly known as Southern Rhodesia (1911-1964), Rhodesia (1964-1979), Zimbabwe-Rhodesia (1979- 1980), Zimbabwe gained political independence in 1980. While the country gained political independence, the colonial legacy still lingers on (Pesanayi 2016; Shizha 2011). Like other communities in Zimbabwe, the Mutema community was not spared from this colonial legacy. How the colonial legacy influences adaptation is the subject of analysis in Chapter 8, but suffice to say here that some of the vulnerabilities to climate change can be traced to colonisation. It has been argued for example that:

> Although people had always died in droughts in …. Africa…the new governing structures often significantly challenged traditional responses to drought. As a result, in several regions mortality figures during El Niño-caused droughts during the nineteenth century increased above earlier levels. (Grove & Adamson 2017, p. 93).

The analysis in Chapter 8 points to how local solutions to climate change including conservation farming and the growing of small grains were largely ignored as they were linked to the colonial mentality of being inferior and a preserve for the poor.

The Mutema community is historically known to be a horticultural community with maize and kale dominating the crops grown. Participants described how in this community maize and kale were akin to identity markers. As participants would say:

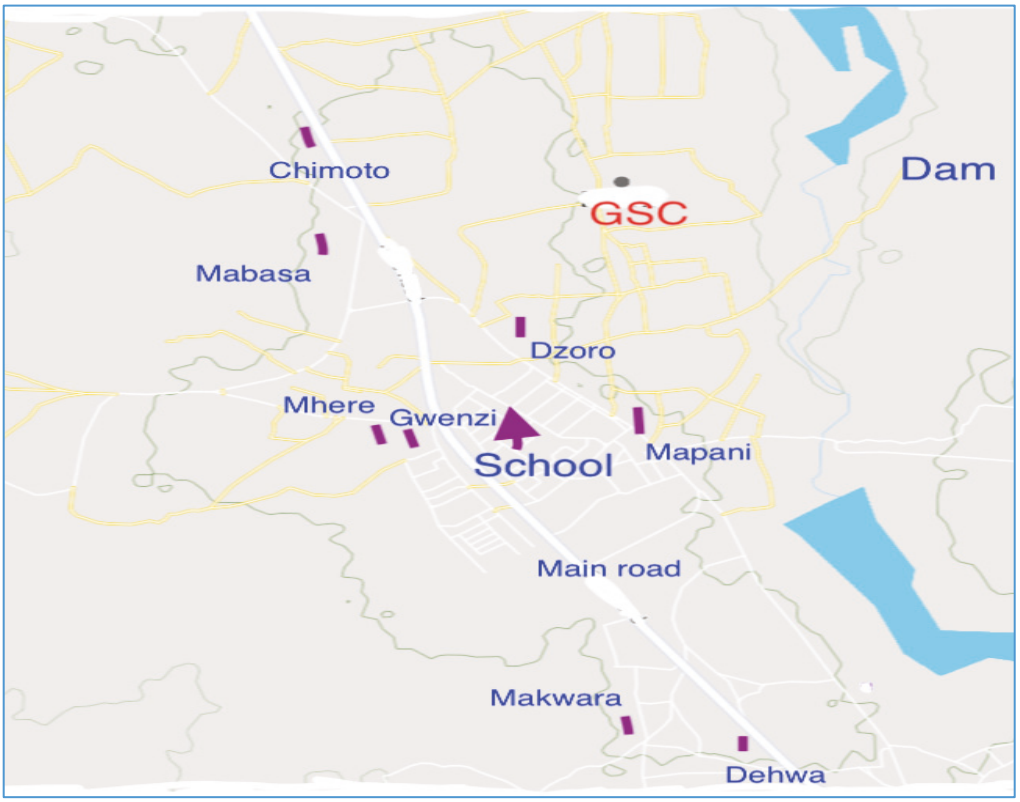
> '*kuno kurima garden mutemo' [*in this community gardening is a convention] and *'chibage ndochikafu chedu, kana mumba musina chibage hamuna chikafu'* [maize is our food, a household without maize has no food]

Further analysis in Chapters 7 discusses how such community conventions influenced the kinds of adaptations taking place. Interestingly, the growing of maize in Zimbabwe is linked to the country's colonial legacy. While maize forms the staple food in Zimbabwe, it is a foreign crop introduced by the European settler farmers way back in 1890. Before colonization, millet and sorghum were the staple crops for African communities (Smale & Jayne 2003). The analysis in Chapter 8 examines how this colonial legacy, has privileged the growing of maize regardless of its vulnerability to climate change.

Since my participants walked to Vagoni for focus group discussions, I limited the study area to within a one-kilometer radius from the school. By the time, I concluded my study, the research site fell within a locale that is categorised as rural. Although the research site is in an area that is classified as rural, the school and its community is located within a growth service center (GSC), popularly known as growth points in the local context. I do not delve into details of the term growth point, but just discuss enough to orient the reader to get an impression of how the growth service center shaped the community's socio-historical cultural context. Growth point is a concept muted by the Zimbabwean government after independence in 1980 to reduce rural-urban disparities through upgrading rural service centers into towns and cities (Chinyamakobvu, Mapira & Ngara 2018; Nhede 2013). As their name suggests, growth points were meant to grow in the physical sense in all spheres of life including industrial growth and infrastructure development. I discuss in ensuing sections how the physical development of the growth service center compromised community members' vulnerability to climate change.

In addition to its location within a growth service center, the Mutema community is located within proximity to two major cities making the community a blend of rural and urban cultures. Land and rentals are cheaper in the growth service center compared to the two nearby cities (S. Aaron, personal communication, August 23, 2016; Z. Munyanyi, personal communication, September 22, 2016). This has increased the demand for residential land resulting in sale of land originally reserved

for pastures and cropping (B. Muhobho, personal communication, August, 23, 2016 per com). While the demand for residential land is on the rise, this has not been matched by a rise in industrial development. Consequently, in the Mutema community like in other growth service centers in Zimbabwe, unemployment is rife (Chinyamakobvu et al 2018; Nhede 2013). Agriculture remains a major and, in some cases, the only source of livelihood. Sale of land thus exacerbate the community's vulnerability and weaken its response to climatic related challenges.



Scale 1:500

Fig 3 Map of the Mutema community plotting approximate positions where the eight families lived (Adapted from Mapcart, 2019)

As discussed in Chapter 1, Zimbabwe, has not been spared from the impacts of climate change. Community members acknowledged erratic rainfall patterns punctuated with prolonged dry spells and rainfall variability had of late become common. Availability of water for both agriculture and domestic purposes had of late been a cause for concern for community members. While there is a large municipal dam nearby, not every household had access to land near the dam. There is piped

water in the community but not every household afforded the installation and maintenance costs. Most households depended on shallow backyard wells which dry up during the hot season for their water supplies. For this reason, irrigation was limited to small horticultural gardens which in some cases were abandoned to die during the dry season. Further analysis in Chapter 7 points to how lack of access to water and other resources sets limits to the kinds of adaptations taking place among community members.

While there is electricity in the community, not every household afforded the installation and maintenance costs. Consequently, most households depended entirely on firewood as a source of energy for cooking and lighting. Compounding that, community members turned to the wild in the event of drought, making the sale of fuel wood a lucrative economic venture for the locals. This has led to massive deforestation in the area. Further analysis in Chapter 8 discusses the tensions arising between human survival and environmental sustainability as technical experts moved into the community to offer advice on climate change and environmental sustainability. While community members valued environmental sustainability, it was not the issue of primary concern for the locals.

In the next section, I define and locate the key informants.

5.2 The key informants

As explained in Chapter 4, one or more adults and a secondary-school-aged member of the Vagoni School Eco-School Club (ESC) were selected from each participating family. The perspectives of the families, both collectively and individually, guided my analysis of learning and change for climate change adaptation in the community. Climate change impacted on the everyday practices of each of these families, but each family's everyday practices and their response to the impact of climate change were intertwined with the family's distinctive history in, and relationship with, the larger community. Shining a light on each of these families to uncover some of their histories and aspects of their culture therefore informs the analysis of their responses to climate change.

As the chapter will show, all of the families were multi-generational, with at least one adult, and at least one child from the immediate or extended family. The conflicts

over and negotiations of different knowledges, beliefs and tools that members of the family drew upon to make sense of, and make adaptations to the impact of, climate change, some of them attributable to generational differences, will be analysed and discussed in Chapter 9. Although ethnomethodologies such as those this study drew upon focus on the situatedness of the everyday practices in the research site, the histories of some of the families in this study showed that not all the everyday practices in this community could be said to be entirely 'local'. As Brandt and Clinton (2002) argued in their critique of situated studies of literacy practices, not all local practices are necessarily locally produced; there can be transcontextual aspects of local practices that enable practices that emerged in one context to 'travel' to other contexts.

An example of such a phenomenon will be presented in this chapter. Moreover, while it was easy to identify those families who had histories outside the Mutema community and could be seen as importers of outside knowledges and belief systems, there were influences from other knowledge and belief systems that were already present. For example, some of the families were members of a Christian church: for example, the Mhere family were Catholics, and the Dzoros and the Chimotos were members of the Salvation Army. The knowledge pluralism created by the combination of the belief systems of these churches with other knowledge systems both old and new in the community is the subject of Chapter 7. Adaptation to climate change is both a social and a material process. This chapter will therefore also point to the families' differing access to material resources and, importantly, productive land, which could explain some of the differences in their responses to climate change.

Scholars studying the processes of expansive learning (Engeström 2018) and sustainable adaptation (Shove 2015; Shove et al 2015; Spurling 2018) argue that for the learning to be socially transformative and sustainable, those involved in the learning must be engaged in questioning what they have taken for granted as 'normal' everyday practice. This chapter shows both how the 'normal' practices of each family are shaped by the family's histories and relations in and out of the community and their material resources and that these 'normal' practices are already being questioned as they fail to yield the outcomes they once did.

First, I present the Mhere family.

5.3 Mhere family

The Mhere household consisted of the married couple Lemuel and Lydia, their two grandchildren, aged five and seven, from their divorced daughter and their 18-year-old nephew Nelson, who was completing the Ordinary level (O-level) of secondary schooling and who was a member of the ESC. Both in their fifties, the couple had been married for 28 years. Lemuel, Lydia and Nelson were participants in the research study.

Because they had only moved to Mutema eight years earlier, the Mhere family members were considered *vauyi* – 'foreign' to the Mutema community. Although the sale of rural land is illegal in Zimbabwe (Chiweshe 2018; Helliker, Chiweshe & Bhatasara 2018), the Mhere family had purchased a piece of land in the Mutema area after Lemuel lost his job in the city. After passing his O-level schooling, Lemuel had initially worked as a meter reader with a local power utility company, then quit after some time to take a job at a company that distributed farm machinery. However, when agricultural productivity in the country fell, he was forced into early retirement; this provided the impetus for the Mheres to buy land and move to the Mutema community.

Because of their history of living in the city, the Mhere family are relatively well travelled and have contacts in neighbouring communities. This, and their status as *vauyi* are considered assets to Lemuel:

> *vakare vese ava vangova nechijairira chekurima ma garden. Zvino apa tiri kuti tikamboonawo varikuuya vaya vari kuuya nedzimwe njere …vazhinji vekarekare vaye havasati vakazvitambira nekuti varikutya kusiya zvitsiko zvevabereki vavo vachifunga kuti inhaka yavo irikuda kuparadzwa. Vasingazive kuti toda kuivandudza kutokunda zvayakange iri*
>
> [the older generation is used to market gardening. But, we are saying these *vauyi* (newcomers) are bringing new insights…most of the older generation have not accepted it for they fear their market gardening heritage is being destroyed…yet they don't understand we are trying to improve on it].

Lemuel's view that as *vauyi*, the Mheres had something new and valuable to offer was materially evident in what they had done on their land. The Mhere homestead stood out because of the cassava liberally grown around the family compound. The family used cassava as a hedge to mark the homestead's boundaries, but more importantly as a source of food. Cassava is a perennial, drought-tolerant crop grown mainly as a source of starch. In the communities where it is grown for food, it replaces starches such as rice and maize. However, cassava is not commonly grown in Zimbabwe, including in the Mutema community. Describing how other members of the community were encouraged to trial growing this 'foreign' crop, Lydia explained:

> *Vazhinji vari kuuya vachitora mbeu yacho vachindoisa kudzimba dzavo. Vamwe vanongopfuurawo nekuroad vobvunza kuti chii icho nekuti vanenge vasingauzive mupfarinya wacho, vamwe vanoziva zita asi vasingazive kuti chinhu chacho chakamira sei…asi manje zvino vanhu vaa kuziva zvokuti vamwe vari kutoti totoda kuti pamunoita hupfu hwacho tione kuti munozviita sei.*
>
> [Many are coming to get the [cassava] seeds. As people pass by our homestead, they see cassava and they ask what plant it is, some just know the name but don't know what the plant looks like…now people know, and some are asking to come and watch how I make the flour].

For Lydia herself, cassava growing was part of a borrowed culture that she learnt in her previous community:

> *kwandakabva ndaiona hangu zvichiitwa. Ini ndakakura na mbuya. Ndaiona mbuya vachiita, tichinzi itai so itai so … Ndakanga ndisingambozvitarisire kuti zvingambokoshe kana kuti inini ndingambozviitawo muhupenyu…*
>
> [Where I came from, I saw how it [cassava growing] was done. I was raised by my grandmother. I saw how she did it and she taught us how to do it…I never imagined it could be this important to me, nor did I imagine doing it myself].

The value of the 'foreign' knowledge that Lydia brought into Mutema was evident in the context of a community experiencing more and more unpredictable rainfalls. Land close to the dam/water courses and wetlands was considered prime land in this

community where water shortages were becoming a perennial challenge. The Mhere homestead, located within 400 metres of the Vagoni secondary school is on dry land, and the family had no access to wetlands which other community members rely on for farming under drought conditions. Although the family lived within a kilometer of the local municipal dam, they had no access to land around the dam which other members of the community used for horticultural purposes.

The Mheres had access to piped water nearby, but the family relied on a shallow, unprotected well located at the back of the compound for their water supply. Lydia explained that the well dried up during the hot season, forcing the family to abandon their gardening activities. Because of their unreliable water supply, the family did not engage in commercial horticulture, an activity that defined this community's livelihood. They were partly dependent on the support sent by their adult daughters who had dropped out of school and migrated to South Africa to work when Lemuel lost his job.

In other ways, the Mhere homestead exemplified a typical rural home in Zimbabwe. Electricity cables passed through the homestead, but the family themselves had no access to electricity on the homestead. Lydia said they could not afford the installation costs of electricity. The family depended mainly on wood fuel for cooking, although they sometimes used liquefied petroleum gas (LPG). Lydia knew that her use of firewood was a contributor to climate change; she admitted:

> *mukubika chaimo matiri kubika umu, nguva zhinji yachona tikashandisa huni pane zvatatoita ipapo kuti ti contribute pakuchinja kwemamiriro ekunze*.
>
> [As we cook, especially if we use firewood, we contribute to climate change].

However, Lydia said the family continued to use firewood because they had no alternative: "*hapana mamwe maitiro atingambozviita*" [there is no other way out].

In the next section, I describe the Dzoro family.

5.4 Dzoros

In contrast to the Mheres, the Dzoro family are indigenous to the Mutema community. The Dzoro household consisted of Danai, the sixty-year-old single parent and her 15-year-old son Farai, both of whom participated in the study, and Danai's two other

children. Like Nelson, Farai was a member of the ESC, although Farai was still in the second year of the junior level certificate.

Danai was born and raised in Mutema as the daughter of the Village Headman, who died only a few years prior to this research study. She maintained active leadership roles within the community, for example, as treasurer for the School Development Committee at Vagoni School and was the Corps Sargent in the Salvation Army Church to which she and Farai belong. Danai was affectionately called Tete (Auntie) Danai by the other research participants in the study. Despite the high regard in which community members hold her, economically, the Danai household had little resources.

Danai went as far as what was then the standard three level of schooling, which is equivalent to modern Zimbabwe's fifth year of primary schooling. She explained that when she was a child, it was considered unimportant to educate girls; because of her lack of education she could not be formally employed. Danai had survived on informal trading including knitting, tailoring and small-scale horticulture, a venture she abandoned during the dry season. She received support from her eldest son but her income from all sources combined totaled roughly US$70 per month. The Dzoro family was poor according to the Zimbabwe Statistics Office's (ZimStats) definition, which as of April 2016, pegged the average Total Consumption Poverty Line (TCPL) at US$96 per month for an individual and US$481 per month for an average family of five (Zimbabwe Statistics Office (ZIMSTAS), 2013).

Unlike the Mhere family, the Dzoro family had access to electricity, one of only two families among the research participants who did have access. However, electricity was expensive, and the family used firewood for cooking to reduce their energy bill. They had tap water supplied by the Zimbabwe National Water Authority (ZINWA) at their homestead. Although the tap never ran dry, the bills were beyond the family's reach; hence, Danai did not use tap water for irrigation. She instead relied on free water from the dam. Danai explained how hard she had worked throughout her life and the resilience she developed as she overcame life's challenges:

> *muhupenyu unosangana nezvakarema… zvondidzidzisa kuti ndishande. Ndofanira kushanda zvakaomarara ndisazorore… ndinoshanda, er ndoshanda. Ndinoshanda, musha wangu uno uyu ndakavaka ndega.*

Zvakandidzidzisa kushanda ndisaite joki sezvo ndakanga ndashaya zvangu murume… Nyika yanhasi yaa kutongoda munhu anoshanda".

[in life, you encounter hardships… it taught me to work. I must work extremely hard, not to relax… I built this homestead on my own. It taught me to work, so I don't become a prostitute since I failed to secure a husband… Contemporary society demands people to be hardworking].

However, by the time I exited the field, Danai had abandoned her market gardening project because she could not bear the heavy manual work:

Hii! Ndakaregedza…ndakaregedza. Ah! unopararaka. Zviri nani kuzotsvaka mari yechikafu pane kuzotsvaka ya dhokota…Ndikati ndife viscose isare, aiwa, iii, … kudiridza nemaoko, ne can unoparara"

[Oh! I stopped… I stopped. Yeah! You destroy yourself. …. I figured is it worth it for me to die to save kale… watering manually using a can will destroy you].

Next, I discuss the Chimoto family.

5.5 Chimotos

Like the Dzoros, the Chimoto family were members of the Salvation Army Church, and the family was also headed by a woman, Jerina, whose husband had died 18 years earlier. Of her four children, there were now only two surviving daughters, both married and no longer living with Jerina. Jerina was in her late fifties, and lived with three of her grandchildren, and a 15-year-old nephew, Garikayi, who had lost both his parents and lived partly with his aunt Jerina and partly with his paternal grandmother while another aunt was responsible for paying his school fees. Like Nelson and Farai, Garikayi was a member of the ESC, while studying in form two of his secondary school. Like Danai, Jerina was born and raised in the Mutema community, but unlike both Lydia and Danai, Jerina finished secondary schooling up to form four.

Like most families in the research group, the Chimoto family depended mainly on rainfed agriculture for a living; a practice that is highly vulnerable to climate change (Chikozho, 2010). Jerina explained that when she was younger and market prices for

horticultural produce were rewarding, she used to make enough money from horticulture to sustain her family. However, market prices for horticultural produce had become discouragingly low. Coupled with that, Jerina was no longer fit enough to continue with the heavy manual work that came with manual irrigation. Consequently, she had scaled down her operations, which in turn significantly reduced her income from sales of horticultural produce to only about US$20 per month, an amount that took the family well below the poverty line (ZIMSTATS 2013). Jerina explained that the cost of installing irrigation infrastructure was beyond the family's reach. Her age, physical wellbeing and income limited the family's adaptation choices.

Water supply was a key source of concern for this family, as it was for the others. For their domestic water supply requirements, the Chimoto family depended on the neighbours' well. However, the well dried up during the dry season. When that happened, the family fetched water from the rural council offices, about a kilometre away. The difficulty of securing water impacted on Jerina's food security, which her own garden could no longer offer. Explaining the challenges she faced when the well ran dry, Jerina said:

> *Kuno takangojairaka kurima magarden tichiti ukarima tumuriwo twako, hawaizoshayawo dhora. Asi iye zvino izvi manje, sanika izvozvi izvi, takatoona kuti kuma garden kwacho mvura yacho iri kutodzikira…chaiko zvokuti unotoona kuti kumberi uku zvinenge zvakaoma. Unogona kutoshaya kana wokuisa mupoto chaiwo. Saka izvozvo manje zvinobva zvaoma*.
>
> [In this community we are used to market gardening because once you grow vegetables you are assured of getting a few dollars. But, right now, the water levels are falling… so low you can tell the future is gloomy. Sometimes you fail to get enough [vegetables] to cook. When that happens, it really gets tough].

Jerina used the expression "*tangojaira*", which loosely translates to formalism/habit/normal practice, to describe how market gardening was perceived in the Mutema community. She implied that market gardening was ingrained in the

practices of the Mutema community. She further suggested that persistent water shortages compromised both her source of food and her source of income.

This takes me to the point where I present the Dehwa family.

5.6 Dehwas

The Dehwa family was a younger household than the previous three. The family had six members: Sarudzayi and her husband Rangayani, both in their early thirties, their eight-year-old son, twin daughters aged five and Sarudzayi's 15-year-old nephew Wedzerayi. Wedzerayi was in form two and was a member of the ESC. Both Sarudzayi and Rangayani were born and raised in the Mutema community. They had gone to school together, both finishing school at form four.

What was striking about the Dehwa homestead was the size of their kale field. Kale covered about three-quarters of the plot. I observed that this was not peculiar to the Dehwas, but true of their entire neighbourhood. Sarudzayi explained that market gardening was a convention:

> *muno umu munhu wese anongorima kovho iyoyi ndoyatakatongojaira. Nyangwe ikatengwa nyangwe ikasatengwa vanhu havaregi kuirima… vanhu vokuno vanorima muriwo ndozvakabata dzimba. Asi nyangwe ukaita R2 nyangwe ukaita R3 vanhu havaregedze kurima.*
>
> [In this locale everyone grows kale because that's what we are familiar with. Whether it sells or not people won't stop growing kale… This community thrives on growing vegetables. Even if they get twenty cents or thirty cents they won't refrain from market gardening].

Figure 4: Dehwa kale field ***(Photographs taken by researcher (2016).***

Rangayani talked about them being 'born into' a market gardening community; it was something they had inherited from their community and their parents. Unlike the families introduced earlier, this household sustained their market gardening tradition by introducing irrigation:

> *yaiti ikati nayei… chibage pamwe unenge wadyara … yobva yaenda. Hachichakwanisa kutupfunura kuti chibude…Painodzoka chochibuda*

chosvika ...kana kuti pazera ... pekuti chinenge chava kuda kuita vana ... yobva yaenda. Wobva waona kuti pano apa ndinoita loss. Regai… ndidiridze. Aiwa hatina kumbodzidziswa nemumwe munhu… takangodzidza toga isu.

[it would rain…probably you plant …and the rains would be gone for good. The seeds won't germinate…or when the rains fall again the seed germinates…grows…to the fruit-bearing stage…the rains vanish again. You realise you will lose out. Let me...irrigate. No, no one ever taught us…we figured it out on our own].

Even so, the sale of the crops was not enough to sustain them economically, and their household income was augmented by Rangayani's casual work. This however, did not lift them out of difficulties altogether, as Rangayani explained:

Mari yatinounganodza pa mwedzi umwechete zvemazuva ekunge zvichibhadhara waitowana mari inoita kana 200, 300. Asi iye zvino manje kutanga gore rakapera irori nairo gore rino iri haa kunyanya gore rino zvatoo worse. Kana kuti ubate $50 chaiyo haibatike. Gore rino ndofunga ingori nyaya yokuti mari haisi kutenderera.

[if business is good, our income for the month is around US$200 to 300. But right now, starting last year and especially this year the situation has worsened. Raising even US$50 is a mammoth task. I think this year this is caused by the cash shortages].

The next section presents the Makwara household.

5.7 Makwaras

The Makwara household consisted of Wadzanayi, her husband, three sons aged eight, 15 and 21 and a two-year old daughter; however, most of the time, Wadzanayi's husband was away working in the city. Forty-year-old Wadzanayi and Jim, the 15-year-old son, took part in the study. Jim, like the other younger participants in this study, was a student at the Vagoni School and a member of the ESC. Like the Dehwa household, the Makwara homestead was located within an area where traditional horticultural activity is clearly visible. Wadzanayi believed that the farming practices

she had adopted were those defined by the community. Citing market gardening as an example, she said:

> *kurima garden mutemo…muno umu munhu wese anongova ne garden rake. Nyangwe ukatengesa nyangwe ukasatengesa tinongorima nokuti kana usina garden muno umu unonzi hauna kukwana*.
>
> [gardening is the rule…everyone in this community owns a garden. Whether you sell [the produce] or not is not the issue, you just set up a garden because in this community, if you don't have a garden, people would think you are insane].

Wadzanayi had a big plot in the wetlands where several horticultural products, including maize, kale, onions and tomatoes, were grown. However, Wadzanayi was not selling any of the produce because there was no market:

> *unotengesera ani munhu wese ane muriwo wake?*
>
> [whom do you sell to, everyone produces their own vegetables?].

This made the market prices unattractive as everyone produced their own. To the outsider, it belied logic that the crop hectarage was more than what her family required for food, and the rest of the crop could go to waste. Wadzanayi explained she had not reduced her hectarage because she is following convention:

> *muno umu kurima garden makwikwi chaiwo saka unenge uchingoitawo zvinoita vamwe. Hapana anoda kunzi ndakasaririra*.
>
> [in this community gardening is a real competition, you do what others are doing. No one wants to be labelled a laggard].

This takes me to the section where I present the Mabasa household.

5.8 Mabasas

Like the Mheres, the Mabasas are considered *vauyi* because the family only came to live in the Mutema community when they purchased land there about eight years earlier. The household consisted of 56-year-old Beula and her 15-year-old daughter, Lesley, who was in third form at the Vagoni School and was a member of the ESC

Club. Beula terminated formal schooling at form four. Speaking of her family composition, and how they sustained their livelihood, Beula said:

> *Kwasara iye [Lesley] uyu. Nokuti baba vevana ava vakashaya muhombe wacho achiita grade seven, [Lesley] aine three years. Kubva ndazongosara ndichichengeta vana vangu ndega. Ndichiendawo…. ndichitengesa ma dhoiri. Ndaa ndisingatogoni asi ndikakurukirai skirt ne blouse munozviramba*".
>
> [Lesley is the only child left under my care. The father of my children died when the eldest was doing grade seven, [Lesley] was only three. I raised my children alone. I went …selling crochet design wares. I had no idea how to do it but, right now if I crochet a skirt and a blouse, you won't believe it]

Her other daughter no longer lived with her and was now working in a nearby city as a seamstress. Despite her poor health, Beula was continuing to work hard:

> *…ndinotengesa zvese ma throw-over, nekurimawo ndinotengesa ne mbambaira. Senge gore rino haa ndaa ndinadzo…*
>
> [I sell various kinds of wares including throw-overs, and farming. I sell sweet potatoes. Like this year I had plenty [sweet potatoes] …].

In the past, she had been involved in cross-border trading, but she stopped for health reasons. Beula's daughter Lesley explained that their sweet potato yield had fallen due to Beula's poor health.

Talking about her low income, Beula said:

> *mari…haiungane…nokuti inenge yakatomirirwa. Pamwe mwedzi unotopera ndisina kubata kana randi. Ukawana 10 unenge wapinda machena, ukawana 20 haa unenge utori mbozha*.
>
> [it's difficult to get a lump sum…because the money goes from hand to mouth. Sometimes a month goes by without raising a cent. If you can raise [US$]10 per month, that's a killing, if you manage to raise [US$]20 you are super rich].

As with some of the other families, access to water and energy presented a challenge. The Mabasa family sourced their water from a well on their compound. While this

well did not run dry, the level would recede during the dry season. Like many other families, the Mabasa family had no access to electricity as they could not afford it. They depended mainly on firewood and LPG for cooking.

Having said that, I move to the Gwenzi family.

5.9 Gwenzis

The Gwenzi household consisted of 31-year-old Fiona, her husband, Tsungayi, 36, their three children and niece Nashley. The couple's youngest child was under two and the eldest was eight. Nashley had grown up in one of the urban areas in Zimbabwe but had moved to live with her aunt Fiona three years earlier when she lost her mother. She addressed Fiona and Tsungayi as Mom and Dad. She was 16 and in the third year of the secondary school O-level course at the Vagoni School. Nashley was a founding member of the Vagoni and one of the club coordinators of ESC. She was also a member of the Zimbabwe Climate Mappers group, which was a youth forum coordinated by a local United Nations (UN) agency in collaboration with the local civil society organisation Miombo Woodlands, that aimed to raise climate change awareness among school aged youths.

The Gwenzi homestead was still under construction at the time of the study and had yet to be connected to electricity and piped water. At the time, the family was reliant on wood and paraffin for cooking, and on a well in their backyard for their domestic water supplies. However, the water levels would recede during the dry season, limiting the amount of their land they could irrigate to the small area of about 30 m^2 that they used for horticultural production.

Fiona's husband was a certified teacher, holding a diploma of education. Fiona herself had terminated her studies at O-level, and she engaged in informal trade and subsistence farming to supplement her husband's income. The family earned a minimum of US$700 per month, which was above the poverty line defined by the GoZ (2016) guidelines. While other children of her age described suffering from food insecurity, Nashley's narrative was different; she conceded she had not as yet felt the impacts of climate change:

> *Um, kumba ndinganyepe. Handisati ndazvi experiencer. Kana nzara inombotaurwa nevamwe, kana chii vachizotaura kuti vano enda up vasisauye*

kuchikoro kana kuti mari ndoinenge ichinetsa, kuzotengeswa chikafu mari ye school fees, inini hangu pandiri hapana chamboti chashanduka since ndakakura zvangu nenyaya ye climate change.

[Um, at home, I don't want to lie. I haven't experienced anything [bad] yet. Even this hunger that other children talk about when they say they end up dropping out of school due to monetary problems. Or the money intended for school fees ends up buying food. As for me nothing has changed about my lifestyle because of climate change…].

Lastly, I present the Mapani family.

5.10 Mapanis

Situated within 500 metres of Vagoni School, the Mapani homestead lies about 600 metres from the local municipal dam, thus positioning them on a flood plain. Where the homestead is used to be a wetland, which has since disappeared. Revai, the mother of the family, and her 16-year-old son Mike took part in the study, because Mike was a member of the ESC. Like Nashley, Mike was a stalwart of the ESC. Revai, now fifty years old, had been living in the community for her entire life. She came from a farming background and felt that much of her farming was heavily influenced by what she had learnt from her parents.

Revai was married, but her husband only came home to visit and did not live with Revai. The couple had four children, and Mike was their last born. Two of her married sons and their families lived with Revai and Mike. Revai explained that the expansion of the nearby growth service centre coupled with population growth had been putting pressure on land availability:

… unenge uchitarisira kuti uchazopa mwana wako wobva wanzi nzvimbo yatorwa yaa growth point. Yava yokugara neanobva Bhuruwayo, abva kwaMutoko, abva kupi. Vana vedu havasisina nzvimbo dzokugara. Zvakangonakawo hazvo asi zvinenge zvichida kuti venharaunda iyoyo vawanewo kana kuri kunzi paita growth point, vanofanirwa kubenefita, ndi vanhu venharaunda,

[…you will be anticipating allocating land to your children, then you are told that land has been repossessed, it now falls under the growth service centre. It becomes residential land for people coming from Bulawayo, Mutoko, wherever. Our children have nowhere to live. Of course, development of a growth service centre is good, but it must benefit locals…].

Figure 5: Agricultural land being converted into residential stands (*Photographs taken by researcher 2016***)**

A walk through the community showed there was a lot of construction work and new homes being established. Due to the community's proximity to a growth point, there was stark competition for land between villagers who need land for farming and the rural council who need the same land for commercial and residential purposes. As land originally intended for agriculture was being converted into commercial and residential stands, this created shortages of productive land among the locals as well.

The Mapani family depended on agriculture and informal trade for their livelihood. The family was one of the two families in the cohort with electricity in their home. Revai used electricity for all domestic purposes. The family did not have tap water and relied on a well in their backyard for their domestic needs. Due to their proximity to the dam, the family had a piece of land around the dam that they used for horticultural production. Water levels in the dam would recede but never ran dry; hence the family had access to a constant supply of water for irrigation. However, installing sophisticated irrigation infrastructure was beyond their means. Consequently, they used buckets for irrigation and this limited the hectarage the family planted under irrigation for market gardening to approximately 300 m^2.

This takes me to the point where I present a summary of the chapter.

5.11 Chapter summary

This chapter analysed the context within which learning and change were taking place in the community, by examining the social and material resources that were available to participants as they made adaptations to climate change. It was found that the Mutema community is a diverse and multi-voiced entity with people from diverse socio-cultural backgrounds. Although ethnomethodologies such as those that this study drew upon focus on the situatedness of everyday practices in the research site, the histories of some of the families in this study have shown that not all the everyday practices can be said to be entirely 'local'; aspects of everyday practices in one context can 'travel' to other contexts (Brandt & Clinton 2002; Shava et al 2010). Some families were importers of knowledge (for example, about crops suitable for being planted) and had introduced innovations to this community that were 'foreign' but sustainable and have been adopted by the longtime residents of the community, for example cassava growing. While it was easy to identify those families who had

migrated from other communities, there were also influences from other knowledge and belief systems that had already been present. For example, many of the families were members of a Christian church, while some also strongly believed in African traditional religionATR. The knowledge pluralism created from these belief systems and how they have created tensions that both enabled and inhibited learning is the subject of discussion in Chapters 7, 8 and 9.

The community is intergenerationally constituted, and the cultural dissonance between children and adults is the subject of discussion in Chapter 9. The community's diversity is also found in the differences in socio-material resources available to each of the households. Despite the differences found among community members, some practices, such as market gardening, were found to be identity markers rooted within the cultural conventions that defined normal farming practices. In Chapters 7, 8 and 9, I further discuss how such cultural conventions served as both sources of resilience and sources of resistance to the adaptations taking place.

In the next chapter, I discuss how the community's diversity created knowledge pluralism about the science of climate change and how the conceptualisations of climate change mediated the goals of adaptation differently.

Chapter 6: (Re)Conceptualising climate change; Voices from the community

6.0 Introduction and flow of chapter

Chapter 6 presents an analysis of what motivated members of the Mutema community to adapt to climate change. Using the theoretical tools developed in Chapter 3, I use the lens of (Engeström's 1999; 2016) third generation cultural historical activity theory (CHAT) to analyse how everyday practices changed due to the impacts of climate change. Cognisant that, from a CHAT perspective, activity systems are driven by motives which are inherently embedded in objects (Engeström 1999; 2010), the analysis is this chapter interrogates the object(s) for adaptation. Objects are arguably communally driven. I argue in this chapter that there is a strongly shared over-arching *object* in community members' adaptations of their everyday practices at the hands of climate change.

However, as actors fulfil objects, they rely on tools, material or symbolic (Engeström 1995; 2010; 2018). Sustainability transitions scholars argue along similar lines that "much of human action is path dependent, building on the way things have been done previously and relying on established, often institutionalised, knowledge" (Abson et al 2016, p. 35). In addition, the way knowledge is generated, applied and transmitted strongly influences the kinds of transformations that take place within a given society (see for example, Geels 2018; Markard 2018; Markard et al 2012; Mukute et al 2018; Nudumoli et al 2018; Naess 2013; Tompkins et al 2010). Moreover, trajectories that society adopts are influenced by the way society frames problems and the way knowledge is produced (Abson et al 2016; Lotz-Sisitka et al 2016).

Taking cognisance of these research findings, the analysis in this chapter interrogates participants' conceptualisations of climate change as a mediating tool (Engeström 1999; 2010). I examine how participants framed climate change risk to analyse whether and how such conceptualisations influenced the adaptation choices they made. In other words, the analysis in this chapter examines the existing knowledge base within the community under investigation to unbundle affordances and

impediments for change; I endeavoured to extricate the prevailing knowledge and value-belief systems and how social notions of reality among participants both enabled and impeded transformative agency.

The first part of the chapter analyses participants' broad conceptualisations of climate change informed from a technical scientific perspective. In this section, I examine how participants articulated the science of climate change and highlight the dilemmas participants faced as they articulated their cognitive understanding of climate change. In the second part of the chapter, I discuss the informal climate change understandings based on personal encounters with climate change. Here I present an analysis of how participants made sense of climate change and how to adapt to its impacts based on people's lived experiences. I tease out what motivated individual participants to adapt. In this section, I highlight how despite being in the same locale, individual households felt and responded to the impacts of climate change differently. In the third part of the chapter, I examine conceptualisations informed by beliefs and speculations. Lastly, I examine the diverse ways participants framed climate change risk in response to the felt and anticipated impacts of climate change and present a summary of the chapter.

6.1 Conceptualisations grounded in external knowledge sources

All participants had interfaced with knowledge from outside the community through such channels as mass communication media, direct interface with technical experts and the Eco-Schools Club (ESC). Agricultural Extension Officers (AEOs), known locally as *Madhumeni (*plural*)* and *Mudhumeni (*singular*)*, and the Environmental Management Agency (EMA) in the Ministry of Environment, Water and Climate (MEWC) emerged as key players in influencing climate change adaptation in the community. How learning and change occurred through the injection of technical expertise is the subject of discussion in Chapter 8, while Chapter 9 analyses the role of children in influencing learning and change. Here, I give an analysis of how such external knowledge disturbed the tools and knowledge systems that mediated participants' conceptualisations of climate change.

6.1.1 Complex climate change: Hard to articulate

My study reaffirms the assertion that some kinds of knowledge are not easily articulated verbally; sometimes, people fail to explain that which they know (Pink et al 2003). While a few participants exuded confidence as they articulated their (mis)conceptions of climate change, the majority publicly declared their ignorance and were non-committal in their responses. On many occasions, participants responded to the question of what climate change was by referring to popular opinion rather than articulating what they themselves believed to be true.

Below I capture a few salient examples of participants' responses.

Farai was a child participant, 15 years old and in his second year of the four-year ordinary level (O-level) of schooling. Farai had been a member of the Vagoni ECS for two years and relayed what people said about climate change in the following manner:

> *Climate change vanombotaurawo vanenge vachiti kuchinja... kunoita weather…mvura isinganyatsonaya ichimbo jamba kunaya...pokukonzeresa apa panoti netsei…ma tradional aiitwa kudhara haachaitwa.*
>
> [when people talk about climate change they say it is the change…in weather… Rains don't fall consistently, sometimes rains skip falling… As for the causes, it's complex...traditional cultural practices have been abandoned].

Farai had a vague understanding of the science behind climate change. He confessed that it was complex to explain the causes of climate change but, based on what he heard, Farai linked climate change to loss of cultural values. Farai presents a typical example of how cultural beliefs mediated participants' meaning making process. This resonates with the view from STS scholars that science cannot be studied outside of its socio-cultural context because learning is socially and culturally imbedded (Aikenhead 2015).

Fiona was an adult participant, 31 years of age, who had terminated formal schooling at the end of the four-year secondary school O-level course. Fiona's understanding was influenced by what she heard on the radio:

> *Um, handingaziwewo zvangu…vanhu vanoti kutema miti kuno disturber ndozvandakanzwa. Zvimwe zvacho hauzonyanyobvunzaka zvinotaurwa imomo muma radio ka imomo. Hanzi pane miti yakareba mvura haitane kunaya. Ndozvinotaurwa ne EMA chero pa radio kuti nzvimbo dzine miti mvura inonaya saka musatema miti.*
>
> [Um, I don't know…people say cutting down of trees disturbs, this is what I heard. You don't get to question some of these things being said on the radio. It is said it easily rains where there are tall trees. This is what EMA says and even on radio they say don't cut trees because it rains in forested areas].

Despite her acknowledgment, in my interview with her, of the massive deforestation that had taken place in her area during her life in the community, Fiona made only an indirect and tentative connection between deforestation and climate change. There is substantial evidence emerging from the data to suggest that for Fiona and other participants in her predicament, the connections between deforestation and climate change appear distant and farfetched. I use examples from participants' excerpts to demonstrate the apparent disconnection between climate change and deforestation.

During individual interviews, I left time for interviewees to add insights and or ask questions. At the end of my first interview with Lydia, one of the adult participants, she confessed her ignorance:

> *Ini ndine zvandisinganzwisise panyaya dzamanga muchindibvunza, panyaya dzekutema miti. Zvinombomira sei kuti zvinonzi mvura inogona kusanaya nemhaka yekuti hakusisina miti panzvimbo, munyika hamusisina miti*?
>
> [There are things I don't understand regarding the discussion we were having, pertaining the cutting down of trees. How do you explain this, it is said that it may not rain because there are no more trees in a given area, in the world?]

Jim was a member of the ESC where he learnt about the role of trees in climate change mitigation and adaptation. Jim admitted he planted trees but did not understand how that helps to solve climate change:

> *sokuzivavo kwangu, hanzi ukasimawo miti here handinyatsoziva zvangu kuti tinenge tichigadzirisa zvakaitasei. Asi hanzi ukasimawo muti hanzi zvinogona kuzokonzeresa kuti climate yacho imbodzikawo mbinjana. Ndiri kuisa mi mango kana mi gumtree ndakazvinzwawo patakaenda ku Environmental Day.*
>
> [it is said if you plant trees something like that but, I don't understand what exactly we will be solving. But, it is said, tree planting slows down climate change. I am planting mangoes and gum trees, I heard about it when we went for the World Environmental Day commemorations].

Jim did not understand the link between trees and climate change; he planted trees because he was told it was the right thing to do. However, from a CHAT perspective, learning outcomes are not conceived of in terms of cognition but, '...outcomes are the expanded objects … are assessed in historical terms, it is about people being able to go beyond their limits and change their own history' (Engeström and Kerosuo 2007, p. 339). Learning outcomes are therefore measured in terms of what people can do. Cognitively, Jim confessed he did not understand the link between trees and climate change. However, Jim demonstrated climate change literacy through planting trees as a mitigation measure. These observations resonate with previous studies which have shown that although scientific literacy is an important dimension of climate change literacy, the public does not necessarily need to understand the complex science associated with climate change (van der Linden et al 2017).

Citing participants' excerpts above, it can be argued that some messages from the scientific community about the links between climate change and deforestation remained an abstraction among certain participants. Some participants, regardless of age and exposure to technical scientific knowledge, could not connect with some of the explanations offered by science; it remained a paradox. They did hear the messages and, in some cases, such as Jim's, adopted the messages. These observations strengthen the argument that climate change science may create cultural dissonance as sometimes it fails to align with popularly held world views (Baer and

Singer 2018; Adger et al 2009; 2013; Albe & Pedrett1 2013; Ungar 2000). Over and above the complexity of the science of climate change, participants held alternative world views, as demonstrated by Farai.

Among these participants, I observed a shared view about the complexity and intractability of the science behind climate change. Wadzanayi was another adult participant and Jim's mother. In her early forties, she terminated formal schooling at the end of the O-level course. Wadzanayi described climate change as:

> *kuri kuita kunge kuri kuita movement iri kuitika here pasi kana kuti weather here, kana kuti ndokunonzi kufamba kwenyika. Ipapo handichaziva kuti ndonyatsotsanangura ndichiti kudii… tongoti mamiriro okunze.*
>
> [It seems as if there is some movement of the ground, as if the weather is changing, probably these are the earth movements. I don't know how to explain that…let's just say weather].

Responding to what was causing such variations, Wadzanayi confessed her confusion as she suggested:

> *Kuchinja pamwe kuri kutongoita… hamhenoka mhepo dzacho idzodzo… tongoti mhepoka, hamhenoka dzinodai dzichidai dzichienda kwadzo, kwadzo…. Hamheno kwadzaa kurovera, mheno mazuvano kuti dziri kurovera kupi*
>
> [These are just changes …I don't know, probably the winds… I am not sure, …let's just say it's the winds, I don't know these winds just blowing in all directions…I don't know, the direction the winds are blowing nowadays is confusing].

Wadzanayi's response was littered with the phrase '*hamheno*' (I don't know/am not sure) and so were the responses of several other respondents. In the local context, when someone says *hamheno*, it literally means, 'this is beyond me', or 'rest the case; the solution is unknown'. *Hamheno* is a term used when the situation at hand is intractable, when someone is in doubt and has resigned from attempting to resolve a situation. The usage of the term in this context serves to illustrate how complex it was for Wadzanayi to explain the science behind climate change. Wadzanayi observed changes in weather patterns, but she struggled to explain what exactly caused such

changes.

The cases cited above serve to demonstrate that, generally, participants' conceptual understanding of the science behind climate change was limited, and in some cases a bit warped. Participants' conceptual understanding of climate change reaffirms the notion that the science behind climate change is abstract and rather complex (Ungar 2000; Sword-Danies et al 2018). These observations reaffirm the argument that scientists have a moral obligation to communicate climate change science in ways that the public can identify with (van der Hel et al 2018; van der Linden et al 2017; Freeman 2018). Otherwise, climate change may continue to be treated like a distant abstraction warranting no action (Ungar 2000).

However, of significant concern is the apparent inadequacy of vocabulary in Shona, the local language of the participants and hence the language of the data, to explain some of the climate change science terminology. The term climate change itself has no equivalent word in Shona and is described as "*kushanduka kwe mamiriro ekunze pasi rose mushure me nguva refu*". This usage creates conceptual barriers, as *nguva refu* [long time] is a relative term. Compounding that, concepts were often mixed and conflated as some participants likened climate change to weather, locally known as *mamiriro ekunze*, and climate variability, also locally known as *kushanduka kwe mamiriro ekunze*. In the local context, when you talk of *kushanduka kwe mamiriro ekunze,* it could mean climate change, it could mean weather changes, or it could also mean climatic variability. Often, participants referred to weather and climatic variability and not to climate change. The terms climate change, weather, climate variability, global warming and ozone destruction were often mixed, confused and conflated. This has implications on the adaptations taking place as discussed in Chapter 7.

6.2 Conceptualisations grounded in the everyday: learning as a connection

While participating in an activity, people rely on tools, both material artefacts and symbolic resources, to mediate and make meaning of the activity (Haapasari et al 2016; 2018; Engeström 2018; Engeström & Keresuo 2007). I therefore paid special attention to the language, tools and 'doings' in participants' everyday practices. From

a CHAT socio-cultural perspective, learning is not a purely cognitive process and is not confined to formalised education settings. I paid attention to climate change understandings entrenched in community members' everyday practices as analysed in the next section.

6.2.1 Climate change as a shift in rainfall patterns, occurrence of extreme weather and reduction in yields and food insecurity

A salient view from the research participants was that the most apparent dimension of climate change is the ways in which rainfall patterns have been shifting, coupled with extreme events leading to more frequent droughts and crop losses. Rainfall patterns have become unpredictable and erratic, creating serious planning challenges for this predominantly farming community. For the participants, the most profound impact of the changing climate was food insecurity, and for adult participants, climate change was synonymous with *nzara* (hunger/starvation as a consequence of drought). When adults talked about climate change they referred to it as *nzara*. Thus, participants could no longer ignore the impacts of climate change as it hit where it hurts most. These are families that have largely depended on rainfed agriculture for survival, so crop failure spells disaster for major aspects of their lives, ranging from the biophysical, to the social, to the economic. Recounting how changed rainfall patterns were creating havoc on farming, Fiona bemoaned:

> *...pamwe pacho mvura inonaya...kwobva kwapisa...mbeu dzotsva, dzofa...hauzoziva kuti wodyara futi here...haunyatsoziva kuti zvinosvika here...pamwe mvura yacho haizodzoka...senge gore rino mvura yakanaya...ndobva yaenda! kubva kwanaya futi...saka vakadyara nemvura yekumashure iyoyo vakakohwa...saka zviri kutivhiringira marimiro edu...manairo emvura hatichaanzwisisa.*
>
> […sometimes rains fall…and this will be followed by a prolonged dry spell…crops wither…you aren't too sure whether to re-plant…you aren't too sure whether the late crop would reach maturity… maybe the rains won't fall again…this year…it rained…then a prolonged dry spell! Then it rained again…so those who planted using these later rains…their maize crop thrived but the first crop failed…this is creating havoc on farming… we no longer

understand the rainfall patterns…]

It was not just rainfall variability that participants were noticing, but also changes in the onset of the rainy season and the distribution of the rains. The first rains have been expected in October but of late, the onset of the first rains has been between late November and January. Moreover, rains, especially the early rains have recently been punctuated by prolonged dry spells, leading to crop losses. Lemuel and Beula used the phrase *femebera-fembera*, meaning 'guess work' to describe the prevailing situation in which even technical experts have reportedly failed to predict weather patterns with certainty.

Participants talked of rains (*mvura*) and 'real' rains (*mvura chaiyo chaiyo*) as if to imply there were fake rains. Participants used this terminology to highlight the significance of the timing of the rains. Children and adults alike suggested that although the overall amount of rainfall received is important, its timing is equally significant. When participants talk of *mvura*, they refer to ordinary rains that may be falling outside the planting period. But, *mvura chaiyo chaiyo* typifies those rains falling within the expected planting period: the rains that sustain crop growth to maturity. Participants had previously expected rains during specific periods. The prevailing practice has been that people planted during those specified periods if there was even the slightest amount of rain: people planted not because adequate rains had fallen, but because it was the time.

These observations resonate with research evidence suggesting that seasons create "…normative, static models of farming systems (Roncoli 2006, p. 84), which in some instances has resulted in crop failure not because there was insufficient rain that season but because the rains fell at the 'wrong' time. As we discussed why crops failed, participants gave responses like:

takarasana nenguva yekudyara... [our planting was mistimed…] (Lydia)

…*mvura yakanonoka kunaya*... […the rains were delayed…] (Farai)

…*mvura haina kunaya*... [it did not rain] (Jim)

I discerned that when participants said *mvura haina kunaya*, they did not necessarily mean 'it did not rain that year'. They meant instead that the rains did not fall within the expected planting period, so it was as if there were no rains. Such statements (it

did not rain, the rains were delayed, we mistimed the planting), however, indicate that participants are conscious of the changes in their environment due to climate change. They are noticing variations (contradictions/disturbances) in rainfall patterns and in some cases, this has led participants to re-organise planting patterns to evade crop failure and hence food insecurity. These observations have implications for externally designed innovations; community members have their own ways of interpreting climate change.

To illustrate how participants conceived the changed rainfall patterns and how it impacted on their farming, I cite the following excerpt from Wadzanayi:

> *Tiri kuwanikwa takaita kunge takanonoka, kunge takakurumbidza. Hapana chikoho chaicho chatiri kuwana … Kana kuti tiri kuita kunge tisina kutaimira here, hamheno. Handichambonyatsoziva ipapo kuti zviri kumbofamba sei*.
>
> [We are caught up in a situation where it seems like we planted too late, probably too early. We aren't reaping significant harvests…it appears as if we miscalculated the planting time, who knows. I really don't understand what's going on].

Wadzanayi talked of mistiming and the miscalculation of the planting period to signify that rainfall patterns had become erratic to the extent that she was planting out of harmony with the rainy season, leading to reduced yields and food insecurity. As theorised by CHAT, the point of departure in expansive learning is questioning the status quo (Engeström 2010). Wadzanayi's example illustrates how erratic rainfall patterns coupled with crop failure created disturbances that led Wadzanayi to question and reflect on her current practices (emergence of critical literacy). The mismatch between expected and reality provided the impetus for Wadzanayi to reflect and to want to adapt (transformative agency) her farming practices. Of course, the object for adaptation would be to improve yields and hence food security.

Some disturbances manifested in the form of strange weather events, as Danai, the oldest participant in the cohort reminisced on:

> *…zuva rakapisa gore rakapera hatisati tariona…ndava inini tikasvika November ndiri kusvitsa 60 years. Asi muno zuva rakadaro hatisati tamboriona…*

> […it was hot last year, we have never seen such…if we get to November, I turn sixty. But, that kind of heat, we have never seen such…].

Of late, it has become extremely hot in summer and extremely cold in winter. Ranganayi, one of the adult participants whose livelihood was mainly dependent on farming, expressed dismay at the ways temperature extremes negatively impacted on farming, as crops have died and yields diminished.

Generally, participants were alarmed by the unpredictability of events caused by climate change. While not fully comprehending the reasons, they could not but notice the changing environment (contradictions/disturbances). Below, I cite examples of participant excerpts that acknowledge the existence of contradictions. Ranganayi, for instance, asserted that hail was a rare phenomenon but when it occurred, it was usually mild and more common in winter. However, during the current farming season the community was hit by unusually strong hail that destroyed crops. As Jinda, a traditional leader in the Mutema community, recounted:

> *gore rino inzara yega- yega nokuti kwakaitika chimvuramabwe chisati chamboitika munzvimbo muno. Zvakatotishamisa kuti chimvuramabwe chakadayi zvamboita sei nokuti muzhizha hamusimbonayi chimvuramabwe chakawanda kudai*.
>
> [this year there is severe hunger because there was hail of a magnitude we have never seen in this community. We were baffled to get that much hail for it never hails this much in summer].

While it hailed throughout the community, some families were worse off than others depending on their geographical location. This brings to the fore the argument that while climate change is a global phenomenon, it tends to affect people to different extents, even within the same locality (Antal 2018; Granderson 2014). What stood out as a manifestation of climate change differed across the members of the community. This has implications on the nature and scale of adaptations because as previous studies have shown, climate change affects peoples and nations differently, hence getting a unified response to climate change is intractable (Freeman 2018; Holden and Marshal 2018; Kagawa and Selby 2010).

6.2.2 Climate change as human-induced interaction with nature and a livelihoods dilemma

Some participants argued that human interference with nature had exceeded some threshold limit, and that this was the source of significant alterations to the atmospheric composition which in turn is causing climate change. Owing to their interaction with technical scientific knowledge, participants cited agriculture, particularly the use of chemicals and fertilisers, unsustainable extraction of natural resources, deforestation, industrialisation, vehicle fumes and overpopulation as examples of human activities that were contributing to the changed climate. Nelson and his uncle Lemuel were critical of a societal trend of people trying to maximise profits without reflecting on their impact on the environment and humanity. Revai, another adult participant, and Nelson highlighted that the use of chemicals in agriculture was still prevalent despite people being knowledgeable about the consequences of using chemicals for the soil and the climate.

These developments resonate with research evidence suggesting that it takes more than knowledge for people to adopt pro-environmental climate action (Hess & Collins 2018). The inability of families to respond was exacerbated by the existence of multiple stressors, especially poverty and lack of infrastructure. Serve for the Gwenzi family, agriculture doubled up, as both a source of food and a source of income; it was their livelihood. When crops failed, participants' direct source of food was jeopardised and the source of income equally damaged. As agricultural production was persistently threatened by climate change, forcing participants into untold poverty and suffering, participants exploited naturally occurring resources in their search for survival, for example, selling firewood for income.

I cite Jim to demonstrate how climate change is tangled up with livelihoods and everyday practices. Based on what he learned from the ESC, Jim acknowledged deforestation as a contributor to climate change (refer to section 6.1). He engaged with afforestation activities both at school and at home as he was aware that afforestation mitigates climate change. Although he acknowledged the role of trees in climate change, Jim also acknowledged that some unsustainable practices are unavoidable because they sustain livelihoods:

kune zvisingaregereka sanika zvekutema miti izvi. Vamwe vanoti kutema miti kunokonzeresa climate change. Pakasatemwa miti hapana huni…ma poles ekugadzira ma garden…kana matanga. Zvinhu zvakadai so izvi handizvione zvinoregereka… tinoita kunge ta ignore kana kuti tisiri kuteerera. Nemhaka yokuti zvimwe zvinhu zvacho hazviregereke manje. Nokuti pangararamike here ipapo pokuti munorarama here musingateme miti... kupisa iyoyo fodya inozotengeswa vanhu vachiwana mari. Saka hazvizoregereka vanhu vanofa ne nzara.

[Some deeds are impossible to abandon, for instance the cutting down of trees. Some say cutting down trees contributes to climate change. When you come to think of it you appreciate if trees are not cut, there won't be any firewood…poles for constructing gardens…cattle pens. Honestly, I don't see how such acts can be stopped…it would appear like we are not heeding the calls [not to cut trees], like we are disrespecting [the laws]. But some of these things are impossible to abandon. How are we supposed to survive without cutting trees…? Tobacco curing contributes [to climate change] but people make money from selling tobacco. It is impractical to stop because people will die from hunger].

Adults confessed they performed some of these practices without giving much thought to their implications for climate change. Such routines are entrenched in daily practices and are considered the normal behaviour. Slash and burn agriculture, for example, is a customary practice in this community, but its sustainability in the context of climate change is already being questioned. The data strengthens the arguments of sustainability transitions scholars that people do not consume things just for the sake of it; they do so as they fulfil the performance of practices (Mylan 2015; Spurling et al 2013; Spurling 2018). As explained above, people did not cut down trees for the sake of cutting, nor out of ignorance. They did so to fulfil certain objects that were part of this community's practices. The learning that took place as participants reflected on these and other practices that have been normalised is the subject of discussion in Chapters 7 and 8.

6.3. Conceptualisations grounded in beliefs and speculations:

In this section, I discuss views about climate change that are informed by beliefs and speculation. In CHAT-informed studies, the value-belief system is one of the artefacts mediating learning (Engeström 1995; 2016).

Some perceived climate change as a natural process beyond human control. Beula was in her early forties and had left school about twenty years earlier. Based on what she learned in school, she said:

> *kuchikoro tichikura kwainzi after … 30 years climate inochinja, ndikoka kuchinja kwacho….*
>
> [when we were younger and still in school we were told…the climate changes after every thirty years, are these not the changes…].

Beula and those who were skeptical about the human impact on climate suggested that nature was just following its course independently of what humans do or do not do. These participants claimed there were limits to what humans could do to mitigate climate change. Sabhuku Bhobho, another traditional leader said:

> *…zvinhu zvinongoenda zvichichinja … kutaura chokwadi chaicho hatina chinhu chatinganongedzera chaicho kuti zviri kukonzereswa ne zvakati…Hatinganongedzeri munhu…kunongova kushanduka kuri kuita zvinhu. Hatingapomeri munhu mhosva aiwa, sokuti zvinhu zvinongoshanduka sekusikwa kwazvakaitwa na Mwari.*
>
> […things change…if the truth be told, there is nothing that we can pinpoint as the cause [of climate change] … We cannot accuse anyone of any wrongdoing…these are just natural changes. We can't blame it on anyone, things just change because it's the way it was created by God].

Consequently, such participants showed signs of disengagement from trying to comprehend or mitigate the risks of climate change; as Beula argued:

> *shanduko ingadiwa asi manje kunaya kwemvura ndokwaMwari…zuva ravo rokuti mvura inaye ndovanoriziva, …Unogona kuti ndichazodyara muna*

December, mvura kubva yanaya muna October watosara, hauzive painonaya chaipo chaipo… saka pakuzoti ungawana dzimwe nzira dzokutiungazodyara uchizokohwa kudarika vamwe asi denga riri rimwe chetero ...saka ndinototamba iri kurira yacho…

[change may be necessary, but it's up to God to make it rain… only God knows the day it rains… You may say I'll plant in December, but the rains may fall in October and you lag, you never know when exactly it rains…you can't expect to plant and harvest more than everyone else, yet you all depend on the same sky…I just play along with the tune…].

While acknowledging the exigency of adapting, Beula thought that humans could not do anything to initiate or schedule rainfall. While climate deniers from the global North explain climate change in terms of natural climatic trends (Oreskes 2018), in this community the narrative was slightly different. Although views in the community varied among individuals, adults widely perceived climate change as a super-natural process beyond human control. This stems from the Shona belief that there is an omnipotent supernatural spirit or God locally known as *Mwari or Musikavanhu* (Gelfand 1970 in Taringa & Sipeyiye 2018), who is the creator of all things and makes all things possible.

There is a belief that God knows what is best for the people; people must make their requests known and their wishes will be granted, including asking for rains (S. Aaron, personal communication, August 3, 2016; W. Chigasa, personal communication, July 18, 2016; M. Marikopo, personal communication, July 28, 2016). Although they prayed to the same God, those who believed in Christianity communicated with God through prayer while those aligned with African Traditional Religion (ATR) believed living members of the community communicated with *Mwari/Musikavanhu* (God) through the *vadzimu (*family spirits*)* and *mhondoro (*clan spirits*)*. The current agricultural season, for instance, saw the community holding a prayer meeting to plead with God to release rains as they were worryingly delayed.

I was informed by Zvisineyi that such prayers were held following a national call by the then president of the Republic of Zimbabwe asking all communities to pray for rain and this serves to demonstrate the power of beliefs among the Shona people. The

data reconfirms earlier studies which have shown that conceptualisations of climate change are mediated by the socio-cultural context (Adger et al 2013; 2018). With a background in geography, Zvisineyi was a graduate teacher who was also the lead patron of the Eco- Schools Club. Zvisineyi was articulate about the science of climate change, but she believed science is subsidiary to the power of God:

> *Mwari ndiye atori ne simba pamusoro pe zvinhu zvese...Nyangwe akazozviisa hake mumaoko e vanhu kuti va maneje... But I still believe kuti zvese zvatingaite isusu scientifically, even science dzacho takatongodzipihwa na Mwari. Mwari ndiye ane the last solution, ndiye ane the final say… musi iwoyo wacho kwakatorara kuchinaya zvokuti vanhu vakatoti tapindurwa…*
>
> [God has dominion over every creation…although he entrusted men with the management [of his creation] … I still believe whatever we may do scientifically, it is God who gave us the science. God has the ultimate solution. God has the final say… It rained all night that very day and people believed their prayers were answered…]

Whether this was a coincidence or whether praying for rains works is a topic for a separate thesis, but suffice it to say that in this community, people acknowledged the existence of supernatural forces that controlled the occurrence of natural events including rainfall. This is not to say that these participants disregarded science, but they asserted that there are limits to science; above science, there is a God who has the ultimate solutions to men's problems.

However, there was a shared view among the adults that people must obey God's commandments or risk angering him and facing the wrath of his vengeance. Those subscribing to the Christian faith, notably Jerina, Sarudzayi, Revai and Fiona, believed that the changes in rainfall patterns that they noticed happened because God was angry as society was becoming increasingly wicked. Those who upheld African Traditional Religion, notably Lemuel, Danai, Farai, Wadzanayi, Ranganayi and Garikayi, attributed the changes to a loss of traditional cultural values that attracted vengeance from ancestral spirits.

Participants with strong beliefs in African Traditional Religion suggested that in the distant past, when people followed traditional cultural dictates, droughts were a rare

phenomenon, as Sabhuku Bhobho reminisced:

> *Kana tikangoita chipwa zvinoita, zvinoita… pakuita kwedu kwe kare taita chipwa… Taitodzoka ikoko pamwe mvura yava kutonaya…saka kana tikangodzokera patsika dzedu dzechinyakare ndinoona mvura ichidzokera pakunaya zvakanaka sezvaisiita kare….*
>
> [Once we perform the rainmaking ceremony, we are good, yeah we are good... in our traditional practice, we used to perform *chipwa*…. It would rain before we left the ceremony…if we uphold our traditional cultural values like we used to, we will get normal rains just like in the past…]

Such participants subscribing to African Traditional Religion cited several practices they perceived as provoking ancestral spirits, including but not limited to cutting trees growing in graveyards; dressing indecently; fishing/swimming in sacred pools; farming on sacred land, for example around natural springs; cutting down of sacred tree species, for example the *muhacha* tree. Central to traditional cultural practices is respect and, in this community, there were concerns especially from traditional leadership that modern society had lost respect: respect for taboos, myths, cultural norms and values, respect for elders and respect for the wild. I cite Sabhuku Bhobho to illustrate the interplay between modernity, livelihoods, loss of cultural values, sustainability and climate change:

> *Kune miti inokosha inoyera, kune nzvimbo dzinoyera dzinokosha. Asi iye zvino inotemwa hamusisina kuti umutsiure munhu haumugone. Pane tusipiti munharaunda umu munhu unomutaurira kuti apa panhu panofanira kugara pakadaro pochengetedzwa. Asi anotoita zvaanoda zvake ava kutopafenza ipapo, anondovakira garden rake ipapo. Haana hanya nazvo chero chete zvichimuitisa mari saka ndomanetsero azvinoita.*
>
> [There are trees that are important, and sacred, there are places that are important and sacred. But right now, such trees are being cut, you can't control people. There are springs in this community, you tell someone you can't do this and that here, they don't listen. Areas around springs must not be interfered with, they must be kept intact. But, they [people] are defiant. They do what they want, they fence the area, erect their gardens there. They

are not bothered for as long as they are making money out of it and this is where the problem lies.].

This loss of respect for traditional practices was said to provoke the spirits of departed ancestors who in turn would withhold rains as a way of punishing the living.

However, participants were divided on the belief that climate change was linked to God's vengeance. Nashley was an active member of the Vagoni Eco- Schools Club. While her aunt Fiona linked climate change to religious beliefs, Nashley reasoned from a purely scientific perspective owing to her participation in the Eco School Club and other programmes on climate change education and learning. Nashley demonstrated critical reflection when she argued:

> *vanhu vakuru ndozvavanotaura but vasingazivi…vanongotaura kuti Mwari wagumbuka… but zvinonetsa kunyatsoziva kuti ichokwadi here … Haumboziva kuti anotsamwa sei, haumboziva kuti chii chinenge chanyanyoitika kuti Mwari azonzi akatsamwa…zvatinodzidziswa kuma workshop unonyatsoona kuti…sure paitika destruction. And then carbon dioxide iri ku emitwa yakawanda, zviri kukonzeresa ma high temperatures. Zvinhu zvokuti unogona kunzwisisa kuti ehe, vanhu vakazvi sitadha vakaona kuti zvinoita. And then zvasiyana nezvokuti Mwari akatsamwa.*
>
> [the elders say out of ignorance…that God is angry…but it's difficult to prove…you never get to know how, you never get to understand what leads to God's anger…what we are taught during workshops you can see clearly that…certainly there is destruction. Carbon dioxide is being emitted in copious quantities, causing temperature increases. These are things you can easily understand and yes, studies have been conducted and results confirmed. This is different from simply saying God is angry].

Nashley dismissed local knowledge as 'ignorance' and mythologies that cannot be proved. Her comments strengthen criticisms levelled against science education in general and climate change education more specifically about the tendency to disregard alternative ways of knowing while epitomising Western scientific ways of knowing (Mukute & Lotz-Sisitka 2012; Pesanayi 2016). The data suggests participants' meaning making was mediated by cultural beliefs that linked climate

change to supernatural forces. In chapter 8, I analyse why such alternative conceptual models must be acknowledged to avoid rejection of innovations (Hoppers 2002; Pink et al 2010; Sillitoe 2002).

While such things as the rainmaking ceremony, taboos and myths may be dismissed as superstition (othered), such practices may work to preserve nature and hence reduce the extent of climate change as these practices discourage humans from interfering with nature. As explained by Lemuel and Sabhuku Bhobho, traditional Shona culture, through myths and taboos, dictated that wetlands could be used for specific purposes, but without altering their natural systems. Sustainability was therefore entrenched in such cultural practices. Unlike the widespread human-centric thinking in Western science wherein humans are regarded as the stewards of the environment, and hence as holding dominion over nature (Sterling 2009), traditional cultural practices within the community stipulated that nature has dominion over men and hence must be treated with respect.

6.3.1 Limits of local symbols and indicators

Notwithstanding the value of their local knowledge systems, participants also acknowledged the limitations of their local knowledge. While there seemed to be consensus on the existence of God and ancestral spirits, participants were divided on the role that rainmaking ceremonies and prayers played in the climate change disaster. Views previously taken for granted were being questioned as participants critiqued prominent value-belief systems pitted against everyday experiences (Engeström 1999; 2010). Jerina, for instance, expressed doubt that offering home brewed beer to ancestral spirits was an effective way of mitigating climate change. Following a careful analysis of events surrounding rainfall and rainmaking ceremonies over the years, Jerina critiqued the efficacy of rainmaking ceremonies:

> *gore rakapera iro takato bvisiswa zvokundobikisa doro… asi ndakaona kutobva kwaita worse mvura yacho. Doro racho rabikwa, mvura yacho hainaye…unobva washaya kunyatsoziva kuti chiri kumbodiwa chacho chii.*
>
> *[*last year but one we contributed towards the brewing of beer [for the rainmaking ceremony]…but thinngs got even worse. The beer was brewed, but it did not rain and you wonder what exactly is required]

Based on her observation of events in the community, Jerina's analysis was that rainmaking ceremonies did not provide solutions to the changed rainfall patterns; the situation deteriorated after *chipwa* was performed. However, Jerina's example illustrates the expansive learning and emergence of critical literacies that took place as participants questioned the taken for granted (Engeström 2010) in their search for solutions to the climate crisis.

Although they could not specifically link the changes they observed to climate change, participants were concerned that some of the local knowledges they relied on had been rendered obsolete. Community members relied on the natural systems, for example the behaviour of trees, wind movement and direction, the colour of clouds and the movement and behaviour patterns of animals and birds, to determine rainfall patterns and more importantly to predict droughts. However, such natural methods were no longer as reliable as they once were. Jerina recounted how fruit bearing patterns of the *hacha* tree and the behaviour patterns of the *harambe*, a local bird, had become misleading.

These observations confirm previous studies which have shown that while the value of local knowledges is acknowledged, the systems on which they depend, such as the behaviour of trees, are being compromised by climate change, making them less accurate (Naess 2013).

This takes me to the section where I analyse risk perceptions and response.

6.4 Climate change risk: forced migration, social injustice and social insecurity

In this section, I discuss participants' conceptions of climate change risk and how they managed such risks. The data strengthens the perspective that people's adaptation to climate change is heavily influenced by their perceptions of risk (Adger et al 2018; Pidgeon 2012). Among these participants, conceptions of climate risk were mainly expressed in relation to its impact on the cohesion of the social fabric. As already mentioned, participants saw climate change as the source of socio-economic insecurities as most participants relied solely on rainfed agriculture as a source of livelihood.

As discussed in Chapter 5, there existed multiple stressors that aggravated participants' vulnerability to climate change. Problems such as poverty, for instance, were not created by climate change per se. However, for these participants whose livelihoods depended on rainfed agriculture, climate change further deepened poverty, while at the same time poverty compromised participants' ability to respond to climate change. There was a shared view among adult participants that food shortages created by climate change destablised the social fabric among families and community members. Over the years, the government protected villagers from food insecurity through food handouts. However, such food aid did not suffice and on occasion did not get to the affected people too late. At times, the situation became so bad that it became virtually impossible for community members to help each other out. Sabhuku Bhobho recalled with sorrow how, as village head, he had hated to see his people suffer, and yet he could not help them out as he was equally affected.

Families and community members had supported each other in times of need. However, climate change weakened social institutions, making it difficult for people to reach out. As yields kept diminishing, so did the cohesiveness of the social fabric. Thus, the impacts of climate change among these participants were felt beyond the physical. This serves to re-affirm the notion that climate change is not strictly a scientific issue; it has social and political dimensions whose scopes lie outside the realm of natural science (Adger et al 2018). This strengthens the argument that regarding scientific solutions as the only viable option can be misleading.

The consequences of the economic hardships perpetrated by climate change extended further: children were forced to drop out of school. Two of the participating families, the Mheres and the Chimotos, narrated the ordeals their children were suffering at the hands of overseas authorities due to their illegal immigration statuses, including restrictions on their ability to travel and visit their parents. Climate change was identified as a possible contributor to such forced migrations that had the effect of severing social and family ties. Lemuel, the father and breadwinner of the Mhere family, for instance, used to work for a company that distributed farming equipment. His job with the agro-based company was his major source of income. Lemuel blamed climate change for the loss of his job and the subsequent suffering of his family:

Ndakanga ndiri munhu aigara nekamhuri kangu kese pano. Asi nemashandukiro akangoita kunze taa kuona kuti munda harisisiri bhanga, vana vakatosiira chikoro panzira, basa rangu rapera. Kwaa kutosairira vasikana vakuru vaviri ava…kuti vandotsvaga mabasa. Saka mhuri yagurwa nepakati nenyaya yekusanaya kwemvura zvakanaka.

[I used to live with my entire family here. But due to climate change, farming ceased to be profitable and I pulled my children out of school as I had lost my job. I drove the two eldest girls…to go get jobs. So, my family was split as a result of poor rains]

Wadzanayi, Sarudzayi and Lydia elaborated on how they sacrificed any luxuries and concentrated on providing just the basics. The women bemoaned how their inability to provide for their families then led to emotional distress, not just for the parents, but the children as well. The women described the challenges as overwhelming, and Lydia and Wadzanayi reported emotional distress that triggered illnesses including hypertension, depression and anxiety, especially among children and women.

In this predominantly market gardening community where livelihoods were historically dependent on rainfed agriculture, adult participants indigenous to this community generally blamed climate change for deepening their economic predicaments as Ranganayi explained:

"*tinositi tikarima tikatengesa mbeu dzedu ndopobva mari yechikoro yevana asi… hatichatokwanise kuwana mari yevana yechikoro kubva pakurima ikoko because mbeu dzacho hadzisi kusvika. Hatichanyatsorima chaizvo izvo zviya zvataisiita kare because tava kushoterwa futi nemvura yokushandisa*".

[ordinarily we get money for school fees from the sale of farm produce but…we can no longer raise school fees from farming because the crops are failing. We no longer practise farming as extensively as we did in the past because we are facing water shortages].

Although other factors could not be ruled out, for example the economic decline in the country, there were concerns among the adults that hardships created by climate change were forcing young adults into early paid sex. Danai's homestead lay within a kilometre of the growth service center. Her observations were that:

> *Kutaura kuno kwatiri kuita kune vamwe vaa kutogara mu [Mutema]ka imomu…Nokuda kwekuoma kwehupenyu chinotanga kushairwa mari yechikoro. Zvaburikidza kutanga nokuda kwekusanaya zvakanaka kwemvura. Sokuti kana mvura ichinaya mubereki anorima achiwana mari oendesa vana vake kuchikoro achiguta achidii*. Zvino kana mwana angogara pamba hapasisina chimwe chaachafunga kusiya kwekungoita zvechipfambi.
>
> […as we speak right now, there are some [school dropouts] living in the growth service center…due to hardships and lack of school fees. All this happening because of poor rains. For if it rains adequately parents get money from farming, send their children to school and produce enough food. Once a child is out of school, they have nothing else to do except indulge in prostitution].

Not to say climate change was exclusively responsible, it did contribute to worsening livelihoods and increasing the vulnerability of younger girls to paid sex. Danai argued that once livelihoods were destroyed, commercial sex offered an escape route from poverty. The existence of social amenities such as hotels, night clubs, bars and brothels in this community which was near a growth center made paid sex a viable commercial venture. These observations further strengthen the argument that climate change has dimensions that fall outside the scope of science as conceptualised in Western views of knowing (Adgert et al 2018). This then calls for the development of alternative conceptual models that seek to identify and resolve problems '…for which scientific knowledge is necessary but not sufficient to respond to such challenges more effectively' (Hart & Bell 2013, p. 76).

There seemed to be consensus among adult participants that climate change affected men and women differently due to differentiated gender roles. There was anger from the women that when it came to making food available, the women were the ones responsible for meeting the need. The general feeling among the women was that men tended to distance themselves, leaving the women at the mercy of the hungry children. The mothers said they had an obligation to make food available because if they failed to provide food, children questioned the strength of their parental commitment.

The two adult male participants, however, argued that the burden was heavier on men than it was on women. Lemuel lamented that climate change and its related challenges compromised his manhood if he failed to provide for his family. Ranganayi further explained how failure to provide for one's family led to a loss of the respect of both the wife and children, leading to emotional distress and crushed egos on the part of the family head. Over and above food security, there were hidden agendas behind what motivated the two adult male participants to adapt. They felt the pressure to prove their manhood and to enlist the respect of their families.

Participants cited water shortages resulting from climate change as a serious threat to their livelihoods, as they depended on water for their daily needs. This is discussed in further detail in Chapters 7 and 8 but suffice here to highlight that technically, climate change and its impacts, particularly the unavailability of water destroyed the participants' livelihoods as they depended on rainfed agriculture.

6.5 Chapter summary

In this chapter, I demonstrated that a community can be a diverse and multi-voiced entity where a plurality of perspectives about climate change are held. Although participants lived within the same community, the personal encounters with climate change varied among individuals. How participants conceptualised climate change risk differed depending on individual experiences and cultural notions of what they believed to be true. Learning and change were mediated by local knowledge rooted in context and experience. Over the years, participants mastered cultural norms, values, symbols and practices that define sustainable living and sustainable agricultural practices. Participants have developed certain views, mindsets and practices to guide how they live, how they interact with nature and how they cope with hardships such as drought and food insecurity. The data strengthens the view that local communities possess a wealth of local knowledges rooted in context and experience (Pink et al 2010; Pesanayi 2016). This has implications on how external innovations ought to be conceptualised, designed and implemented.

Indirectly, climate change introduced new and unfamiliar knowledge systems as technical experts intervened in a bid to help community members make sense of what is going on and how to build resilience and reduce their vulnerability to the changing

climate. Technical scientific knowledge has in some cases created a sense of cultural confusion, as participants were forced to cognitively adjust to information that was inconsistent with what they believed in. Additionally, there was evidence of intergenerational cultural dissonance between children and their parents as in most cases the two groups drew on dissimilar sources of knowledge.

Compounding that, some incidents highlighted how the science of climate change seemed like a distant abstraction that created challenges for participants to make connections with reality. A typical example is how participants struggled to make connections between deforestation and climate change. These observations reconfirm the argument that there are times when scientific information fails to make a real impact on human behaviour because such knowledge has failed to align with what is already known (Adger et al 2018; Ungar 2000). Lay people may possess world views that do not relate to the explanations that science offers. Moreover, the data reconfirms previous research which has shown that the public do not necessarily understand science in ways that scientists do (Filho et al 2010; Ungar 2000).

There were instances when participants rejected explanations offered by science, but some participants challenged the explanations informed by a traditional cultural perspective. Critical literacies emerged as participants questioned and reflected on the taken-for-granted knowledge and beliefs; for instance, some questioned the validity of the rainmaking ceremony as a strategy for mitigating climate change. Some knowledges were ridiculed; for example, Nashley referred to indigenous knowledge as ignorance. Knowledge plurality will be discussed further in Chapter 8.

The data demonstrate the intractability of articulating climate change and illuminate the limits of the vocabulary of the local language in mediating meaning-making. However, this chapter strengthens the view that literacy is not restricted to cognition and formal schooling but is a social practice. While they failed to eloquently articulate the complex science behind climate change, participants demonstrated climate change literacy in their local innovations, strengthening the view that a limited ability to verbalise climate change science as it is perceived in Western scientific ways of knowing does not translate to illiteracy (Pink et al 2010). For these participants, climate change literacy mainly manifested in the ways they interpreted the changes they experienced and how they acted to counter the negative impacts of such changed

environments.

However, making meaning of the changing climate was akin to finding their way through a muddle of compelling, competing and sometimes conflicting conceptions and practices that were mutually exclusive. This learning itself is examined as a social practice that emerges in response to and, in some instances, despite a range of historical, socio-cultural and environmental factors including traditional beliefs, poverty, intergenerational differences and crop failures. As climate change creeped into the community it created disturbances (Engeström 2016) in the form of changed rainfall patterns, occurrence of extreme events and social insecurity triggering community members to question and reflect on what they had taken for granted as normal rainfall patterns.

The data reconfirm the view that adults learn on a need to know basis (Brockett & Hiemstra 2018; Conole & Paredes 2018; Courtney 2018). In this community, the most profound impact of the changing climate was food insecurity and for the adult participants, climate change is synonymous with *nzara* (hunger/starvation as a consequence of drought). For a community sustained by rainfed farming, adults mainly saw climate change as the source of socio-economic insecurities. Adaptation to climate change was therefore no longer an option and for these participants, the overarching object for adaptation was to evade socio-economic insecurities. At the center of the adaptations taking place was evading *nzara*. The next chapter discusses the processes and outcomes of learning that took place as participants pursued this object of evading *nzara* (hunger/starvation consequence of drought).

Chapter 7: Everyday practices and sustainable adaptation to climate change: Learning from the experts

7.0 Introduction and flow of the chapter

This is the first of three chapters that examine what and how learning has taken place as members of the Mutema community have adapted their everyday practices in response to climate change. I limit my analysis in this chapter to community-based learning. Chapter 8 examines the learning externally mediated by technical experts, and Chapter 9 analyses the role of children in influencing learning and change. It is worth emphasising that although these three chapters are presented separately, the boundaries between community innovations, technically driven innovations and children's agency were permeable. The fluidity of the boundaries of learning is elaborated in Chapter 10.

Socio-cultural scientists and sustainability transitions thinkers have argued that climate change adaptation is not strictly a technical process but entails social change and that transitioning towards sustainability demands innovative ways of learning and thinking about knowledge generation and transmission (Lotz-Sisitka et al 2017; O'Brien & Sygna 2013). However, meaningful adaptation "requires learning and … the scales and complexities of climate change demand new forms of…learning" (Collins & Ison 2009, p. 359). This suggests that using the lens of Engeström's (1999, 2008b, 2016;2018) expansive learning for analysis of the learning and change in the community and for radical transformation of existing practices could yield particular insights to the Mutema community about the possibilities of transitions to sustainable solutions and their impact on climate change.

Following the analytical approach of CHAT described in Chapter 3, I examine a selection of the changes in farming practices that I observed in the community and discussed with the participants. I focus on these practices as activity systems constituted with the community members as the *subjects* and their goal of food security as the *motive.* Engeström (1987, 2008b, 2018) argued that possibilities of expansive learning emerge when existing activity systems experience a *disturbance*

that introduces contradictions within the elements of the activity system. Learning can therefore take place whenever participants encounter disturbances to their existing everyday practices. For this study, an example would be changes in the rainfall patterns that led to the traditional farming techniques no longer yielding the crops that they had in the past. A disturbance could also be the introduction of new *tools* that mediate the activity, changes to the existing '*rules*' for doing things, changes in the composition of the *community*, and/or reconfiguration of the *division of labour* within the community.

Engeström (2008a) identified diverse ways in which disturbances to activity systems are managed, each affording a different potential for radical transformation of existing practices. To analyse the way community members have responded to disturbances to their practices, I examine how the history, power relations, and values of the participants came into play, for example, as sources of resistance, strength and resilience. Through close analysis of the dynamics of the selected activity systems in response to climate change-related disturbances, this chapter will illustrate how members of the community were learning as they adapted to the impacts of the changing climate.

In the first part of this chapter, I analyse the diverse ways community members adapted to the felt impacts of climate change and analyse their adaptation strategies in relation to their understandings of climate change. I also examine the learning that took place as the participants experimented with innovative ideas. This leads to an analysis of the different spaces and places for learning, the learning enshrined in community conventions, and how newcomers imported literacies into Mutema. This is followed by a review of socio-cultural shifts in food preferences introduced by climate change. I then analyse the nature of adaptations taking place. I pay attention to changes in socio-material practices, that is, changes in the interactions among and between people, materials and social tools – the everyday practices of the community members' lives. By examining the changes in this way, I can begin to understand the extent to which these changes constitute expansive learning (Engeström 1999, 2010) that eventually leads to sustained and radically new practices. I conclude by capturing the salient issues from the chapter.

7.1 Self-regulated learning through trial and error informal experiments

Of significant concern (a major disturbance) in this predominantly horticultural community that depends mainly on rain-fed agriculture was how shifting rainfall patterns would create a sense of panic and confusion as members of the community contemplated the best time to plant (refer to Chapter 6 for a more detailed discussion). Considering that agriculture is climate sensitive, one could expect farming practices to have changed as the climate changed as Jerina acknowledged:

> *machinjiro ari kuita manairo emvura ari kuita kuti nesuwo tichinje maitiro edu, tichinje nemarimire edu*
>
> [the way rainfall patterns are changing is engendering changes in the ways we do things, changes to our farming practices].

Climate change has pushed people out of their comfort zones, forcing families to break conventions and informally experiment with diverse ideas, and to test and trial what might work for them in real life situations using locally available resources. Where the main driver for adaptation was the focus on increasing yields, research participants not only implemented innovations but also evaluated the merits of the innovations, thus learning by reflecting on and transforming their practices (Engeström 1999, 2010; 2016; Haapasari et al 2016; 2018). While in some cases adaptation was clearly thought out, in others it was accidental, as exemplified by Wadzanayi's experience with late planting:

> *ini ndakandoti nonokei nokuda kwekushaya hangu zvinhu…zvokurimisa, but ndakatoona kuti…ndakatokohwa than vakakurumidza… Ndiri kudzidza kuti, dai tangoti January wacho iyeye ndowekutongorima*.
>
> [I planted late due to lack of … materials, but I reaped better than those who planted early. I am learning and am wishing for people to consider planting in January as the norm].

More interestingly, the learning often went unnoticed; some of it happened incidentally through lived experiences (Leow & Zamora 2017; Marsick, Watkins, Scully-Russ & Nicolaides 2017) as Lydia said:

zvimwe zvacho unenege usiri kutomboziva kuti uri kudzidza

[with some of these things you don't even realise you are learning].

There was a shared view among participants that in the context of climate change, ignorance was an inescapable reality because events could not be predicted with accuracy. Consequently, participants could not help but learn continuously:

kurima kwamazuvano yangova fembera-fembera…

[contemporary farming is all about trial and error…] (Beula)

ukada kumira nechinhu chimwechete chinobva chapondwa…saka taa kungoti chauya toronga, chauya toronga… [Vanhu] havachazive pane chiraramo chaipo.

[if you choose to stick with one thing, that one thing is destroyed…. whatever comes our way, we try, whatever we lay our hands on, we experiment…[people] no longer know exactly how to survive] (Lemuel)

Below I discuss some of the innovations in farming practices (expansive learning and transformation) that participants engaged in, in response to shifting rainfall patterns. What I present are examples of innovations participants engaged in and/or proposed as they reflected on the everyday in their search for sustainable adaptations to the changing climate. Many of the innovations were not planned but merely trial and error informal experiments as discussed below.

7.1.1 Re-configuring planting regimes

Participants recounted that there were set times when specific kinds of rains were expected which guided community members on when to plant what. The scripted rules dictated that October marked the onset of the planting period. However, rainfall patterns had shifted and as Lydia recalled, shifting rainfall patterns were a major source of crop failure:

pamakore maviri apfuura, takarasika zvakanyanya. Kunaya kwakaita mvura isu takatofunga kuti i bumharutsva tisingazive kuti ndiyo mvura yokutodyara nayo… Iro zhizha rino iri rakarasisa vakawanda nokuti mvura yacho yakangonaya zvekuti payakaenda yakabva yaenda zvachose. Kudyara

kwatanga taita zvakabva zvatombobuda zvakanaka kubva zvambotikurei kubva zvatsva nezuva. Zuva raipisa! Pakazonaya mvura zvizhinji zvanga zvatsva…mvura yakanonoka, vakarimira mumashure ndovakakohwa…

[the last two years, we grossly miscalculated. When the rains fell, we thought they were *bumharutsva,* we didn't realise it was time to plant…the last agricultural season deceived a lot of people because it rained and there was a prolonged dry spell. We had planted, the crop germinated, grew slightly but withered. It was hot! When it eventually rained, most crops had withered… it was too late, those who planted late harvested].

As she reflected on the events of the last three agricultural seasons, Lydia acknowledged that rainfall patterns had changed. She said those who planted later than usual suffered fewer losses than those sticking with old planting regimes. By studying her cropping patterns and the timing of the rains, Lydia acknowledged the exigency of reconfiguring planting dates. She recognised that crops failed not because of inadequate rains, but because her timing was off. However, despite this new reality, planting after October was not yet accepted as normal practice; participants largely referred to it as *kunonoka kudyara/kurimira kumashure* – 'late' planting. As predicted by Engeström (2008a), I observed that sometimes disturbances were acknowledged but their resolution was shelved (avoiding confrontation). This happens for several reasons, but as Jerina noted, planting post October defied the scripted rules.

Considering that agriculture was crucial to livelihood, such defiance was akin to mental illness:

mukadzinin'ina wangu akanonoka kurima akatodyara kunge ikoko kuma 20 chaiko December. Tava kutoseka tikati ...mava kudyara makonye makanonoka. Isu tikati vakuru vakati ukaona benzi rapururudzira mumunda waro siya rakadaro. Aa! Chibage chaakaita gore iroro ka, mvura yakanonoka kuzoendaka. Akaita chibage chakaoma, chisina kana gonye, chisina kana chinyi. Saka unoona futi kuti kana wangofunga kuti ini ndava kutodyara, dyara. Haikona kuti haa, gore rino hakuna mvura. Mvura yakamborimwa muna Dec, ini handicharima….unenge watofoira.

[my sister-in-law planted late, around 20 December. We laughed…and said to her you are seeding worms, you are late. But then elders always say if you see someone with mental sickness celebrate their field, leave them alone. Oh! You won't believe it, you should have seen the maize she harvested last year because the rains stopped late. The maize matured, no worms, no nothing. So, you realise that once it dawns on you that you want to plant, just plant. Don't say, there is no rain this year. We have never planted using December rains, I am no longer planting…you definitely flop]

Contrary to the criticisms, the crop thrived, an experience that triggered Jerina to re-evaluate, compromise and modify (Engeström 2016; 2018) her views regarding 'late planting'. What Jerina's sister-in-law did was considered madness; it was a disturbance to the scripted and 'normal' planting season. Although the late planting was accidental, it created an opportunity for Jerina to disregard community conventions regarding normal planting dates as she learned from the experiences of others.

Before climate change was a concern, the planting of maize in this community occurred all at once. Because plots averaged one hectare per household, planting would be completed in a day or two. However, as rainfall patterns had become highly unpredictable, some participants reconfigured planting regimes and staged their planting as a risk management strategy. Below I highlight examples of critical literacies that emerged as participants reflected on planting in stages:

- *Ini ndakadyara mumera umwe chete. Ndokurasika kwandakaita ikoko, zvokuti pamwe dai ndakazoita mumera wechipiri pamwe ndochaizonyatsosvika ichocho…*

  [I planted in one go. This is how I lost it, had I planted again, the second crop might have thrived…] (Lydia).

- *Hazvichade kuti mvura ikanaya nhasi wobva waisa munda wese. Aiwa unoruza unongoisa kota October; woisa futi November; woisa futi December; kana even January anoita*.

- [it's no longer advisable to plant the whole field in one day. No, you risk losing out, you plant a quarter in October, plant again in November, and again in December, and even January is still good] (Fiona).

7.1.2 Reducing hectarage and scaling up irrigation

A common adaptation strategy was to reduce crop hectarage, and in extreme cases to abandon rainfed farming entirely. For some, they reduced their hectarage to avoid the trauma associated with persistent crop failure.

> *Kurima kwacho kwava kupedza simba… saka unozongodyara padiki uchingoti ko ndinofireyi.*
>
> [farming under the circumstances is discouraging…. planting extensively has became disheartening so you end up planting just a small portion] (Lemuel)

Farming is an investment, as most households depended on small scale commercial horticulture. Persistent crop failure forced most participants to keep hectarage to a minimum as a risk management strategy. Farmers have used irrigation as a farming method but historically only for market gardening. As rainfall patterns became erratic, some participants scaled up their irrigation system to include crops that ordinarily grew under rainfed conditions.

Although some participants learned about irrigation from Agricultural Extension Officers (AEOs), Ranganayi and his wife's decision to irrigate maize was self-regulated and exemplified how innovations emerged out of a self-critical process (Engeström 2018; Haapasari et al 2016;2018):

> *…hapana kwatakambozvidzidziswa kuti kudiridzira kunobatsira… takangodzidza toga isu…mushure mokunge tamborohwa nenzara yakaomara. Tikati mai mwana tinofa nenzara pano nevana. Ndopatakatanga kudiridzira.*
>
> […. We were never taught that irrigation helps…it was something we learned on our own… after we experienced severe hunger. And we imagined perishing from hunger together with our children. That's when we started irrigating].

This exemplifies the incidental learning that happened as community members

navigated through challenges which disturbed the existing rules, creating space for the participants to reflect on and transform their farming practices (Engeström 2016; 2018). Figures 6 and 7 show examples of how community members innovated to irrigate their crops using locally available resources.

Figure 6: Simple petrol pump in shallow well *(Photographs taken by researcher 2016)*

Figure 7: Using containers for irrigation (*Photographs taken by researcher, 2016)*

Despite its usefulness and potential benefits, irrigation had not been widely adopted because most households could not afford the requisite infrastructure. The Dehwa family used a small pump. However, the pump could only draw water to a maximum depth of 9 m, forcing the couple to reduce their hectarage during the dry season. Save for the Dehwas' plot under irrigation, which covered about a hectare, most plots averaged about 500m^2. The Mapanis, Makwaras, Mabasas and Dehwas scaled down, while the rest abandoned irrigation during the dry period as it became increasingly difficult to access water. Temperature extremes coupled with heavy manual work presented peculiar challenges for the older and feeble participants (Danai and Jerina) and nursing mothers (Wadzanayi):

> *hatichazvikwanisa…makumbo haachadi, takasakadzwa nema garden …Ndava kungomirira zve muzhizha*.
>
> […we can't do it anymore…the feet can't cope. We were incapacitated by gardening…I just wait for the rain season], (Jerina).
>
> *ndakazvikonewa…uko ndinenge ndichi carer mwana wangu, uku ndoda kudiridza ndega nemaoko angu. Saka ndakangoita ikaka koga kandima ikaka ndokandinokwanisa*.
>
> [I couldn't handle it …I need to care for my baby, while I must irrigate manually. So, I concentrated on this small and manageable portion] (Wadzanayi).

The examples cited above resonate with research evidence suggesting that while being knowledgeable about climate change is vital, knowing does not always translate into agency (Gonzalez-Gaudiano & Meira-Cartea 2010; Nidumoli et al 2018; Stegs 2018). Sometimes, people fail to practise what they know due to the existence of typical constraints.

7.1.3 Managing risk through polyculture

Participants embraced polyculture, a form of agricultural practice where more than one kind of crop is grown in the same place. The main scientific reasoning behind the practice is that it reduces pests and diseases through species diversification (Finney and Kaye 2017; Stevens 2017). However, the primary reason for practising

polyculture as explained by participants was to manage the risk resulting from uncertainty and unpredictability of climate change:

- *unenge uchingoiitira kuti hameno zvinopedzerana imomo ndava mvura yacho haichanyatsozikanwa manairo ayo.*

  [You just say whatever, they (crops) will sort themselves out for the rainfall patterns have become unpredictable], (Lydia).

- *Kunenge kuri kuti ukakona kukohwa chibage unowanawo beans…*

  [If you fail to reap maize, you may harvest beans…], (Sarudzayi).

The more enterprising farmers intercropped plants that were thought to be incompatible. Ranganayi, for instance, intercropped maize with kale, a practice that some regarded as unconventional but that worked to the family's advantage. Although polyculture improves crop resilience there is scientific evidence suggesting some plants are incompatible and hence cannot be intercropped (Lin 2011; Seran and Brintha 2010). There were reported cases of both successes and failures as exemplified by Lydia and Sarudzayi's responses respectively.

- *Mumupfarinya wamuri kuona uyu ndakanga ndakadyara chibage futi imomo, saka chibage ndakabvisa kwasara mupfarinya*

  [I intercropped maize and cassava in that cassava field you are looking at. I have since harvested the maize] (Lydia)

- *Ndakanga ndakaisa beans muchibage asi, harina kuita mushe rakavhungwa nechibage*. [I intercropped maize and beans, but the beans were outcompeted by the maize] (Sarudzayi)

These were informal experiments, not informed by science: trial and error learning. While on the one hand there is little research evidence for suitable intercrop combinations of maize with vegetables (Ali, Rahman, Asaduzzaman, Hossain, and Mannan 2015), Vimbayi, the mother of the Mbozha family asserted there is substantial experiential knowledge suggesting that intercropping maize and kale is counterproductive:

> *chibage ne vhisikosi hazviwiririrane…mukome wechibage ukadonhera pamuriwo unobva waita mavara zvobva zvadonhedza grade ku market*.

[maize and kale are incompatible…if maize pollen falls on kale it stains the leaves reducing its market value].

Undeterred by critics, the Dehwas had intercropped maize with kale over the last five years. Fig 8 captures images of the Dehwa maize-kale intercrop.

Figure 8: Maize-kale intercrop (*Pictures taken by researcher 2016)*

As Ranganayi, the father of the Dehwa family reported, the maize flourished, and others copied them:

> *vamwe vanhu vese vagari vemuno mu area vanotoshamiswa, vanotoyemura. Pakutanga vaishamisika kuti vana ava, vana vadiki vakadai vanoita pfungwa dzakadai! Asi vamwe vava kutotevedzera muma next medu imomu*.
>
> [everyone in this locale was surprised, yet they marvelled. At first, they were baffled, how such youngsters could be that creative! Some among our neighbours are imitating us].

Ranganayi's narrative demonstrates how what started off as a household defiance of normal farming practices was adopted by neighbours: they were taken through cycles of expansive learning (Engeström 1999; 2000; 2010).

7.1.4 Wetlands and streambank farming

As temperature extremes and prolonged dry spells became a common occurrence, the unavailability of water for irrigation, compounded with a lack of infrastructure, created a surmountable challenge for the farming community. As Revai elaborated, the unavailability of water introduced disturbances to where plots were sited:

> *kare taimborimira kudunhu kuno uku asi iye zvino ma garden ave kurukova kuedza kutevera mvura*.
>
> [we used to have our gardens on dry land over here, but we have since relocated to the stream because that's where the water is].

Although streambank cultivation ensured food security, it compromises environmental sustainability. Grass around the dam was burnt to pave the way for irrigation pipes. Danai described how each year, the water levels in the dam continued to drop and yet farmers kept shifting their plots closer to the water. Eventually, there was a greater risk of siltation, further compromising farmers' access to water. This resonates with research evidence suggesting that not all adaptation measures are sustainable (see for example Eriksen et al 2013).

Wadzanayi and her neighbours had their gardens in a nearby wetland. Historically, community members had sustainably utilised wetlands to grow crops that withstand

waterlogging, for instance the local rice and bananas. However, as water shortages presented persistent challenges, wetlands were drained to grow crops that did not withstand waterlogging, for example kale and maize. Notwithstanding the benefits for farming, wetlands are sensitive ecosystems that offer a special type of habitat and unique ecosystem services, including but not limited to, flood control, water purification and carbon sequestration (Verhoeven & Setter 2009). By letting the water out of the wetland, farmers altered this ecosystem into dry land, hence compromising wetlands ecosystem services (Verhoeven & Setter 2009).

Wadzanayi's and other families' gardens in the wetland provided their major livelihood. Not to say environmental sustainability was unimportant as exemplified by participants' responses, but environmental sustainability was not the primary issue of concern; achieving food security was. There is no doubt of the value of achieving food security, but in some instances food security was achieved at the cost of the environment (Eriksen et al 2013). Although ignorance could not be ruled out, the realities of climate change, compounded with multiple stressors, in some cases forced people to behave as if they were illiterate.

In this section, I demonstrated that, for these participants, climate change adaptation was a tradeoff for improving livelihoods. Whether they were designing their own experiments or trialing ideas learned elsewhere, the general advice was to proceed with caution. As Wadzanayi warned:

> *iye zvino izvi haungodyara…unotanga wamboongorora kuti zvinoita here*.
>
> [These days you don't just plant…you first evaluate the feasibility].

Beula thought that as new tools were introduced to farming, it was crucial to start small and only expand when satisfied with the outcome of the innovations:

> *kana wakangwara unombo tiraya kandima kadiki woona kuti zvinoita here. Ukaita yard yese unopinda nzara apa wakateerera pfungwa dzemunhu. Kana waona zvaita wozorima pahombe kwete kungotanga nepahombe…Kana zvaramba wodzokera kwako kwekudhara. Hanzi kudzidzaka hakuperi, saka unoramba uchingoterera uchiedzawo zvinenge zvataurwawo nevamwe izvozvo*.
>
> [if you are clever, you experiment with a small portion, observe what happens

and evaluate the outcome. If you plant the whole plot based on hearsay, you predispose yourself to hunger. If the outcome is positive, you may increase hectarage but, you can't just start by planting a substantial portion... If the results are not impressive, resort to your old ways. Learning never ends, keep listening to what others say, but continue trying].

Beula suggested that finding sustainable solutions to climate change demanded that she be strategic, keep an open mind in a continuous search for sustainable solutions and avoid rushed decisions lest she risk compromising food security.

Next, I discuss examples of the learning that took place through processes of social interaction among community members.

7.2 Reflecting on and modelling practices of others

Nyaya idzi dzinongotaurwa tangosangana nyangwe uchienda kuchigayo, nyangwe uchienda kupi, dzinogona kungotanga dzakafanana naidzodzo. Nyaya yenzara iri kungotaurwa pese-pese iyi!

[These issues are discussed wherever and whenever we meet, be it on the way to the grinding mill, could be anywhere, the discussions just erupt. Nzara (hunger/drought) is being discussed everywhere!] (Wadzanayi).

There were several social groupings in the community where people met and networked as they shared issues of mutual concern. Such groupings included, among others, churches, traditional ceremonies, women empowerment clubs, the family and male *indabas* (traditional male conferences). Other social spaces such as public transport, funerals, weddings, and social soccer matches provided opportunities for learning about climate change mitigation and adaptation.

Below I discuss examples of the learning that took place through social places and spaces of interaction.

7.2.1 Learning collaboratively through peer interaction

Community members learned as they collaborated with peers who shared problems of mutual concern. In his peer network grouping, people learned through look and learn tours, discussions and deliberations as they shared ideas and materials to help

them transition from crop to orchard farming. Lydia described the networking among groups of women who participated in women's empowerment clubs:

> *izvozvi kune madzimai vari kuchererana makomba e zero tillage…vakaitira kuti kune vanenge vasingazive vaye- vaye kuti zvinoitwa sei, ndopavanowana mukana wekuziva ipapo…*
>
> [as we speak right now, there are women teaming up and digging basins for zero tillage in their fields on a rotational basis…so that those who don't know how it's done get an opportunity to learn…].

Apparently, some women in the community were more experienced in conservation farming than others. These more experienced farmers wielded authority to dictate solutions (Engeström 2018). The less experienced farmers learned from the more experienced farmers through peer networking, a process that might be likened to what Lave & Wenger (2001) called legitimate peripheral participation. The gardens and fields provided a learning context where people learned by silently observing their neighbours' practices from a distance, as Sarudzayi elaborated:

> *vazhinji vaikopa…vaitoona tichidiridza votoshaya kuti vanhu ava varikumboita sei…Vozoona at last manje vanhu vaye vakakohwa zvinotyisa. Hatina kumbobvira tamboenda tichindodzidzisa kuti diridzirai*
>
> [most people copied… as they saw us irrigating and wondered what was going on…Eventually, they realised our harvests were phenomenal. We never went about teaching people to irrigate…].

In other situations, people mentored each other as they jointly resolved problems of mutual concern, as Sarudzayi elaborated:

> *…kubvunzana…Tinodzidzisana…Fanika muriwo iye zvino izvi kwanga kune kakonye… kanga kambochemedza vanhu makore apfuura aya… patakazoziva mushonga uyu maingonzwa ari pano ati dai mambonotenga abha*.
>
> […we ask each other …We share knowledge… on pests…what pesticide to use …]

Additionally, people visited each other's gardens and learned from firsthand experience as Wadzanayi explained:

Handi muri kuona tuma onion twandiri kuisa muma side umu, ndakatozvidzidzawo kubva ndatokopawo kune mumwe. Mumwewo wandakakopa iyeye achitoti ndozvazviri ndozvazvinoitwawo ndasvikawo mugarden make zvakangodarowo.

[you see these onions I planted on the sides, I learned and copied from someone. That person told me thus the way to go when I visited her garden].

I use the term *information leaks* metaphorically to refer to a situation when people accessed information not intended for them. Describing the learning that took place on public transport facilities, Beula explained:

Zvimwe unongozvinzwawo mukufamba imomu...muchifamba mumakombi umu vachiti zvinhu hazvina kumira mushe imi mvura haichanaya zvakanaka, dyarai mbeu dzinokasika kuibva.

[we hear some of these things as we travel…on the commuter omnibuses you hear such things like the situation is bad, it's no longer raining appositely, plant early maturing varieties].

Although the information was not intended for them and their intent in being in that place was not to learn, there were times when information simply leaked, evoking participants to modify their views (Engeström 2008a) regarding their farming practices.

Participants voiced concerns that sometimes the information shared in social circles was counterfactual, as Lydia divulged:

t*inombotaura hedu mukusangana kwedu kazhinji vamwe tinenge tisina ruzivo nazvo …. Unenge waakungotaura vazhinji zvavanenge vafunga kwete kuti ndezveruzivo, haa kwete! Zvoruzivo zvinenge zviri zvishoma*.

[We talk as we interact but normally most of us are not knowledgeable about it [climate change] … People just express their opinions not to say what they say is factual, oh no! Informed discussion is limited].

Climate change is a serious livelihood issue, so people talked about it whenever and wherever they got a chance to do so as Lemuel hinted, saying *mazuvano munhu wese angova mudhumeni*. [these days anyone and everyone claims to be an AEO].

According to this view, anyone and everyone claimed to be a technical expert. Participants, therefore, were mindful that not everything being shared was authentic. Compounded with that, finding a solution to climate change proved complex, as Beula remarked:

> *answer haisi kuwanika, haisi kubatika zvekumhanya, nokuti haa inongova fembera-fembera*.
>
> [the answer to that, is not found, it's elusive, it's all guess work].

The literal translation of the phrase '*kubatika zvekumhanya'* is it cannot be caught so fast; the phrase is used to describe situations that are elusive, complex and intractable. Sarudzayi lamented that while research on climate change was ongoing, a solution to climate change was currently nonexistent:

> *Ii! Iye zvino izvi hapana ati ambova ne answer vachiri kutongotsvakurudzawo kuti vanhu kuti chii chiri kumbokonzeresa kuti mvura isanaye zvakanaka*.
>
> [oh! Right now, no one has the answers they are still researching what's causing climate change].

Sarudzayi and Beula teased out the idea that knowledge about climate change was incomplete. Thus, participants acknowledged their learning was mainly based on trial and error.

Next, I discuss the learning that took place as community members emulated more successful farmers.

7.2.2 Learning from more successful farmers

There was a shared view among adults that much of the information shared was not documented anywhere. However, community members relied on knowledge that had been confirmed by the observation of its successful practical application. While climate change rendered most households' food insecure, some produced in surplus, as Ranganayi confessed:

> *vamwe even muno umu zvinongofaya, haana nzara….*

[There are some in this community who are doing exceedingly well, they know no hunger].

Certain names in the community kept being mentioned as role models whose farming practices were worth emulating. I engaged one such family to discover what made them more successful than others. I call this family the Mbozha family (not their real name). I interviewed Vimbayi, the mother of the family. Their homestead stood out as a distinct symbol of wealth in this community where poverty was rife.

Figure 9: A section through the Mbozha homestead: **The family house and staff quarters; inserted is the typical household** (*Photograph taken by researcher (2016)*

There were two 5 000 litre-capacity water reservoirs mounted in the garden, fowl runs about sixty metres long and an immaculate house, much too big for the family of four. Vimbayi explained that the couple built their business empire from farming.

Initially, the couple focused on horticulture. With the help of a family member, they penetrated the bigger markets and supplied their produce to a local teachers' college. However, due to the economic challenges the country currently faced, markets tumbled, rendering market gardening less profitable. Vimbayi explained that the family felt the brunt of the changed rainfall patterns like everyone else in the community, but they set up several mechanisms to counter the effects of climate change. The couple diversified into raising chickens to sell to locals and a retail outlet in the nearby city.

Figure 10: Fowl runs and chickens (*Photographs taken by researcher (2016)*

The family had electricity in their home, were connected to the local water supply system and had an electric pump-operated borehole as backup. The family depended on these resources and scaled up irrigation to include crops that ordinarily grew under rainfed agriculture.

Figure 11: Part of the irrigation infrastructure (*Photographs taken by researcher 2016)*

The Mbozha family offers a typical example in this community of the fact that while climate change may be regarded as a universal problem, it tends to affect people differently across places and even within the same locality (Granderson 2014). Additionally, the case demonstrates how social inequalities play out in climate change adaptation. The family had resources, including but not limited to money, access to reliable sources of water, electricity and market privileges which some members of the community did not have. Unlike other community members, the Mbozhas had adequate irrigation infrastructure and water that allowed them to plant throughout the year. As Ranganayi said, the family's success gave other members of the community hope and more importantly, informal lessons to help them cope with drought, as they served as role models:

Takadzidza kubva kwaari tese pano apa… akatanga achingorima madomasi…Anga asati ava businessmen zvatiri kutaura izvi. Anga achingoita zvatakaita izvi, navadzimai vangu ava. Ndopatakatanga kuonawo kuti ndinogona kukopawo murume uyu zvaari kuita izvi… vanhu vakaita saivava i role model yedu.

[Everyone in this community learned from him…he started off growing tomatoes…He wasn't a successful business then. He was doing exactly what my wife and I are doing. That's when we realised we could emulate that man…people like him are our role models].

Participants raised several issues regarding what made some farmers more successful than others despite being in the same community and experiencing similar climatic changes. Although opinions varied among participants, the pervasive view was that organisational skills, especially timely planting and sourcing inputs on time; knowing the right kind of seed for one's kind of soil; incorporating moisture retention techniques; and access to resources were what set those who succeeded apart from those who failed.

Participants not only learned from prominent business people, but also from ordinary people. Ranganayi elaborated that credentials do not really matter, but the person you are learning from must be talking from practical experience:

Tinokopa kuvanhu vanenge isusu…havana zvavo kudzidza kusvika pa level dzapamusoro sesu…asi kuti tigone kumukopa munhu uyu, iye anenge achitochiita chinhu ichocho kana kuti akachiita. Anenge akatombobva mazviri... akambenge achirima zvakadai nezvakadai, obva ashandura achionawo maipiro azvo…Isusu sevanhu zvedu kutaura chokwadi tinokoshesa kutanga taona pakamboitwa. Totenda taona sa Thomas.

[we emulate ordinary people, just like us…not highly educated, just like us…but, that person will be practising what they are preaching. They would have gone through the experience…they would have changed their farming practices after assessing the limitations….as human beings, the truth is we value seeing what has been done first. We believe after seeing like the doubting Thomas].

Using the biblical allusion to the doubting Thomas, Ranganayi dismisses abstractions while emphasising the value attached to context-specific knowledge that is rooted in experience. Lydia reminisced how she emulated the farming practices of a particular elderly lady in the community whose crop consistently did well.

> *...kutimba kwatiri kuita uku, kune vamwe Mbuya munda wavo wese vanotimba kudai. ...mbuya ivavo vanoita chibage. Saka ndakazovabvunza kuti munombozvifambisa sei. Ndovakandidzidzisa kuti unotora mashanga, woisa pa compost, wochera gomba rako....*
>
> [...there is this elderly woman who digs up her field just like this...that granny harvests lots of maize. I asked her how she does it. She said, you must dig on time. If possible, make your basins ready, and add manure. She is the one who taught me that you take straw and add to the basins...].

Generally, participants were convinced to trial solutions only when there was substantial evidence that the innovations are worth emulating. Contrary to the scientific, mechanistic and deterministic paradigm that regards science as a universal truth (Gonzalez-Gaudiano & Meira Cartea 2010), for these participants, the worth of knowledge lay in its practical value and depended on who was talking.

7.2.3 Learning embedded in family history, traditions and customs

Family history, customs and traditions mediated the learning that took place. Lydia for example described how her grandparents grew cassava when she was a child, a practice she later adopted:

> *kana zviri zve mupfarinya ka ndakambogara pasi ndikati inga kuti vana mbuya vangu vairima wani mupfarinya. Takakura tichidya mupfarinya....* [As for cassava, I sat down, and I reflected on how my grandmothers used to grow cassava. We grew up eating cassava...].

Jerina, Revai and Sarudzayi confessed to sharing new seeds with their mothers. The data suggests that, throughout life, the family continued to have a strong bearing on what people believed to be authentic and had a strong influence on the adaptation choices that people made. However, in some instances power relations between

married couples played out, derailing the adoption of innovations. It was common for couples to engage in open conflict (Engeström 2008a) as they debated clashing views. Fiona experimented with late planting but planted only a very small portion because she and her husband held opposing views about late planting:

> *… ndakati inini regai ndiise chibage muna January. Baba vapano vakati chibage chemuna January hachiite but, chibage ichocho ndakatochidya mwedzi wakapera. Chakatosvika asi vaiti hachisvike mvura haizonaye manonoka. Vakazotozvidemba vakati dai wakatoisa pahombe chingadai chakatosvika and chaachisina futi makonye. Saka zvokutoti January futi unogona kutoisa chibage.*
>
> [I decided to plant maize in January. My husband said January maize won't thrive, but I ate that maize last month. It matured and yet he said it wasn't going to. He regretted it and wished I had planted a bigger portion. The maize matured and wasn't attacked by the stalk borer. So, I realised, you can plant even in January].

Although Lemuel and Lydia agreed on some innovations, there were incidents when the couple's views clashed, derailing their implementation of innovations. For instance, Lydia knew about the advantages of zero tillage, but it took her more than two years to implement the idea because of her husband's condescension:

> *kakusanzwisisa nekakushora kari matiri kanoita kuti zvinhu zvedu zvisafambe zvakanaka…kunge muri vaviri kudai so, unenge uchitaurawo neumwe wako. Hazviite kuti ndingoti chandanzwa kwandanzwa ndotouya ndoita pasina kuwirirana neumwe wako*.
>
> [lack of knowledge and condescending attitudes disrupts the smooth flow of things…if you are a couple, you discuss with your partner. I can't implement ideas I learnt elsewhere without discussing with my partner, we must agree first].

As discussed in Chapter 5, the Mutema community is highly patriarchal; women and children are regarded as inferior and so are their ideas. These observations confirm other studies which have shown that in both the Global North and South, while women were more vulnerable to climate change, women were not part of decision-

making processes (Ahmed, Lawson, Mensah, Gordon & Padgham 2016; Alston 2014; Arora-Jonsson 2011; Mukoni, Mudaly & Moletsane 2018). It therefore follows closely that adopting innovations proposed by wives entailed a reconfiguration of the division of labour within households, as husbands wielded the authority to dictate how and what innovations were implemented.

7.2.4 Other places and spaces for learning

As part of their social responsibility programming, churches offered informal lessons to help their congregants deal with the changed rainfall patterns. Although I did not ascertain the credentials of the educators from churches, the six women who partook in lessons offered by churches acknowledged to holding information from churches in high esteem as Danai explained:

> *dzidziso dzinobva kuma church dzinogamuchirika zvakanyanya. Kunyanya dzinobva kuvaFundisi vedu*
>
> [advice from church is readily acceptable...especially that coming from our church Ministers].

Following the teachings from her church, Jerina intercropped maize and cowpeas. While some participants learned about zero tillage through interactions with technical experts, Danai's adoption of zero tillage was influenced by teachings from her church. Previous studies have shown that as climate change is increasingly linked to anthropogenic processes, human ethics play a significant role in addressing climate change (Baer & Singer 2018; Garcia & Sanz 2018; Lyon 2018), hence religion and other social institutions that teach values have a role to play in mitigating climate change (Oman & Morello-Frosch 2018). However, this field of inquiry is still evolving.

Although not in my original plan, I ended up at a funeral as Danai, one of the participants, had lost her sister. I could not help but eavesdrop on the conversations during the funeral wake. I sat next to a group of five women who seemed to know each other, who were discussing the unpredictability of weather patterns. It was August and ordinarily temperatures would be expected to be warming up. However, on that day, it was rather cold, and this seemed to have triggered the discussions. Their discussions touched on confusing temperatures and confusing rainfall patterns.

One woman remarked that these changes were happening because the gods were angry, and an elderly woman interjected:

> *kunaya kwemvura ndokwa Mwari…hakuna anoziva Mwari bhatani raanotokonya kuti mvura inaye.*
>
> [it's up to God to make it rain…nobody knows the button that God presses to release the rains].

The other women laughed. I joined in the conversation to ascertain why they had laughed. The youngest of the women explained climate change from a Western scientific perspective:

> *mukatarisa climate yekuno uku inenge desert climate, kunopisa and hakuna miti yakanyanya…izvozvo ndozviri kukonzeresa kuti mvura isanyatsonaya zvakanaka kwete izvi zvekunzi Mwari akatsamwa.*
>
> [if you look at this community, our climate resembles desert-like conditions, it's hot, there are fewer trees…these are the reasons we don't receive a lot of rainfall and it's nothing to do with the God is angry hype].

I later caught up with the young woman, an environmental science student at a local university; this explained her Western scientific orientation. I discerned that as people mixed and mingled in social spaces, knowledge on climate change was shared and people learned as they reflected on others' and their own practices. As climate change was a dilemma for livelihoods, each time adults met, it was almost imperative to discuss coping mechanisms. Typical conversations I would hear were:

- *makakohwa here?* [did you harvest anything?]
- *kanjani nzara muri kuzvigona sei?* [how are you dealing with hunger?]
- *gore rino inonaya iyoyi?* [do you think it will rain this year?]
- *kubva kwatonhora September uno chiiko?* [how could September be this cold?]

To conclude this section, I argue that as climate change continued to wreak havoc on farming, community members consciously sought solutions to improve their farming practices, and hence, their food security and livelihoods. In their search for sustainable solutions, farmers consulted with and copied other members of the

community. This happened through processes of social learning interactions in which more experienced members showcased best practices while the less experienced members developed the capacity to improve their own practice. The social learning that took place was planned, purposeful and directed at achieving set goals: improving yields for improved livelihoods. However, views about how to adapt were diverse. Clashing views were debated, meanings negotiated, and solutions dictated by those occupying privileged positions (Engeström 1995; 2008b), for example, more experienced farmers and family heads.

Next, I analyse the learning that took place through reflective questioning of long-held views and cultural conventions.

7.3 Reflecting on and questioning cultural conventions: Capitalising on *vauyi* to introduce innovations in farming

The Mhere family and a few other people did not originate in Mutema. According to Lemuel, the father of the Mhere family, the community labelled such people '*vauyi*', which in the local context literally means 'those who came from outside'. Lemuel recognised that as *vauyi* were 'foreign' to the community, they were predisposed to challenge the status quo and substantially effect the change that families desired to adapt (refer to Chapter 5 for a more detailed discussion). Below, I discuss some of the prominent farming practices enshrined in community conventions.

7.3.1 Challenging conventional farming practices

> *munharaunda muno muriwo ndopane hupenyu, ndopane hupfumi*
> [in this community market gardening is where life is, it's where the wealth is] (Lemuel)

Although market gardening defined the Mutema community, there were concerns among those participants with an extended history with commercial horticulture that market gardening was no longer viable.

> *kugarden kwedu ndokwatinowana mari asi…hatizokwanisa kuiwana because market yacho tikaenda nomuriwo tinozotengesa nemari iri pasi...* [market gardening is our source of money but…we fail to get the money because when

we take our vegetables to the market, we sell at ridiculously low prices….], (Sarudzayi)

As discussed in Chapter 5, market gardening was nothing more than complying with community conventions. Lemuel contended that for original members of this community, transitioning from market gardening and especially the growing of maize and kale was an act of challenging the status quo:

Takaremadzwa…Saka, chijairira chotoda kubva pachiri…chinouraya?

[We are encumbered…we ought to break free from convention…it [convention] kills].

Lemuel trusted *vauyi* to drive the change this community needed; they were not as 'locked in' to the farming practices prevalent in the Mutema community as were original members. As an example, the Mhere family was transitioning from maize to orchard farming.

Figure 12: Challenging conventional farming practices: transitioning to orchard farming (*Photographs taken by researcher, 2016).*

Next, I analyse how the Mhere family challenged some of the community conventions.

7.3.2 Growing 'foreign' but drought tolerant crops

Introducing drought tolerant crops had become imperative as Lemuel reasoned:

> *tava ku shifter kuzvirimwa zvinenge chibage zvinomirira mvura yemudenga… nekuti zviri kutipa dambudziko kuti mvura iri kubva yashomeka pamwe yobva yauya paisingakarirwe nekuti haichina nguva yakanyatsonaka….*
>
> [We are shifting from growing crops such as maize that are rainfed… this is creating problems for us as rains are unpredictable…].

The value of the 'foreign' knowledge that was brought into Mutema by Lydia was evident in the context of a community experiencing increasing unpredictable rainfalls:

> *...patakasvika munharaunda ino iyi ...ndakaona pasina kana akanga ane mupfarinya. Ndikati ini ah! Pamwe ndozvinoitwa kuno uku asi inini handide kuzviteedzera. Ndoda kumboona zvaiitwa nana sekuru vangu nana mbuya vangu kuti hazviite here, hazvindiraramise here. And ndakazviedza zveshuwa ndikazviona zvichindiraramisa*.
>
> […when we came to this community …I realised no one was growing cassava. I thought to myself, ah! Probably this is how they do things here, but I said I wasn't going to follow. I want to see whether if I can't survive on what my foreparents did. I tried it, and for sure it sustained me].

Figure 13: Growing foreign but drought tolerant cassava (*Pictures taken by researcher 2016*)

Originally from South America, cassava is perennial and one of the most drought tolerant crops providing sustainable solutions to food security and poverty in drought-prone regions of Africa (Guira, Some, Kabore, Sawadogo-Lingani, Traore & Sawadogo 2017). However, "in Zimbabwe, cassava production is negligible; in Mutema, cassava was little known although it was slowly being integrated into some families' cropping regimes and diets. In addition to the Mhere family, the Gwenzi, Chimoto, Mapani and Makwara families had to a smaller extent planted cassava plants on experimental bases. Changed rainfall patterns, coupled with their interactions with the Mheres, created spaces for those families to compromise (Engeström 2008a) and adopt cassava, a foreign crop, as part of their innovations (Engeström 2008a) in farming. As Fiona, the mother of the Gwenzi family recounted:

> *mupfarinya ndakautorawo kwa Mbuya [Mhere] kuda kundoedzawo kuti zvinofamba sei…Takazozvifunga tatoona kuti mvura yacho haisi kunaya zvakafanira.*

[I got the cassava from Granny [Mhere] just to see how it goes...We figured it out when we realised it was no longer raining appositely].

Although research in this field is still limited, the data confirm previous studies which have shown that immigrants and internal migrants contribute to changing a community's local knowledge systems (Dun, Klocker and Head 2018; Klocker, Head, Dun and Spaven 2018; Shava, Krasny, Tidball & Zazu 2010). Although their study investigated the adaptations that happen when people move from rural to urban areas, Shava et al (2010) observed that as rural people migrate to cities, they "retain and adapt knowledge from their agricultural past" (p. 585). The Mheres had maintained contact with their relatives in neighbouring Malawi and had a daughter who had married into a drought-prone community outside Mutema whom they also learned from. The couple started growing trees while they lived in the city, a practice they continued when they relocated to Mutema (Chapter 5).

Besides importing crops, the couple also imported farming technologies. I noticed that their plants grew on raised beds, unlike customary practice in this community where plants grew on level surfaces, a practice they imported from Malawi. Lemuel elaborated:

Zvema ridge izvi ndakazvinzwa nekuzviona ku Malawi…tichimbondoshanya …ndakatobvunza kuti muri kumbozviitirei… ndoimwe nzira itori nyore pakuchengetedza hunyoro…

[I witnessed and heard about raised beds in Malawi…while visiting…I inquired why they did it…This is one effortless way of conserving moisture…].

In view of the prolonged dry spells that characterised the prevailing rainfall patterns in their context, the family relied on knowledge they imported from Malawi to conserve moisture.

For this family, a combination of family history, exposure, inner drive and creativity constituted the repertoire of tools they drew on as they ventured into new territories. This takes me to my next argument where I defend the position that alongside shifts in conventional farming practices was the exigency to re-conceptualise food choices, as maize, the staple crop, was highly vulnerable to drought.

7.3.3 Reconceptualising the concept of decent food; Staple food and cultural identity

In this section, I discuss participants' narratives about shifts in socio-cultural practices regarding food choice. As predicted by anthropologists, I found that food preparation and dietary practices are closely linked to cultural identity. Individually and collectively, humans are defined by what they choose to consume (Hongladarom 2018; Manomova 2018; Crowther 2018). Participants continued to refer to maize as if it was synonymous with the word crop, even when referring to crop failure. There was substantial value attached to maize. Similarly, when food was mentioned, it was almost always assumed to mean *sadza*, a thick porridge mainly prepared from maize meal. *Sadza* could be prepared from other cereal crops like rice and finger millet, but here *sadza* referred only to that prepared from maize meal. Other meals were referred to by their specific names, for instance *sadza rezviyo* (finger millet meal), *sadza remupunga* (rice meal). Lydia, for instance, talked of *hupfu* (meal) and *hupfu chaiwho* (the real meal), when she said:

> *…inini ambuya vangu pandakambondovaona vaindibikira sadza re rice kubvira pandakaendera kusvika ndidzoke. Zvokuti ndakatozoita zveku complainer kuti aiwa chimbondibikirai hupfu chaihwo*.
>
> [...when I visited my grandmother, she prepared rice meal from day one until I returned. I had to complain and said no, would you please prepare the *real* meal].

Lydia implied that other forms of meals were unauthentic.

Adult participants indigenous to the community could eat all other foods but, without maize, it felt like there was no food; as Danai argued:

> …ku*nyangwe dei tikawana zvinonaka sei zvinana rice asi kana usina kudya sadza unenge usina kudya…mumba kana musina hupfu munenge mune nzara*.
>
> […you may eat all these tasty foods like rice but without eating sadza it's just as good as you haven't eaten…a household without maize meal is a hungry household].

According to Danai, it was either *sadza* or no food; other foods were treated as

invisible and accorded inferior statuses. While children cared less about changing the staple if tasty alternatives were made available, adults indigenous to the community expressed distress at the thought of not having *sadza*; as Ranganayi bemoaned:

> *Zvikanzi sadza hakuchina unotombotika hupenyu hwapera… pamwe munhu hauzofa zvako asi, panotora nguva ipapo kuti tijairire zvinenge zvavapo*
>
> [I cannot imagine life without sadza, it feels like the end of life… Of course, you won't die but, it takes time to adjust to the new situation].

Mindful of the exigency to evade the suffering accompanying maize failure, Ranganayi conceded:

> *…chiri kuramba chichitsva… pfungwa dzakavandudzwa dzinozouya saizvozvi. Climate change yavako zveshuwa zviri kutooneka. Asi nohuchenjeri hwavapo tinogona kudiridzira*
>
> [it's [maize] persistently failing… this ignites innovative ideas. Climate change is here for real and yes, the signs are visible. But, now we are knowledgeable, we can irrigate…].

Ranganayi would rather innovate farming technologies to ensure the continued availability of maize than give up on the staple, while Beula thought it was maize that identified (Hongladarom 2018) not just the participants but the nation:

> *nyika kuti inzi nyika kunge tine chibage… kana pasina chibage hupenyu hapana*!
>
> [for this country to be a country we need maize…for without maize, there is no life…].

Maize thus, according to these arguments, created a sense of both national food security and identity. Notwithstanding its vulnerability to climate change, all participants grew maize because it was conventional. Like market gardening, maize farming offered an example of how existing systems that may be unsustainable are stabilized through lock-in mechanisms (Geels 2010;2011;2018; Spurling 2018) which create path dependency making it difficult to dislodge existing systems (Geels 2011).

While participants held strong notions about what made food sources acceptable, they

implemented several strategies to ensure their families were fed even when they fell on tough times. The innovations varied among households and below I discuss some of the adaptations. The realities of climate change pushed families out of their comfort zones as participants introduced new foods to their diets to avoid sole dependence on maize. In some instances, this meant people eating foods they despised, as Wadzanayi bemoaned:

> *unoguma waa kungodya zvimwe zvinhu zvisingamboita*
>
> [you end up eating despicable things].

The adult community referred to 2009 as '*gore riya rokudyiwa hacha'* [that year when people ate *hacha* (*pallinary curatellilifolia* fruit)]. This signified how widespread the practice was. I became aware that although the fruit was nutritious and tasty it had a very unpleasant smell that tended to repel most people. The fruit was eaten only as an act of desperation.

In the same year, the government and donors introduced foreign foods that came in as food aid to cushion households from the brunt of food insecurity, as Revai confessed:

> *Ndinoyeuka gore ratakamboita zvekupiwa chikafu ichi, ndakaona zvinana bulgur, haa hatina kumbogara hupenyu hwose ne kudya bulgar isusu, but yakadyiwa ne kuda kwe nzara…*
>
> [I remember the year we received food aid, I saw stuff like bulgur. Haa! We had never in our lifetime eaten bulgur, but it was eaten because of hunger…].

Participants spoke of "*gore ratakadya hacha*" (the year we ate hacha) and "*gore ratakadya bulgar*" (the year we ate bulgur), suggesting that once the situation returned to normal, the despicable foods were abandoned, for they only served as stopgap measures. As cited above, participants held strong notions about what they considered decent food. As previous studies have shown, I observed that what people considered decent food was heavily contested as there were conflicting views depending on among other factors taste, nutrition, health benefits, costs and availability, age and socio-economic status (Crowther 2018; D'Sylva & Beagan 2011). The eating of *hacha*, for instance, was associated with desperation. While acknowledging that rice offered a tasty substitute for maize, adult participants

considered rice eating a foreign culture: to be embraced but not to replace maize.

It had become necessary to consider alternatives to the emerging food crisis, including small grains such as finger millet that are drought resistant. However, the transition from maize entailed changing the rules governing 'normal' diets, and such transitions that involve radical transformations were usually resisted. While small grains offered a viable alternative, this was largely ignored for several reasons. The general feeling was that meals prepared from small grains were unpalatable. Beula and Fiona claimed continuous consumption of the meals caused diarrhea and, in some cases, bloating. Danai and Sarudzayi complained the meals could not be taken daily as it caused loss of appetite. For Fiona and Lydia, the meals looked unappetising and the colour of finger millet meal was off-putting. Jerina believed the problem emanated from cultural conventions that were difficult to dislodge.

Similarly, Wadzanayi cited lack of exposure to alternative foods as contributing to their not being appreciated, especially by children. In addition, the successful growing of small grains demanded a sense of community to share the risk of losses due to predatory birds. Danai blamed the resistance to small grains on convenience:

> *Tiri kuramba tichingorima chibage kana dai chikatotsva. Hachina labour yakawanda. Zviyo manje zvinonetsa. Zvakareruka ndozvataa kuda*!
>
> [We continue growing maize even if its failing. It's less labour intensive. Finger millet is labour intensive. We want things the easier way!].

The Mhere family, however, provided a model of how reconceptualisation of the concept of decent food provided a sustainable solution to food insecurity. As a child, Lydia was allowed to be a picky eater, a practice she regretted in her adult life. Lydia asserted the most sustainable way to evade *nzara* was to diversify sources of food through for example embracing new foods.

As she reflected (Haapasari et al 2016; 2018) on the present food shortages and her childhood, Lydia decided children must be trained to eat all kinds of food to reduce their vulnerability to food insecurity:

> *…dai zvainzi vanhu vanofunga semafungiro andinoita kuti tikadzidzisa vana zvinhu chekudya chese. Nyange kukashaika chibage, mwana haaite dambudziko rokuti pashaikwa hupfu. Muno umu vamwe vana havadye*

mupfarinya, nokuti havauzive, havaurime. Inini pano apa ndikaita dambudziko ndikashaya hupfu ndikabika mupfarinya vazukuru vangu… nokuti zvinhu zvavanoziva.

[I wish every parent shared my views on training children to tolerate all kinds of foods. Even if there is no maize, children will adjust to other foods. In this community, some children do not eat cassava because they don't know it, they don't grow it. If I can't get maize meal, I feed cassava to my grandchildren…because they are familiar with it]

In addition to having had childhood experiences that made her regret her picky eating, Lydia and her husband Lemuel were raised by parents whose staple was cassava and not maize. Consequently, the pair enjoyed some degree of liberty from cultural conventions that positioned maize as an identity marker.

7.3.4 Restructuring meals and reducing food waste

One of the changes in the everyday practices of the community members that became increasingly evident and even more obvious than the introduction of new foods to the diet was the reorganization of meal timetables. Before food insecurity became a persistent concern, the normal practice was for families to have three meals per day, with at least two of them prepared from maize meal. As maize became scarce, families limited the staple meal as exemplified by the following responses.

- *…hatichaitaka sadza masikati, sadza mauro zvekudhara, hazvichaita. Tikanwa tea yedu nembambaira makuseni zvatopera. Tozodya sadza manheru…* […we no longer have *sadza* in the afternoon, and then *sadza* in the evening like we did in the past, that's no longer possible. If we have tea with sweet potatoes in the morning that's it. We have *sadza* in the evening…], (Danai).
- *Vana vanogona kutobuda vasina kutombodya chikafu nokuti panenge pasina* [sometimes children go out without eating because there won't be any food], (Sarudzayi).

There was a shared view among mothers that as food was becoming scarce and expensive, it was critical to conserve the little that was available. Participants

therefore implemented several strategies to minimise food waste. Before climate change was an issue of concern, locals had maize in abundance and cared less about wasting *sadza.* However, climate change continued to wreak havoc on maize yields, forcing people to buy instead of growing their own maize. Cognisant of the shortages, mothers transformed (Haapasari et al 2016) their cooking practices to avoid throwing *sadza* away as that had become costly to do. The commonest transformation was to reduce the size of the cooking pot, which in the local context is largely referred to as '*kuchinja poto'*. Better still, Danai proposed measuring quantities of food before preparing it to avoid wastage.

While all households prevented food waste at the point of consumption, and preserved food at the production and processing stages, no participants had access to modern technologies for food preservation, such as refrigerators and freezers. Consequently, significant amounts of food still got wasted due to spoilage. This resonates with research evidence suggesting that about a third of food produced for human consumption globally goes to waste (Gustavson, Cederberg, Sonesson, Ulf & van Otterdijk 2011).

7.3.5 Diversifying sources of livelihood

Whether they limited food wastage or not, there was a shared view among participants that being solely dependent on farming was no longer sustainable and diversifying sources of livelihood was imperative. Participants said:

- *vanhu vaa kuita vachichangamuka kuti ukaramba wakamirira chinhu hwani unofa nenzara. Saka vanhu vazhinji vava kuita vachichengeta huku dze Chirungu*.

  [people are becoming conscious as they now realise if you keep relying on one thing, you die of hunger. Most people are now raising English [broiler] chickens] (Beula).

  Mazuvano kwava kuitwa mukando. Ndoimwe iri kutibetsera kuraramisa mhuri. [These days we are being sustained by social entrepreneurship] (Danai)

Beula speaks metarphorically '*vanhu vava kuita vachichangamuka'*. In the literal

sense of the phrase, *kuchangamuka* goes beyond consciousness to embrace transformative agency informed by reflection. The transformations included but were not limited to rearing small animals, casual work, informal trade and social entrepreneurship.

Figure 14: Diversifying sources of livelihood: raising small animals (*photographs taken by researcher 2016)*

The analysis in this section illuminates the existence of what Brandt & Clinton (2002) call the transcontextualised and transcontextualising potential of literacies: the view that while literacies are socially embedded in the local context, literacies can travel, integrate and endure. *Vauyi* served as a disturbance, as they introduced changes to the community's social composition. I demonstrated in this section how maize was regarded as more of an identity artefact than simply as food. However, *vauyi* did not react in the same manner as the indigenous adults as their cultural notions of food choice and their lifestyles were slightly different.

This takes me to the section where I discuss how essential it is to learn new skills.

7.4 Learning new skills: organisational skills, anticipatory thinking, weather diaries

Participants acknowledged that successful adaptation entails not only adapting farming practices, but also learning new skills. Sarudzayi proposed "*zvava kungoda kungorongeka mumba mako hako*". [it demands that you and your household be highly organised]. In Shona, the word *kurongeka* means more than just being highly organised. Lemuel explained:

> *munhu akarongeka…ane muono we mberi-mberi murefu, ne kuzvibata ne kuzvidzora pazvose, unokoshesa nguva ne basa, une nzvenzero kwadzo*. [they have vision and foresight, exercise discipline and self-control in all they do, value time and work, and are highly analytic].

Lydia added that another part of being *munhu akarongeka* means being a good planner, knowing your place, doing things the right way and knowing your stuff. These are some of the survival virtues community members have mastered and sought to master to sustainably adapt to climate change. Even though most households did not keep physical records of their yields, they compared seasonal yields, especially of maize, to evaluate the merits of specific innovations. Lemuel summarised it this way:

> *... tinotarisa mumashure, toti vandudzei. Totarisa toona kuti manairo aiita mvura yakanaya sei? Maisiro atakaita fertilizer here? Saka izvozvo zvinoita kuti tigadzire hwaro hwedu, tigadzire chombo chedu…Tinodzidza tichibva kumashure tichiona zvakaitika kumashure.* […we look back and innovate. We look, and question is it because of the way it rained? Is it because of how we applied fertilisers? That helps us establish the facts and prepare our weaponry…we learn from the past, through observing what happened in the past].

Revai, Jerina, Lemuel and Lydia shared the view that individuals should consider keeping weather diaries, documenting the onset of the first rains each year so they could plan their farming from an informed viewpoint. The argument raised by these participants was that farmers must prepare for the rainy season well in advance so

that when it rains they plant immediately. According to Lydia, such information, was vital to informing future farming decision making as it enabled people to act from an informed perspective. Next, I close this chapter by highlighting the salient issues emerging from the chapter.

7.5 Chapter summary: Community innovations for climate change mitigation and adaptation

In this chapter I demonstrated how the everyday farming practices were changing as community members questioned and critically reflected on what they had taken for granted as normal farming practices (Haapasari et al 2016; 2018). Community members adapted and innovated practices through cycles of expansive learning involving questioning, reflection and cautious experimentation. Learning and change was iterative, and was dependent on the sharing and negotiation of new knowledge and resources in light of traditional knowledge and practices. In CHAT terms, this could be understood as establishing and learning within a collective zone of proximal development (ZPD). Changes were made to historically unquestioned 'rules' (where, when, what crops are grown) and tools (new farming technologies, new varieties of seeds), as trial and error learning led to collective confidence in new practices.

The kinds of new practices that were emerging in response to the disturbances were found to depend on what was being questioned and who was doing the questioning. How power and labour were distributed within the activity systems enabled insight into whose voice could be heard, whose tended to be silenced, and what could or could not be questioned. For example, more successful farmers wielded the authority to dictate solutions (Engeström 2016; 2018), but women's ideas were generally undermined.

Learning and change was mediated through diverse spaces and places including the family, peer and other social networks, neighbours and the community. The fields, the home, the gardens, public transport, churches, clubs and social events and gatherings all afforded opportunities for learning and change. People learned as they reflected on their own and others' practices, as they informally experimented with innovative ideas, as they observed and questioned cultural conventions and as they

debated, deliberated and asked questions. While many of the innovations were deliberate and clearly thought out, some were accidental and incidental discoveries. Adaptation was intricately linked to living and participants did not always view it as learning, but as part of the everyday.

Over and above adapting their farming practices, participants acknowledged that climate change demanded that they develop innovative ways of knowing (new tools). Participants were compelled to learn new skills, competencies and mindsets, including anticipatory thinking and organisational skills that were relevant to living in contexts of vulnerability and risk and uncertainty. In some instances, successful climate change adaptation meant that the participants re-thought what ordinarily had been regarded as normal practice, while in others it meant normalising the abnormal. There were cases when participants embraced what they called strange and despicable foods to cushion their hunger.

Additionally, successful adaptation has entailed changing the rules that define normal practice (Engeström 2010; Haapasari et al 2016; Roystona, Selbya & Shove 2017). There are isolated pockets of arguments among some that in the context of climate change, where maize the staple food kept failing, notions on food and diet must change. Participants, especially *vauyi*, conceded that if they are to adapt meaningfully, market gardening and heavy reliance on maize must be questioned. Successful adaptation also meant abandoning certain practices and/or unbundling the relationships between practices (Roystona, Selbya & Shove 2017; Spurling 2018). For instance, there is an intricate relationship between food security and cultural notions regarding food choice. While small grains offer a viable alternative, they are not the preferred food of choice.

Although practices were changing, these were mainly incremental adjustments that would not alter the superstructures that perpetuate unsustainability; radical transformations were rare. In some instances, cosmetic changes were introduced to cater for the here and now. Certain foods, for example, were consumed during critical periods but abandoned once the crisis was over. While some of the adaptation measures might not be sustainable in the long term, there seemed to be escape routes that diverted the community's attention from engaging with climate change in a holistic manner. Not all innovations being adopted were sustainable; for example,

wetlands farming addressed food insecurity but compromised environmental sustainability. Ignorance could not be ruled out, but I observed as had previous studies that over time, many human endeavours to manage their environment manufacture new risks, some of which are so intractable that traditional risk analysis and methods are rendered obsolete (Baer & Singer 2018; Freeman 2018).

This takes me to Chapter 8 where I analyse the learning resulting from technically driven interventions.

Chapter 8: Negotiating knowledge plurality in everyday practices

8.0 Introduction

This is the second of three chapters that examine the learning that was taking place as members of the Mutema community adapted to climate change. While the previous chapter examined the learning that occurred within community members' everyday practices, this chapter examines the learning that occurred through the injection of technical and scientific knowledge from external experts. As discussed in Chapter 3, literature in science, technology and society (STS) and sustainability transitions studies illustrate how people's everyday knowledge and practices come into tension with scientific and technical knowledge when external experts enter their community to provide advice (Abson et al 2016; Pesanayi 2016). This chapter will describe and analyse the diverse ways in which technical expertise entered the Mutema community and how members of the community interacted with it and analyse what kind of learning emerges from this.

The Mutema community is not a closed system; although participants valued the local knowledges rooted in their experience, they did not actively reject or ignore abstract technical scientific knowledge. As the impact of climate change is becoming obvious on communities, technical experts from different government departments, the business community and civil society began to intervene in the Mutema community, to assist community members in adapting to and mitigating the impacts of climate change. Using Engeström's (2008a) three Cs (communication, coordination and cooperation) typology of interactions discussed in Chapter 3, this chapter analyses the interactions between these various expert groups and community members, recognising that the objects of the interactions seen from the perspective of each of these experts may not necessarily be in concert with each other, nor with the objects perceived by different community members. Whether and how the objects and the roles and the attendant scripts of the subjects are questioned and critically examined will provide a lens through which the learning from the expert interventions can be analysed.

In the first part of the chapter, I analyse the role of media, including information and communication technologies (ICTs) and public broadcasting. This is followed by an analysis of experts from businesses using new products as a mediator of their interactions. With specific reference to the role of the Environmental Management Agency (EMA), the next section discusses the role of legislation and community outreach programmes in advancing learning for climate change mitigation and adaptation. This is followed by an analysis of the learning that resulted from farmer extension programmes. In the concluding section, I synthesise salient issues and findings about the nature of learning arising from experts' interventions.

8.1 Reaching communities remotely through Information and Communication Technologies and other media

Participants interacted with climate change information through ICTs, mainly the radio, television and mobile phones. Children cited the internet, books, magazines, posters, newsletters, fact sheets and CD-Roms as other communication media with which they interacted. I discuss examples of the learning that took place as technical experts used their authority to inform and model solutions remotely through ICTs.

Danai, the only participant who received farming advice via short text message (SMS) from EcoFarmer, a local microfinance insurance programme, confessed she trusted such advice because she believed in the authority of technical knowledge:

> *ndivoka vana mazvikokota saka tinenge tichingoti vanoziva*
>
> [these are the technical experts, so we assume they know]

Technical experts used their authority (Engeström 2008a; 2018) to update existing models of farming. However, the nature of interactions between technical experts and community members resembled what Engeström (2008a) called coordination; specialists offered packaged solutions without engaging community members. While community members respected technical advice, all adult participants voiced concerns that not everything communicated on radio turned out to be true, as Danai noted:

> *pa radio ndopamwe panotirasisa…senge gore rino handina kutorima zvanzi pa radio hakuna mvura asi mufunge…mvura yakatonaya…zvokuti vane ivhu rakanaka…kutaura kwatiri kuita kuno uku vari kutokohwa…*

[The radio is one source that misleads us…I didn't plant this year…it was announced on radio there won't be any rain this season but guess what…it rained…those with good soils …are harvesting as we speak right now…].

In the local context, the term *kurasisa*, literally translated to mean deception, is used commonly when reference is made to a trusted source. Other participants confirmed Danai's assertions of being deceived by the radio. While Danai resisted planting following advice from the radio, Fiona reduced her hectarage:

takazongorima padiki tanzwaka pa radio kuti hakuna mvura…nyaya yokutya kuti zvinhu zvinotsva

[we planted a small portion when we heard on the radio that there won't be much rain…you fear the crop would fail].

These observations strengthen research evidence suggesting that despite recurrence of droughts, risk management strategies in Africa remain poor (Baudoin, Vogel, Nortje & Naik 2017). Additionally, climate change is marred with uncertainty. While the radio mediated learning for climate change mitigation and adaptation, the authority of technical knowledge was being questioned (Engeström 2016) because predictions from technical experts failed to match reality. Often, this led to the rejection or only partial adoption of innovations as community members treated specialist knowledge with scepticism.

Additionally, in some cases the proposals being suggested by technical experts were not feasible for some farmers to adopt for several reasons. Participants explained that technical experts most often offered advice but not the materials that implementing the proposed innovations would require. Such piecemeal developmental approaches have in some instances led to the rejection or partial implementation of innovations. Danai, for instance, adopted most of the advice but cited resource constraints and market speculation as obstacles.

Unoongorora kuti zvavari kuti rimai onions zviri kutengwa here? Sokuti pamwe ucha waster mari yauchatenga ma onions, ma fertiliser, mishonga…unotanga watarisa kuti zvinozoita market here…kuzoshayaka mishonga nezvimwe zvirehwa -rehwa ndozvinondinetsa….

[You analyse what they say like if they say grow onions, are the products selling? For you may waste money buying seed, fertilisers

and chemicals…you first consider whether there's a market for such products…I don't have money for the requirements, that's my problem.].

Despite the confidence she had in the EcoFarmer technical expertise, Danai undertook her own assessment of the practicality of the advice before adopting it. Often external experts' innovations were adopted piecemeal, which often created apathy among community members. Many times, technical experts proposed innovations but without giving community members the support needed to ensure successful implementation of the innovations. Community members, for instance, were sceptical of trialling crops where markets were not guaranteed, or worse still, where market prices were lower.

Next, I analyse how marketing of new products enabled learning.

8.2 Capacity building through marketing of new products and services

Although farmer extension services have traditionally been the preserve of government, there have been a series of initiatives from Non-Governmental Organisations (NGOs) and private enterprises to promote climate smart farming technologies that improve food security. Seed manufacturing companies collaborated with local Agricultural Extension Officers (AEOs), holding workshops and establishing demonstration plots on farms as they marketed new breeds of seeds, chemicals and fertilisers. Different businesses exploited existing platforms such as social clubs and churches to bring together technical experts and members of the community as Revai explained:

> *kuma church, ma club, nekuma shows kwatinoendesa mbeu dzedu vanogona kukutaurirai kuti mbeu dzenyu dzamakadyara idzi dzaida kudyarwa nguva yakati saka munezenge maakuwana ruzivo kana kuzodzidzisana kune vanenge vasina kuenda kundowanawo ruziwo irworwo…like zvema zero tillage…nekushandisa compost…Zvakabatsirawo kana nesu tose takayambukawo nazvo.*
>
> [at churches, clubs, and [agricultural] shows they tell you when you should have planted your crop, so we gain knowledge which we share with others

who might have missed on the programmes… zero tillage…composting…I benefited from such programmes].

This is another of example of how learning was mediated through informing and modelling solutions. Additionally, the example illustrates the permeability of the boundaries of learning as information from technical experts was eventually shared among social networks. Observational data confirmed NGOs advocated raising small animals such as quail birds, chickens, fish and rabbits that matured faster and did not demand too much food and water.

Instead of donating food, civil society organisations facilitated capacity building to help community members to solve their own problems in a more sustainable manner. All adults had adopted a certain variety of cowpea that was said to mature in two months; hence in the community it was known as '*katumanzi'* (that which matures in two months). This cowpea variety was mainly donated by NGOs to the more vulnerable members of the community. However, the seed was shared among social circles, as Revai conceded:

> *Aka ndoka 2 months kandanga ndichitaura kuti hakatane kusvika. Mukangokadyara zveshuwa 2 months exactly katova kanyemba katooma, mavakutokadya. Ndakatopiwa na Amai vangu mbeu kune kwavakaitambiriswawo…nema donor zvichinji kanokasika kusvika zvokuti kanokasika kupedzawo nzara mumba*.
>
> [This is the *katumanzi* that I was talking about, it matures early. Once you plant it, for sure in exactly two months it would have matured. I was given the seed by my mother. She received the seed from…donors who said it matures fast hence, provides an immediate solution to ending hunger].

However, some participants were wary of hidden agendas as they believed some businesses and donor agencies used climate change as a marketing gimmick to promote their products, as Ranganayi hinted:

> *zvimwe zvacho munhu unofanira kuvhurika maziso ndava ava vari mu business. Vanongotaura zvinoita kuti zvinhu zvavo zvitengwe*.
>
> [with some of these things you must not follow blindly because these are people in business. They use juicy language to sell their products].

Lemuel emphasised how the market was flooded with deceptive products that worsened the plight of this farming community who desperately needed quick fixes to food security.

> *...tava kungoedza chose changonzi chinoita, angoti fertiliser iyi inoita tavakuedza…saka tava kungoti chauya toronga, chauya toronga… Vanhu havachaziva pane chiraramo chaipo.*
>
> […we are trying anything, and everything thus said to be good… People no longer know exactly what sustains life].

The examples cited by Lemuel and Ranganayi demonstrate the emergence of critical literacies as people evaluated the sustainability of new products. The two cases emphasise the exigency of critically reading advertisements and products to evade false marketing, as blindly following advice was a source of vulnerability.

This takes me to the section where I discuss how learning took place through community outreach.

8.3 Using authority to update current models of environmental management

While a number of government departments were involved in climate change projects in Mutema, I focus on the one organisation that was cited by all participants as having an impact on the ways community members adapted their practices to the impacts of climate change. As part of government initiatives to cushion communities from climate change, the Environmental Management Agency (EMA) ran community outreach programmes to raise awareness and mobilise human agency for climate change mitigation and adaptation. Takunda, the officer in charge of climate change projects with the EMA, summarised EMA's climate change adaptation and mitigation interventions with communities as follows:

> On a national scale…we have the coping with drought and climate change project… we are promoting small grains. Then wetlands restoration and utilisation project…evasive species eradication to… increase grazing land…afforestation and reforestation projects… fireguard construction…bee keeping… waste… mountain ecosystem protection and management projects.

A snapshot analysis of Takunda's comments suggests that EMA programming is tilted towards environmental sustainability. This sets in motion the discussion on what motivates people to learn and what happens when the objects of adaptation are in tension. As Engeström (2004) explained, interventions that disregard the local context (objects fail to align) risk being rejected. Further to that, it is argued adults learn on a need to know basis (Arndt & LaDue 2007, Taylor 2017). For these participants whose motive for adaptation was to evade *nzara*, the analysis in this section teases out whether environmental sustainability on its own was sufficient to motivate people to adapt their practices.

Below I discuss some of the ways EMA facilitated learning and change.

8.3.1 Capitalising on dominant voices to facilitate learning and change

The Environmental Mnagement Agency seldom donated climate-smart technologies but collaborated with community members to plant trees in open spaces as part of their afforestation programmes. Community members thus learned by doing as technical experts introduced new knowledge while updating current models of environmental management through workshops, demonstrations, informal discussions and lectures. Takunda explained that the programming was context specific as EMA designed programmes to respond to specific needs of individual communities. In Mutema, EMA programming emphasised managing fires and stopping deforestation, as these were rife.

Historically, EMA delivered interventions as packaged solutions and rode on the strength of traditional leaders and opinion leaders to model solutions as Takunda explained:

> *If you want to convince a particular community, because we have always worked with them, so we know. We use local leadership, opinion leaders…Before we go to the povho [masses] we sell our ideas to the local leadership…As we approach the masses, the traditional leaders will be leading the process…I can just invite members of the community whom I would have identified as a stumbling block or are influential. I would have identified that if this one stands up to talk, everyone would listen to them.*

The nature of interactions between EMA and community members can be likened to

Engeström's (2008a) concept of communication: EMA simply solicited the support of prominent community members without necessarily acknowledging their views. Sabhuku Bhobho, one of the local traditional leaders confirmed Takunda's assertions:

> *DA watinoshanda naye ndiye anopihwa zvinhu zvabva kuhurumende onzi chienda undoudza vanhu. Isu kana tapihwa zvatinenge tapihwa todzoka nazvo kuvanhu*.
>
> [The local DA is government's point of contact. Whatever we are told, we take it to the people].

The community members were thus expected to passively implement innovations as recommended by specialists, while traditional leaders ensured that orders were followed through authoritative silencing (Engeström 2008a).

Ranganayi, one of the participants who took part in such community outreach programmes confirmed Takunda and Sabhuku Bhobho's assertions and added that over and above education and awareness, community members, under the guidance of village heads, planted trees in open spaces. Ranganayi conceded that his participation in such activities organised by EMA had influenced his practices:

> *zviriko zvakawanda zviri kushanduka… Hatipise sora pano, kana makatarisa mazuva amakambouya pano, pakanga paine sora rinotyisa apo, ndakaricheka …handina kupisa. Ndokushandisa sora iroro semanyowa ndakaita mulching mumuriwo*
>
> [there is a lot that is changing…we do not burn grass here, you will remember the last time you came here there was a lot of grass in that spot over there, I cut the grass …I did not burn. I used the grass as manure and mulch for the vegetables].

Ranganayi's excerpt demonstrates a typical example of the transformative learning that took place as members of the community interacted with technical scientific knowledge. Ranganayi described how he stopped burning grass as he reflected on the environmental impact of burning. Not only was his mindset transformed but also his behaviour, some of which was evident through several of interventions he and his family implemented. Not everyone in the cohort of participants accomplished the same levels of learning, but interventions by technical experts 'disturbed' some of the

historically unquestioned rules that had defined normal practice through designing programmes that challenged participants' every day practices.

This takes me to the section where I discuss learning resulting from observing legislative tools.

8.3.2 Learning through observing and enacting public policy guidelines

Despite the inadequacy of existing policies in guiding meaningful adaptation, government policies played a critical role in promoting learning for climate change adaptation (see Chapter 1 for details). People were arrested and fined if caught committing crimes related to environmental mismanagement. Although the Zimbabwe Republic Police and EMA played a role in ensuring legislation was followed, at the community level, this role was the jurisdiction of the chiefs, headmen and village heads.

Although traditional leaders were not technical experts per se, they served as bridges between technical experts and the communities they served. There existed strict guidelines, especially concerning the cutting of trees as deforestation was rife. As these guidelines, laws and policies were enforced, it created spaces for some to learn, as Revai's case illustrates. Although her conceptualisations of the relationships between deforestation and climate change are not complete, the emphasis on deforestation created conceptual disturbances that stirred Revai to reflect on the logic behind the legislation.

> *handizive zvangu kuti science idzodzo vakadziwanepi dzekuti mvura inonaya pane miti…asi ndakatozvicherechedza ndikatoona kuti ichokwadi*
>
> [I don't know where they got that science from to say where there are trees, good rains are received …but I have analysed it and I realised it's true…].

Throughout my interactions with Revai, she emphasised the value of conserving trees:

> *ndinodzokera kuti patinodzidziswa neMadhomeni, vane kutikurudzira kwavanoita kuti, simai miti, musateme miti. Ukaenda pachivanhu chedu, vana mbuya vedu vaitaura kuti mvura inonaya munzvimbo dzine miti…kuruzivo rwevana vechikoro vanodzidziswa zvokuchengetedza miti izvozvo. Ndiri*

kungoona kuti zvinenge zvichindobatana kuti tiri kuedza kuti tibatanidze chinhu chedu; tiwane mvura.

[I will repeat that when AEOs teach us, they encourage us to plant trees, not to cut trees. If you go back to our customs, our grandmothers told us it rained better in forested areas…in school, children are taught to conserve trees. The way I see it, all these combinations of factors point to one thing: for us to get rains].

Revai's experience is an example of how people reflected on their practices and searched for the meaning of why legislation reproached some of the practices they regarded as normal. As Engeström (2016;2018) explains, it is such reflections on normal practices that eventually lead to transformation, and hence the adoption of new practices. Policies were thus akin to Engeström's (2008; 2016) rules, while traditional leadership and other law enforcement agents mediated the enactment of such rules. As the laws were followed this created space for community members to transform their practices (Engeström 2016).

However, I discerned that not all innovations emerged out of reflection; some resulted from authoritative silencing (Engeström 2008a). Jerina, for example, attributed her reduced firewood consumption to abiding by the law:

ukawanikwa uine huni senge dze misasa idzodzi dziri kurambidzwa ne EMA idzi unosungwa.

[If you are caught with firewood, especially from the Musasa tree [*Brachystegia spiciformis*], forbidden by EMA, you'll be arrested].

Jerina professed ignorance on why cutting trees was forbidden:

ipapo handingazive zvangu asi ma Sabhuku anoti musateme miti…EMA inorambidza kutema miti….

[I don't know but village heads say we mustn't cut trees…EMA forbids cutting of trees…].

Additionally, Jerina planted trees around her homestead as she followed blindly:

zvinongonzi kudyara miti kwakanaka

[it is said that tree planting is good].

Although her efforts contributed to mitigating climate change, Jerina's actions were not informed by reflection.

While in some instances authoritative silencing (Engeström 2008a) led to learning and change, in others change was resisted, and this is my next focus.

8.3.3 When interventions engender miseducation

Despite the existence of legislative tools, crimes against the environment were concealed, as they were typically committed at night. However, law enforcement agents were aware of such acts of mischief. Jinda, another traditional leader, stressed that although law enforcement was important, programming incorporated communication, education and awareness. While education and law enforcement were critical components of EMA programming, people may continue to break the laws for as long as they do not have alternative livelihoods, as Takunda bemoaned:

> *people usually cope through unsustainable practices using the natural capital…in the event of a drought… livelihoods become natural resources based more than when they have alternative sources of livelihoods…people will tell you that yes, we know EMA will arrest us but, I'll do. What that person will be telling you is that my challenge is a livelihoods problem. So, a solution to me should be a livelihoods solution.*

Ideally, intervention projects were designed in ways that allowed community members to learn through firsthand experience while they participated in practical projects designed to improve livelihoods while at the same time mitigating climate change. However, in Mutema, EMA programming adopted a fragmented approach as it lacked the livelihoods component because of weakened institutions:

> *ma government departments ari crippled zvakanyanya, and zviri kudzosera implementation yema projects kumashure*
>
> [government departments are severely crippled, and this severely derails implementation of projects] (Takunda)

As discussed in Chapters 6 and 7, practices like unsustainable utilisation of wetlands and streambank cultivation were rife, despite awareness and the existence of

legislation, due to livelihood dilemmas. These observations resonate with research evidence suggesting that adaptation remains a futile task unless the underlying issues such as poverty that perpetrate unsustainability are addressed (Shove et al 2015; Spurling 2018).

Compounding that, interventions from technical experts were driven by several organisations working in loosely connected teams. While, on the one hand, NGOs enabled learning for climate change adaptation, their approach to development differed from governments' developmental trajectories. Takunda explained that normally, NGOs incentivised communities through food handouts and cash transfers. On the contrary, government did not normally incentivise, firstly because they could not afford it, and secondly because they doubted the sustainability of such developmental approaches. Takunda argued that such contradictions in the conceptualisation and implementation of interventions created a sense of ambivalence among community members. Government driven initiatives risked being neglected due to ruptures, that is blocks, breaks or gaps in the intersubjective understanding of and flow of information (Engeström 2008a) between community members, government and civil society:

> *Saka iwe ukazoenda ikoko usina chinhu panenge patova nema mixed feelings among these communities. Kungo appreciator kuti we are doing these things for us vanenge vava kutoda futi food. Vanhu vanoguma vava kufunga kuti they are supposed to be paid. And we are having challenges kana usina mari yekubhadhara vanhu, even kuma workshops havauye*.
>
> [If you go out there empty handed, there are mixed feelings among community members. Instead of appreciating that whatever they'll be doing is for their own benefit, they expect food handouts. People end up thinking they are supposed to be paid. And we're having challenges because if you don't have money to pay them, people won't come, even for workshops].

Takunda contented that community members misconstrued EMA's roles and responsibilities. Compounded with that, community members overlooked the fact that while EMA played a leading role in interventions, the success of interventions depended on community participation:

The ideal thing would be for stakeholder participation. Our mandate is to showcase best practices but it's everyone's responsibility to adopt innovations. We can't do everything as EMA alone, it's not possible. Community members hold these perceptions that even when people see veld fires, they think its EMA's role to come put it out.

While government and NGOs forged partnerships for climate change interventions with the community members, the nature of interactions was more of coordination where individual actors continued to represent themselves and their organisational mandate (Engeström 2008a). Takunda acknowledged that ruptures in the normal flow of work between EMA and NGOs and between EMA and the community members presented peculiar challenges to successful implementation of innovations.

Compounding that, EMA's overemphasis on burning and deforestation created the false impression that if one was not burning nor cutting down trees, one was not contributing to climate change, as exemplified by the following excerpt: Mike was a child participant, who was also a founding member of the Eco-Schools Club. Mike understood that burning contributes to Green House Gas (GHG) emissions. To reduce his family's negative environmental impacts Mike confessed that:

Ini kumba handipise marara kana ndanzi ndipise. Ndinondoarasisa kubani

[When I am told to burn rubbish at home, I don't burn. I dump the rubbish in a nearby flood plain].

Mike thought there was no harm in dumping rubbish in a flood plain; what was important was the rubbish was not being burnt. It was not just Mike: participants generally referred to burning and deforestation as if they were the only issues that mattered in climate change mitigation and adaptation.

Next, I present an analysis of how farmer extension services enabled learning.

8.4 Using authority to update current models of farming: Learning through farmer extension services

The department of Agricultural Extension Services (Agritex) was cited by all adults as another arm of government that significantly influenced climate change adaptations among participants. I gathered data from Agritex through document

review and personal interviews with one AEO working in Mutema. In the local context, AEOs are popularly known as *madhumeni* (plural) or *mudhumeni* (singular). I call the AEO I interacted with Mudhumeni Ketty. She had been working with the Mutema community for the past nine years.

Adult participants learned to adapt to climate change as they interacted with AEOs through agriculture extension services. Although there were isolated concerns among participants regarding the reliability of information shared by AEOs, *madhumeni* were generally regarded by members of this community as authorities because their advice was firmly grounded in technical expertise:

> *ndofunga ruzivo rwukapihwa neivava vakadzidzaka ava handi ndozvatinoziva kuti vakadzidza ndivanotaurazve chokwadi. Ndovanenge vakangonaka kuteerera senge madhumeni*
>
> [I think advice must come from those educated, this is what we know, that the educated tell the truth. It would be good to listen to people like AEOs] (Fiona).

Participants explained how *madhumeni* informed and modelled farming practices through such channels as the radio, TV, community gatherings, and individual visits. Mudhumeni Ketty explained that government was heeding the impact of climate change. Consequently, AEOs were mandated to design and implement innovations tailor made to help community members not only to heed the changed rainfall patterns, but also adapt their farming practices. In her role as AEO, Ketty sought to help farmers reduce their vulnerability by managing risk and improving their resilience to the changing climate. Mudhumeni Ketty helped farmers to develop anticipatory thinking skills and to be reflexive practitioners.

As described by participants, Ketty encouraged farmers to study their environment, to weigh the pros and cons and to consider alternatives before implementing any actions, to be forward planners, to diversify their farming and to explore alternatives, as Jerina explained:

> *Madhumeni vanoti iwe unofanira kuziva mbeu inoenderana nevhu rako…usapa mvura mazita… mvura nyangwe ikanzi yanonoka nyangwe October ikasanaya… kana ikanzi yanaya November… kutanga kwa December, ngatingodyarai nokuti hakuna anoziva mwaka wacho kuti uri*

kuenda kupi … mvura ikanayawo October kana uine hybrid ne hombe iyoyi iyi, unofanira kudyara, kungokurumidza kudyara. Asi ukaona tave munana November kuperawo kwaana November mvura isina kunaya nyangwe uinayo chitoregedza kudyara. Chidyarawo mbeu inoti mvura ikaregedza kunaya December, January unogona kuzowana.

[Agricultural Extension Officers say it's important for farmers to know the right seed for their type of soil…they encourage us to plant even if the rains are delayed… because no one can predict the rainfall patterns with certainty. They teach us that if it rains in October you can plant the long-seasoned varieties; it's important to plant early. Once we get to November, it's too late to plant [long-seasoned varieties]. You better plant seed that will thrive even if it rains in December or even January], (Jerina)

Below I paraphrase the nature and rationale of Mudhumeni Ketty's farmer extension services programme. Ketty's farmer extension services covered climate change mitigation and adaptation strategies including, but not limited to, adopting short-seasoned varieties, growing small grains, conservation agriculture, soil and water conservation, water harvesting and utilisation of marsh land. Additionally, she incorporated social skills such as teamwork and group cohesion. To get the information across to the farmers, Mudhumeni Ketty employed the following strategies, not in any order of priority, that created opportunities for farmers to learn from each other and from experts.

First there were farmer-to-farmer extension programmes, where successful farmers, known as 'master farmers', showcased best practices through field days. A field day is a look and learn tour where farmers learn from technical experts and those farmers doing well. Extension workers used the platform to disseminate information on good farming practices and to model farming practices in specific directions (Baudron, Andersson, Corbeels & Giller 2012)

To achieve these ends, Mudhumeni Ketty relied on her expertise and professional networks. Mudhumeni Ketty organised innovative and interactive workshops for farmers, but also responded to group and/or individual farmer requests. Upon invitation, she conducted on-farm visits to provide individualised technical support

to farmers. As she visited farmers she compiled reports based on field experience which she later referred to when providing advice to farmers. However, Ketty conceded that the role of AEOs, critical as it was, remained advisory:

> *Hii! Ipapo pane nyaya nokuti kune vanozviti vanoziva…Vasingade havamanikidzwe nokuti kune vanozviti vanoziva…vamwe vanoramba kutambira dzidziso nokuti ndine zvandakaona kumwe. But kana vakandobondera ikoko kwavanenge vaenda vanodzoka zvavo.*
>
> [Oh! That's an uphill task because there're some who think they know it all…. We don't force it on people because some claim to know it all…some reject my advice because they have seen it elsewhere. But when they hit a dead end they come around].

In the local context, the phrase '*pane nyaya*', literally translated, means 'there is a real issue here'. Ordinarily, such a phrase is used when the task at hand is intractable. In this case, Ketty used the term to express the intractability of convincing certain sections of the community to adapt their farming technologies in specific directions. Ketty thus admitted her advice was sometimes rejected and she blamed it on '*vanozviti vanoziva*' (they think they know) and '*kune kwandakambozviona*' (I have seen it elsewhere). Ketty's responses offer an example of how epistemic injustice played out between experts and community members. Ketty adopted a specialist approach and her interactions with the community members may be likened to what Engeström (2008a) referred to as coordination interactions, where actors strictly follow the scripted rules without questioning. The knowledge and creativity of the community members is therefore undermined, and this may create ruptures in the normal flow of work (Engeström 2008a).

A lack of acknowledgement of alternative ways of knowing, as exemplified by Ketty's responses, has been regarded by some scholars as the 'othering of other knowledges' (Hoppers 2002; Merriam et al 2007): ascribing a lower status to other knowledges.

Below I illustrate with a specific example how this othering manifested and how it led to loss of local knowledges that are potentially useful.

8.4.1 When knowledge is stigmatised: The dilemma of conservation farming

Conservation farming is generally defined as any farming method that works on the three principles of minimum disruption to soil structure, crop rotation and keeping the soil covered as much as possible (Mazvimavi & Twomlow 2009). Conservation farming strives to produce food without using synthetic chemicals or fertilisers while ensuring the health of the environment. In the Zimbabwean context, conservation farming is popularly known as zero tillage or *kurima chibhakera* and has been practised since time immemorial. In fact, before the continent was colonised, conservation farming was the normal farming practice in traditional African society (Brown, Nuberg & Llewellyn 2017). During colonisation, the colonisers' agricultural methods, typically based on mechanisation and the use of chemicals, were introduced; they were considered by the colonisers to be superior to the existing conservation farming technologies (Mazvimavi 2011).

As previous studies have shown (Naess 2013; Pesanayi 2016), I observed that such subjugation of conservation farming resulted in the loss of local knowledges as they became associated with being primitive. However, despite being ascribed a lower social status by the colonisers, conservation farming has proved to be a sustainable approach to farming under changed climatic conditions (Baudron et al 2012; Cheesman, Anderson & Frossard 2017; Mazvimavi 2011; Mupangwa, Mutenje, Thierfelder & Nyagumbo 2017). Ironically, conservation farming has been re-introduced to Africa by Western scholars through different aid and research programmes over the last two decades (Corbeels et al 2014).

As zero tillage was (re)-introduced by technical experts, Lydia's first encounter with the concept was when she visited a community outside Mutema. A year later she decided to experiment:

> *zvinhu izvi ndakatanga kuzviona pandakamboenda ku Goromonzi asi handina kuzviita ipapo…Ndakachengeta zano iri kwegore rose… kubva ndaisa ma lines angu four andanga ndakaisa zero tillage…four ma lines iwayo akapa musiyano pane mamwe ma lines…ndosaka season yakapera ndakabva ndaisa zero tillage pahombe.*
>
> [I first came across the concept when I visited Goromonzi, but I muted the

idea for a year, after which I planted only four rows under zero tillage…those four rows performed exceptionally well…this is the reason I scaled up the hectarage under zero tillage the past agricultural season].

Lydia's case exemplifies the fuzziness of boundaries between the spaces and places of learning and the accidental and incidental learning that took place as people adapted their everyday practices. Lydia was not in Goromonzi specifically to learn, but by coincidence she attended a field day where zero tillage was being showcased.

Although she acknowledged the success of zero tillage on that person's plot, Lydia was cautious about adopting the concept wholesale without a prior trial run. A year later, Lydia experimented with zero tillage and conceded that compared to the crop she grew under the conventional methods, zero tillage improved yields, leading her to adopt the practice in the following year.

"*ndakatoona kuti ukachinja marimiro…zvinoita. Ndakatombotora nguva ndakamboti haa, zvinhu izvi zvingaite izvozvi? Handina kumbobvira ndambozviita gore iroro. Ndakazozviita gore rakazotevera racho.*

[I realised that if you change your farming methods…it pays off. It took me some time, I thought, well, does this thing really work? I did not do it that year, but a year later.

However, despite its usefulness and potential benefits, the adoption of zero tillage remained peripheral among participants. This resonates with research evidence suggesting that despite two decades of research and advocacy on conversation farming, its uptake in African communities has been pathetically low (Baudron et al 2012; Corbeels et al 2014). Previous studies with small scale farmers in Zimbabwe (see for example Baudron et al 2012; Corbeels et al 2014; Pesanayi 2016) have shown that chief among the reasons were a lack of adequate crop residue, as most families practiced mixed farming where crop residue is fed to animals; lack of markets for organically produced goods, leading to reduced incomes; and the fact that the model for conservation farming being driven by technical experts originated in large scale commercial farming in South America and has not been adapted to the local context (Baudron 2012).

While the reasons cited above remained relevant in Mutema, the data suggest that

knowledge power relations had an even stronger influence on the ways conservation farming was conceived. Zero tillage was generally regarded as primitive and a preserve for the poor. Below, I explain how these perceptions have been linked to the country's colonial legacy that valorised Western views of knowing at the expense of local knowledge systems (see for example Pesanayi 2016; Shizha 11).

The Mutema community, like every other community in Zimbabwe, had had a long history of colonisation. As my survey of literature in Chapter 2 showed, one of the tragic effects of colonisation in Africa was the regarding of everything local, including the indigenous knowledge systems, as inferior, unauthentic and primitive (Hoppers 2002; Pesanayi 2016, Shizha 2011). Long after Zimbabwe's independence in 1980, this legacy of colonisation lingered on in this community. Beula, for example, admitted she continued to adopt practices that she knew were detrimental to climate change because "*tinotya kusekwa kunzi takasaririra*" [we fear being labelled laggards]. Beula feared that if she identified with traditional cultural practices, she would be ascribed a lower social status.

Although it was re-introduced through Western initiatives, zero tillage was one traditional and yet potentially viable adaptation practice (Corbeels et al 2014; Pesanayi 2016) that was stigmatised as archaic and ascribed a lower social status as it was regarded as a preserve for those without ploughs as shown by the following interview excerpts:

> *…kune inonzi zero tillage yokuti kana washaya gejo……*
>
> […there is what is called zero tillage – if you don't have a plough….] (Danai).
>
> *madhumeni…vanoti cherai makomba… nokuti unogona kushaya mari yokurimisa….* [AEOs …say dig basins…because you may not have money to hire a plough…] (Ranganayi)

Mudhumeni Ketty reaffirmed participants' assertions about zero tillage as being restricted to those without ploughs:

> *kune vaya vasina magejo… tinokurudzira zero tillage*
>
> [for those without ploughs…we encourage zero tillage].

There seemed to be an assumption that zero tillage was meant for those without ploughs, which translates to those who were poor. As ploughs are ox-drawn, one could not own a plough without also owning cattle. In traditional Zimbabwean society, cattle were a symbol of wealth (Mawere & Nhemachena 2016), hence those without cattle were deemed poor. Compounded with that, zero tillage lacked the convenience offered by modern agricultural practices typically modelled around Western ways of knowing. It presented peculiar challenges for the feeble participants.

While all adult participants acknowledged the scientific benefits of zero tillage such as improved yields, moisture retention and reduced weeding, its adoption remained peripheral. This resonates with research evidence suggesting that climate change has other dimensions that cannot be analysed from a purely scientific perspective (Engeström et al 2016; Mukute & Lotz-Sisitka 2012). Additionally, if interventions fail to align with long held views, they are bound to be rejected (Naess 2013).

This takes me to the section where I discuss how epistemic injustice manifested in externally driven interventions.

8.4.2 Knowledge plurality, epistemic injustice and the role of green shows

In this section, I analyse an example of the social engineering machinery extension officers used to perpetuate the dominancy and supremacy of the technical expert perspective. I observed, as found in previous studies (Boillart & Berkes 2010; 2013; Pesanayi 2016), that while the role of indigenous knowledges in adaptation has been acknowledged, interventions continue to adopt a specialist perspective; the technical scientific perspective is valorised while indigenous knowledge systems are treated as if they are not knowledge systems in their own right.

Agritex organised green shows or agricultural shows, which in the local context are simply called shows. Green shows are mainly look and learn tours where farmers showcased their produce to a panel of judges. Farmers whose produce had the most desired attributes were awarded prizes. Ketty explained that such platforms provided networking opportunities and created spaces for learning from firsthand experience through demonstrations, from experts and from each other:

p*aku displayer mbeu paya umwe akaonawo mbeu yaafarira anobva abvunza kuti nhai mbeu yenyu iyi irudzii obva audzwa saka izvozvo zvinoita kuti varimi vedu vabatsirike pakusarudza mbeu yakanaka*.

[As the farm produce is displayed one may like the display and ask what type of seed was planted and they will be told. That way, farmers get help regarding selection of good seed varieties].

Green shows served as mediating artefacts that pushed farmers to their limits as they desired to produce the winning products. Conjointly, the green show concept had an inbuilt component of ensuring farmers' compliance to technical advice. Technical experts set the benchmarks for acceptable farming practices and monitored farming processes from land preparation to harvesting, grading and storage, as Sarudzayi, a green show participant, elaborated:

kana wapinda mu show madhumeni vanozotevera kumba vachioona marimiro amuri kuita. Pulazi havazodi zvokuti musanganise mbeu…handi muri kuona idzi nyemba dzangu kuti dzakasanganaka, ndichatodzisarudza ndichiisa dzakafanana padzo dzega ndichiita kg, kg, kg; ndozvinodiwa ku show…

[Once you enter the [green] show contest, *madhumeni* conduct follow up home visits to monitor the way you are farming. Additionally, they don't like mixed cropping …as you can see my cowpeas are mixed, I will separate them by variety and pack them into 1 kg packages; these are the requirements of the [green] show…]

As exemplified by Sarudzayi's case, participants were made aware of the expectations for the competition prior to it. Those who wanted to enter the competition followed the guidelines while those who defied technical advice literally disqualified themselves from the competition. While participation was voluntary, the nature of interactions between farmers and technical experts resembled what Engeström (2008a) termed coordination. Technical experts defined the rules for acceptable farming practices, and green shows enabled technical experts to impose their authority on farmers. Community members simply toed the line as specialist knowledge was esteemed while local knowledges of the community members were undermined.

Some scholars however, have argued that such approaches to development that undermine the creativity of the community members are counterproductive because they do not lead to real transformation (Engeström 2008a; Vänninen, Pereira-Querol & Engeström 2015). Due to resource constraints, AEOs were not able to follow up on all contestants and this led some to disregard the rules, as exemplified by Sarudzayi's mixing of crops. Additionally, some contestants cheated by displaying products they sourced elsewhere, as reported by Lydia:

> *ndina amai veku church kwangu vatova ne two years vachitamba show…zvimwe zninhu zvacho zvavakaenda nazvo ndini ndakatovapa*.
>
> [There is this lady from church who has participated the last two years…I gave her some of the products she exhibited…]

Notwithstanding the limitations of adopting this specialist developmental approach, Mudhumeni Ketty spurned community members' views, believing it to be misguided and risky for farmers to disregard her advice:

> *vanozodzoka kana vakandobondera ikoko*
>
> [they will come around when they hit a dead end].

The word *kubondera* literally translates as "bumping into a solid surface"; in the local context it is used to describe situations that are catastrophic and/or a gross miscalculation. Ketty, therefore, likened the rejection of her farming advice to catastrophe; she was the expert and expected farmers to adopt their scripted roles without questioning while she "coordinates their actions as if from behind their backs" (Engeström 2008a p. 50).

While participants acknowledged AEOs as authentic sources of farming expertise, they did not regard *Madhumeni* as the only source of expertise. Contrary to what Ketty believed, participants relied on diverse mediating artefacts as they adapted their farming practices, as discussed in Chapter 7. While climate change is a recent phenomenon, indigenous communities have a wealth of knowledge which they have relied on over the years as they build resilience to sustainability challenges (see for example Pesanayi 2016; O'Donoghue 2018). I found that participants had to varying degrees experienced and learned to build resilience to droughts and food insecurity

long before climate change became a concern as Danai, the oldest participant in the cohort, reminisced:

> *Nzara yakagara iriko asi kare zvanga zvisingadaro. Asi 1991 to 92 yaa pakaita nzara iye yokuti waipedza 2 weeks usina kudya sadza nokuti waito shaya hupfu kumasitoro… uchitorarama nechingwa…kubva kwazoita ya 1998*
>
> [Droughts have always been there but were not as frequent. But, 1991 to 1992, there was a serious drought and severe food insecurity, you would go for two weeks without eating *sadz*a [the local staple] as there was no maize meal in the shops… we survived on bread. Then there was another drought in 1998].

Danai's response is indicative of the resilience she developed over the years as she survived a series of droughts in the past. She cited for instance how she survived on bread and not the local staple, *sadza*, during the 1992 drought, one of the worst droughts to ever hit the country. This ignites debate on the exploration and positioning of alternative ways of knowing and the possibility of merging technical scientific knowledge with the everyday knowledge of participants. As Engeström (2004) explains, development is characterised by constant ambivalence and struggles that emanate from the division of labour within activity systems. How these struggles are managed has implications on the trajectories that innovations take.

In the next section, I illustrate that if specialists prescribe decontextualised solutions that are alien to the community members' developmental dynamics, such solutions are bound to be rejected or altered in practice (Engeström 2008a; 2016).

8.4.3 Epistemic injustice and the limits of science

Some participants voiced concerns that although technical experts served as crucial mediating artefacts, sometimes they issued advice that worsened the plight of this farming community. As community members adopted innovations proposed by technical experts, they in some instances detected inconsistencies between theory and practice. Cases were cited where technical expertise was questioned, altered and sometimes rejected. Those participants who were well travelled and exposed to other cultures (e.g. Lemuel), the risk takers, assertive ones and those who constantly sought

innovative ideas (e.g. Ranganayi) and those assuming breadwinner positions (e.g. Danai) showed a tendency to question technical expertise.

There was an apparent consensus among participants that climate change had created serious knowledge gaps even among those with technical expertise. As discussed in section 8.1, there were instances when the information communicated through the radio was inaccurate, hence undermining participants' planning, compromising yields and worsening food insecurity. Participants voiced their concern that climate change was so confusing that even technical experts could not predict events with certainty; as Fiona concluded:

> *ruzivo runobva ku radio rwakanaka sokuti ava ndivo vanoongorora mamiriro ekunze…asi sevanhu…pamwe tinopotsa*
>
> [information from the radio is good for it comes from experts in weather patterns…but as humans…sometimes we err].

Ranganayi explained he sometimes disregarded advice from *Madhumeni* as he believed that his innovations based on a long history of trial and error were more reliable than what he called "*ruzivo rwemubhuku*" [bookish knowledge]:

> *Imwe inenge iri yemu book zvayo asi haizotovedzerwa zvakanyanya. Isu pano apa kana tichidyara tinodai kudonhedzera kunge nzungu… Ndinofanoita land prep yangu nguva iripo saizvozvo ndofanodyara zhezha risati rasvika, ndodiridzira mbeu yangu yozosvikonaiwa yavapo ndaita dry planting. Saka dzidziso yokunzi mirira kutanga kwanaya zvaiitwa kare, kutanga kwanyatya, unosara, wogofoira*
>
> [Some of this information is bookish knowledge, so we don't follow it strictly. We cluster the maize together using spacing recommended for groundnuts…I do my land preparations in advance and plant before the onset of the rain season, irrigate the crop until the onset of the rain season. I ignore this archaic teaching that says you should wait for the rain season to set in, you lag, and you fail dismally].

Ranganayi argued that some of the recommendations made by *Madhumeni* were outdated abstractions with potential to compromise his family's food security and he disregarded such advice:

handigone kumuteerera chete nokuti mudhomeni. Nokuti abva ku Arex saka ane chikoro…

[I don't act on advice just because it's coming from mudhumeni. Simply because they are schooled…].

As Ranganayi's wife Sarudzayi conceded, they relied more on what worked for them in practice:

izvi zvokubatanidza ndakangozvionawo zvichiitwa pano… Tinenge takaisa manyowa. Mbeu yangu chero ikaita diki asi inenge iri kohwa pakuru, ndinowana chete.

[this practice of clustering seed was already in place when I married into this family...We put lots of manure. Even if my plants turn out smaller, I harvest big].

This was intergenerational knowledge rooted in everyday practices of this family. Not to say the couple disregarded everything said by AEOs, but to highlight that advice from AEOs was not always taken at face value; it was evaluated for its merit and pitted against what worked for the couple over the years. The Dehwas' experience offers an example of how members of the community rejected technical expertise and broke conventions (Engeström 2008a) in trial and error experiments in their search for sustainable solutions to food security.

Lemuel was one participant who was surpassingly critical about innovations driven by *madhumeni*. This is not to say he completely disregarded advice from madhumeni, for he certainly adopted some, including zero tillage, but voiced that madhumeni fueled food insecurity as they relied on abstractions:

zvokuti madhumeni tinganyatsovatevedzera, tiri kufa. Ndozvauraya vanhu nenzara. Nokuti unobva wanzi rimai ka short term measure kachibage aka. Wobva warima kambeu kaya uchingokarima mvura yanaya zvakanyanyisa kobva kaorera mumunda. Ndosaka munhu wese iyezvinozvi ava kungomhanya nechangouya, changotanga kuti, kana ndikadari zvinozoita kana ndikadari zvinoita kana ndikadari zvinoita.

[Following advice from *madhumeni* is killing us, this is what is causing food insecurity … They tell us to plant the short-seasoned variety, we do so; you get above normal rains that season, the crop rots. This is the reason people are experimenting with anything and everything in search of a sustainable solution].

While views varied among individuals, there was an agreement among participants to suggest that helpful as they might be, there were limits to the interventions proposed by technical experts. Thus, from this perspective, science alone could not provide the requisite solutions because scientific knowledge is fallible, as explained by Fiona:

unezonge wava kungoti chiregai ndingodyara mheno Mwari ndovanonaisa mvura… Zvokuti zvozodii, zvozodii, Mwari kana vachinge vangoti gore rino mvura inonaya, inotonaya…Rumwe ruzivo tinozongoruwanawo hedu kubva kumadhomeni nekwe ve weather report. Asi isu tongoziva kuti mwari ndiye muiiti wazvose. Ruzivo…iye zvino rwava kunetsaka…Pamwe rwedu rwemadhomeni rwachoka pamwe rwunogona kukurasisa futi…senge last year zvaibva zvanzi…mvura kana yatonaya rimai. Asi vakarima chokutanga chakatsva

[you just plant and leave it to God as he is the one who releases rains…we may talk about this and that, but if God says it will rain this year, it surely will rain…Of course we get knowledge from *madhumeni* and the meteorological services. But what we know is God is the creator of all things. Knowledge…has become tricky. Sometimes listening to *madhumeni* can be misleading…last year they would say…once it rains plant immediately. But the first crop failed].

In chapter 7, I discussed how some of the challenges such as cultural perspectives on food choices fell beyond the scope of the natural sciences. These observations thus further strengthen the exigency to look beyond 'normal' science for solutions to climate change.

This takes me to the section where I discuss examples of the limits of science in adaptation.

8.4.5 Intractable climate change

While participants held divergent views about technical interventions and the sustainability of their solutions to climate change, there were reported cases of both successes and limitations of technical interventions. Community members experimented with new breeds of seeds which were designed to be drought tolerant and early maturing. Jerina had experimented with a new breed of maize seed which she later adopted. Jerina shared the seeds with her mother to spread risk, for they both doubted the success of the unfamiliar seeds:

> *…ndakaipihwawo noumwe munhu…Ndobva ati mbeu iyi ini handisi kutemba nayo. Ini ndobva ndati kana neniwo handisi kutembawo nayo, nokuti inini handisati ndaishandisa hangu. Ndobva angoti, hazviite here kuti tiitewo hafu, hafu kubva tachinjana… ndakazoisa kamwe kandima kayo yoga kuti ndigonyatsoona kuti chinoita here…saka… ndakanyatsoona kuti imbeu yakanaka.*
>
> [I was given [seeds] by someone…who did not trust their seeds as they were from a new breed. I told them I didn't trust them either, for I had never grown this kind before. We negotiated to split the seeds in half and we swapped… I had another small portion where I planted just the new seeds because I wanted to evaluate the results… I realised it's a good breed of seed.

Jerina's strategy was to start small; she only scaled up after evaluating how the new breed of seeds performed. Jerina's case offers another example of how critical literacies emerged as participants questioned technical knowledge and how community members were cautious about adopting expert advice without making a prior assessment. While Jerina shared a success story, not everyone who experimented with new seeds reported success, as demonstrated by the following participants' excerpts.

Beula had experimented with a named breed of new seed which she later abandoned as she was dissatisfied with the outcome:

> *handina kuzoidyara kechipiri, ndakangoidyara gore rokutanga… inobva yapfukutwa iri mumunda imomo usati watombokohwa. Saka ndinowanzorima hangu iyoyi… Dziri nani idzodzo but dzinoda mvura yakawanda.*

[I planted just that one year…it suffers weevil attack while still in the field, before you even harvest. I normally grow [long-seasoned]. They are better off but demand more water.].

As she critically evaluated her own practices, Revai grew both traditional maize varieties and the recently introduced early maturing varieties to manage risk as rainfall patterns could not be predicted with certainty.

Madhomeni anenge achikukurudzirai kuti mvura iri kunonoka kusvika saka zviri nani kuti mudyare mbeu dzinokasika kusvika…ma long grain anonetsa kuti mwaka wachoka unobva wakasikawo kupera iyo ichiri kuda mvura. Gore rino takadyara mbeu hombe nembeu diki…mwaka wacho zviya ukanyatsopihwa mvura yakanaka, hombe iyi yakanakira pakuti ine huremu hwokuti kana dai mukada kuzonotengesa kana kunana GMB kuya, yakanaka.

[*Madhumeni* encourage us to grow early maturing varieties as the rains are delayed…The problem with long-seasoned varieties is the rain season ends before they mature. This year, we planted both short and long-seasoned maize. The advantage of long seasoned varieties is that, if you receive normal rains that season, they are high yielding and, in the event that you want to sell, it weighs more].

However, new problems emerged as community members adopted early-maturing maize varieties. Lydia, Sarudzayi and Jerina showed me evidence of how the last farming season their maize crop was badly affected by excessive rains that caused the seed to rot before harvesting. Beula and Fiona voiced the new seeds were more vulnerable to weevil attack while Revai was concerned they were low yielding. Fiona added the crops are dwarf making them vulnerable to attack by predatory chickens.

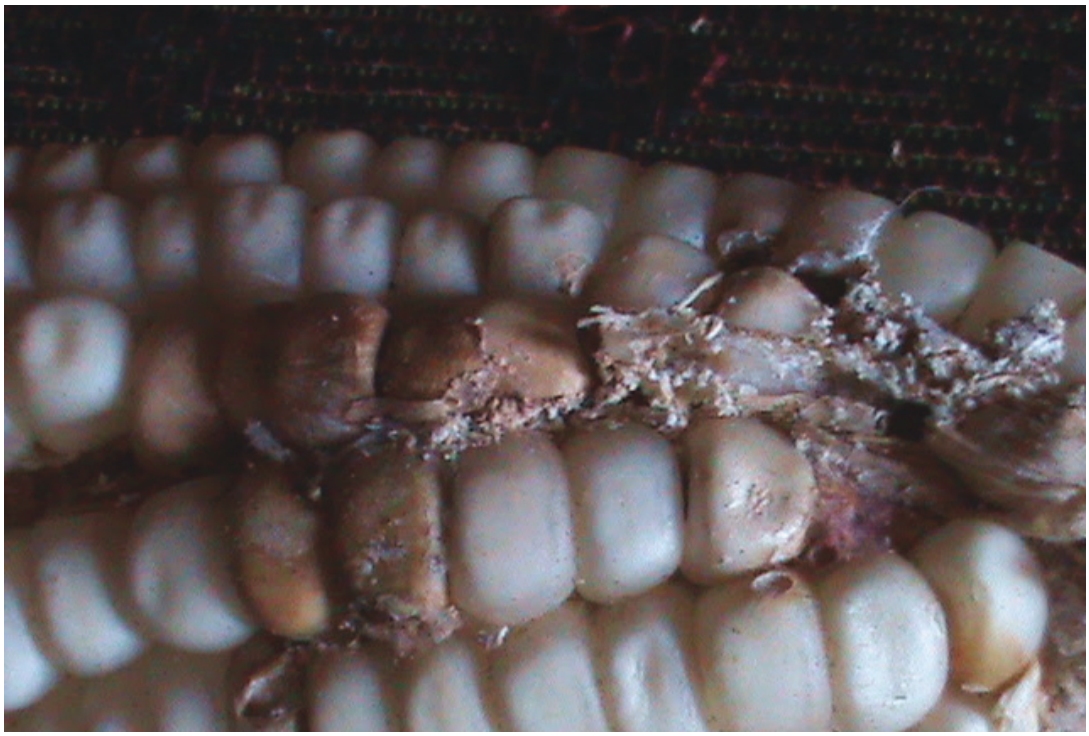


Figure 15: Some of the problems with early maturing varieties (poorly developed cobs, weevil attack and rotting**,** *Photographs taken by researcher 2016)*

The participants' observations are backed up with research evidence. Research conducted in parts of southern Africa has shown that although great strides have been made in seed technologies, the newly developed seeds cannot cope with the rate at which the climate is changing (Challinor, Koehler, Ramirez-Villegas, Whitfield & Das 2016). The same authors explain that increased temperatures accelerate crop growth, resulting in reduced crop biomass. The examples cited herewith are indicative of the intractability of climate change and the limitations of technical scientific knowledge in solving the climate crisis.

These observations confirm the assertion that in the context of climate change, where knowledge about the subject is still incomplete, solutions remain elusive and discipline-specific approaches fall short of resolving the climate crisis (Lotz-Sisitka et al 2017). As some scholars have argued, I observed that finding a solution to the climate crisis, thus, goes beyond the scope of traditional science (Lotz-Sisitka et al 2015) and moves towards post-normal science where a plurality of perspectives is acknowledged as legitimate.

This takes me to the section where I summarise the salient issues from this chapter.

8.5 Summary: Synchronising abstract knowledge and context specific knowledge

In this chapter, I analysed community members' learning as they interacted with technical experts. The analysis has found that over and above interfacing directly with members of the community through forums such as workshops, look and learn tours, competitions, community outreach and farmer-to-farmer extension; technical experts endeavoured to deliver climate change education, communication and awareness programmes on radio and in print and electronic media. The experts exploited existing social structures to inform and model solutions as they sought to update existing models of farming and environmental management. Learning and change took place mainly through authoritative silencing, self-critical evaluation of own practices, observing and reflecting on legislation, informally experimenting, and blindly following authority. This learning has led to changes in the rules (e.g. how crops are grown, for example adopting conservation farming technologies), tools for

adaptation (e.g. adopting new maize cultivars).

In this community, climate change adaptation implied unlearning of certain habits and learning or even re-learning of different habits, for example abandoning the convenience of modern agricultural practices to adopt the more labour-intensive conservation farming technologies. Through their interventions, technical experts introduced disturbances (Engeström 2008a; 2016) in the community's knowledge systems and ways of life, which triggered cycles of expansive learning as community members questioned the historically unquestioned rules (e.g. the kinds of seeds grown and how crop residue was managed). However, the nature of interactions between experts and community members were mainly what Engeström refers to as cooperation and coordination; technical experts assumed a specialist perspective as they set objects for climate change adaptation and capitalised on dominant voices in the community to stir an agenda that sought to drive community adaptations in specific directions.

In some instances, the interventions proposed by technical experts were not congruent with the community's lifeworlds and this created ruptures (Engeström 2008a) in the normal flow of work. In these cases, innovations were either rejected (e.g. small grains), partially adopted (e.g. conservation farming) or altered in practice (e.g. altering recommended plant spacings). The analysis found that while participants valued advice from technical experts, their actions sometimes appeared to defy logic, and were based more on their instincts because the experts' advice fell short of solving their problems.

Historical struggles over competing knowledge systems had resulted in loss of local knowledges, for example about conservation farming methods, that could be applied to sustainably adapt to climate change. As a result, people continued to apply principles of conversation farming only peripherally. While both experts and community members' activities were oriented towards the goal of climate change mitigation and adaptation, the objects of specific interventions pursued by some expert groups were not always what members of the community regarded as their most pressing needs or their preferred choices, for example small grains and conservation farming. While technical experts emphasised environmental sustainability, community members' most immediate need was to evade starvation.

Additionally, community members were mindful of growing new crops if markets were not guaranteed. Compounding that, some innovations (e.g. growing more marketable products, like potatoes) demanded material resources beyond the reach of community members. This led to neglect or partial uptake of innovations; for example, community members disregarded legislation as they drained wetlands and cultivated along streambanks contrary to what technical experts advised. These observations are consistent with other research studies suggesting that unless interventions address people's immediate needs, climate change adaptation remains a futile goal (Davies-Reddy & Vincent 2017).

Compounding that, climate change was a sensitive topic as it typically created livelihood dilemmas for this predominantly horticultural community; thus, community members exercised caution and trialed any expert advice before deciding to adopt it wholesale. There was a keen sense of doing what was 'safe' as community members pursued their shared object of evading *nzara*.

I observed the desirability of greater and more meaningful collaboration among the various expert groups implementing innovations within the community as discoordination in the design and implementation of interventions often led to resistance to the uptake of innovations. As Engeström (2008a) explains, when dealing with complex issues involving loosely connected organisations, new forms of work, typically modelled around what Engeström refers to as reflective communication, must emerge to explore the possibility of creating cross-organisational collaboration. This calls for practitioners to not only develop a new concept in transforming their activity, but also to analyse the need for change and development and implement a new concept to meet current challenges. Thus, from this perspective, actors must break away from the scripted codes of action and take initiatives to transform collaboratively (Engeström 2008a; Virkkunen 2006). Learning is therefore not to be restricted to community members, but professionals may need to 'unskill' (Argyris 1986) and 'deprofessionalise' (Engeström 2008) as they unlearn the skills and habits that are making them fail to connect with each other and with the people they are meant to assist.

In the next chapter, I discuss the role of children in influencing change.

Chapter 9: Children as agents of change in climate change adaptation

9.0 Introduction and flow of chapter

This is the third of three chapters that analyse the learning that had been taking place as members of the Mutema community adapted to climate change. While Chapter 7 examined the learning that occurred when participants interacted with the everyday knowledge, Chapter 8 interrogated the learning that had been afforded as participants interacted with technical scientific knowledge. In this chapter, I analyse how children's learning influenced the ways adults were adapting to climate change. Notwithstanding its primary focus on children, this chapter examines the Eco-Schools Club (ESC) as another form of educational intervention in the community and seeks to analyse how this intervention intertwined with the community members' sense-making of climate change. The analysis in this chapter thus interrogates whether and how children's participation in the ESC influenced their parents' understandings of climate change.

As explained in Chapter 1, the education system in Zimbabwe is challenged at all levels to develop responsive curricula to "*create a new generation of youth whose behaviour will be climate compliant*" (GoZ 2016 p. 58). However, the government directive appears to be based on a simplistic assumption about how children can act as agents of positive change and influence societal decisions (Chineka & Chabikwa 2015). Moreover, the approach ignores cultural and historical factors, including power relations in the community, that may limit the possibility of people's knowledge and intentions translating seamlessly into pro-environmental behaviour (Shove 2010a).

The need for a critical perspective on the power of a children's programme to have a wide community impact has been argued by some scholars who have found that programmes targeting children are not always successful (Malone 2013; Satchwell 2013) because adults are the key decision makers in contemporary society (Stephens 2008). Engeström's (2008a; 2010) concept of division of labour thus becomes crucial in this analysis of children's agency in a community where children are ascribed a

lower social status (Huffman 2014). Considering that children are betwixt and between the school and the community, Engeström's (2008a) 'three Cs' typology of interactions (Coordination, Cooperation and Communication), discussed in Chapter 3, is also helpful.

In the first part of the chapter, I profile the ESC and the three teachers who served as club patrons. Next, I analyse how the ESC enabled learning for climate change mitigation and adaptation before I discuss the limits of children's influence. This is followed by an analysis of the learning mediated by the formal school curriculum. Next, I discuss the learning resulting from participating in the research project before I wrap up with a discussion of the salient issues emerging from the chapter.

9.1 Vagoni Eco-Schools Club (ESC)

The Vagoni Eco-Schools Club (ESC) comprises thirty students and three teachers (club patrons). Profiles of eight participating students were presented in Chapter 5. Their ages ranged from 14 to 17. The three club patrons, in no particular order and identified by pseudonyms, are Zvisineyi and Samantha, both female, and Thomas, the only male. Membership in the ESC was open to all and students were accepted into the club on a first come, first served basis. Membership was voluntary, and members were supposedly intrinsically motivated to serve the club. Neither a formal qualification nor experience was required of the club patrons "*for it is the passion for environmental stewardship that keeps the club alive*", explained Zvisineyi.

At the beginning of each school term club members met to deliberate on the theme they would focus on, with the goal of creating a sense of shared objects on the vision of the club. The range of themes as set out by the national Eco-Schools programme (ESP) included climate change, waste management, natural resources use, nature and biodiversity, global and local issues. Children elected a theme after assessing the school and its community to identify critical intervention areas. Zvisineyi elaborated on the issue of the children's ownership of and agency in the club agenda:

> *Pakati pevana tinotsvaga ma coordinators vanenge vari very enthusiastic, ma self starters vaye-vaye. Tobva tavatungamidza… Isusu chedu kungo guider chete …Tinenge tichida kuti vanyatso feeler free, kuti we are the*

owners of the club…But whenever you feel there is gap in knowledge tinoita tichi follower.

[We appoint student coordinators from those highly enthusiastic, those who are self-starters. We let them lead…our role is to guide…We want them to feel they own the club…But whenever you feel there is a gap in knowledge, we follow-up].

Nelson, Nashley, Lesley and Mike were among the club coordinators; they formed the elite group of students who led others.

9.1.1 Thomas

Thomas was able to bring his professional and community perspectives as a sponsor of the Club. In addition to being a teacher, he was a farmer in the Mutema community. Thus, much of the information he shared on the community's climate change adaptations was based on firsthand experiences. In the school, Thomas was the Deputy Principal, so he brought an administrator's perspective.

Thomas had been trained and certified as a teacher in the early 90s, specialising in geography and Shona (a local language). He was teaching geography and was the founding member of the Vagoni ESC. Thomas was one of the few teachers who had participated in the most recent national curriculum review process, making him a valuable source of information on the curriculum review process mentioned in the introduction to this chapter, and how the formal curriculum would respond to issues of climate change.

9.1.2 Zvisineyi

Zvisineyi was in her late twenties and was regarded as the powerhouse behind the day-to-day running of the Vagoni ESC. She played the coordinator role and was my point of contact with the research participants. I interacted with Zvisineyi more than anyone else during the research process. Zvisineyi was passionate about the ESC and told me she had been inspired by Thomas to join the club. A recent graduate from one of the local universities, Zvisineyi held a graduate diploma in education with a specialisation in geography and commerce. She was teaching commerce at the time of this research.

9.1.3 Samantha

In her late forties, Samantha was a certified teacher with specialty in home management. Her teaching experience spanned about three decades, but she had been at Vagoni for less than a year. She was new to both the school and the community. When I first contacted the school, Samantha had been there for five months. However, within that brief period, Samantha had established a personal herbal and vegetable garden and an orchard and had acquired a piece of land in the community to grow yams, a crop that is regarded as foreign to the Mutema community. While new to Vagoni, she was not new to the eco-schools' concept as she had been actively involved in the programme in her previous assignments.

9.2 Affordances and barriers to learning and change

The Eco-Schools Club served as a learning and networking platform where members shared both material and symbolic artefacts to help them engage with pro-environmental climate action. In this section, I discuss how the ESC mediated children's learning.

9.2.1 Learning collaboratively through peer interaction

Mike elaborated how his reflective questioning precipitated by participation in the ESC helped him to understand his environment. He confessed there were instances when he failed to comprehend the changes taking place in his community and when that happened, he approached his teachers for assistance. For Mike, debating local environmental issues where diverse views were presented served as disturbances that led to learning and change.

> *Kazhinji kacho ruzivo rwe climate change ndinoruwana kuno ku environment club kwatinenge tichidzidziswawo. Sometimes kana ndine zvinhu zvandinenge ndaona ndatadza kunzwisisa ndinouya ndobvunza ma ticha… iwewe pauchapa vamwe ruzivo munenge muchibatsirana paruzivo, pama discussion apa panobuda ma solutions akawanda.*
>
> [I normally get to know about climate change from the environment club [ESC] where we are taught. Sometimes if there are things I don't understand

I come to my teachers for help…as you give knowledge to others you help each other, as you discuss lots of solutions emerge], (Mike, student)

Garikayi described the learning that took place among peers and the transfer of skills from the Eco-School Club to the home.

…mu apple ndakamuwana kweshamwari yangu …tinotaurirana kuti muti wakati ndinawo. Iye obva andipawo. Ini kana ndine chandiinacho ndomupawo. Kupota uchishandisawo zvinhu zvinoita kuti muriwo ukure zvisiri fertilizer. Kunge kutora churu. Takatozviita pamibhedha iri apo

[…I got the apple tree from my friend…we discuss as we exchange trees. He gives me what he has. I give him what I have. Using alternatives to chemical fertilisers in vegetables. Like using clay soil. That's what we did with those vegetable beds over there].

Children thus learned from their teachers and from each other through processes of social interaction. In the case of Garikayi, the skills he learned at the ESC were transferred to the home.

9.2.2 Field visits and commemoration of dedicated events

The ESC participated in commemorations of key environmental events both within and outside the community. I attended the 2016 World Environmental Day commemorations with club members. Children learned as they interacted with technical experts and students from other school clubs. In a speech delivered during the event, Gift, the founder of the Eco-School Programme in Zimbabwe encouraged students to be change agents in the school and at home:

Eco-Schools is about environmental management, both at home and at school…it is about your [children's] responsibilities, both at school and at home. It gives you [children] the opportunity to explore the world…to find how you [children] can tackle the emerging crises…

While the Vagoni Eco-Schools Club did not make any presentations at this event, students appeared to be engaged in learning as they interacted with professionals and peers. For example, Jim planted trees at home after this event.

ndakazvinzwawo patakaenda ku Environment Day kuti unofanira kuita inonzi afforestation

[when we went for the [World] Environmental Day [commemorations] I heard we must do what is called afforestation].

There were displays from individuals and organisations showcasing green production technologies. ESCs also displayed models and products on diverse environmental issues ranging from recycling to waste management and renewable energy.

Figure 16: Examples of children's displays; *waste bin made from recycled tyres, model of biodigester, shopping bag made from recycled plastic* (*Photographs taken by researcher 2016*)

Children learned as they interacted with the exhibitors. Garikayi recounted from the event:

> *mapepa atinorasa akatokosha, anogona kutoshanda zvimwe zvinhu. Nokuti ku [Miombo] ndakatoona bag rakagadzirwa nema paper bag…*
>
> [the papers we throw away are valuable for they could be re-used. When we went to [Miombo], I spotted a bag made from paper bags].

9.2.3 Researching local sustainability issues: The Eco-Challenge

Mike was a club coordinator and together with Nelson and Nashley was among the students who participated in the 2014 edition of the Eco-Challenge, a competition hosted by Miombo in collaboration with the Ministry of Primary and Secondary Education (MoPSE) to evaluate environmental learning and stewardship among schools in the ESP. Based on environmental and sustainability issues of major concern in their local context, each school elects a theme to focus on, researches the theme and compiles a portfolio of evidence which will be presented to a panel of judges. Children also competed in quizzes, poetry, song, dance, drama, art and models that draw from local sustainability concerns. The winning schools were awarded prizes and certificates of acknowledgement. At one point, Vagoni Eco-Schools Club earned a certificate following its successful participation in the Eco-Challenge. Their project was on clean energy, as Nashley elaborated:

> *Certificate yatakapiwa yanga iri ye model yatakanga tagadzira ye clean energy. Yanga iri ye solar energy. Yanga ingori imba ine ka solar panel pamusoro ne battery. Taiti tikagadzika pazuva kamba ikako ma lights anga ari mukati mekamba ikako aiita on. Imba yakagadzirwa ne anonzi…. Then [Mike] ndiye aka provider ma lights ne battery. Inini na… tisu takazonyora note inotsanangura how the model works.*
>
> [We were awarded a certificate after we made a model on clean energy. It was a solar model. It was a house with a solar panel and a battery on top. When we placed the model in the sun, the lights turned on. The miniature house was designed by … then Mike provided the battery and the lights. [a former member] and I wrote the note explaining how the model works].

Nashley explained that their focus on solar was motivated by the massive deforestation in the community and the desire for community members to adopt cleaner and more sustainable energy sources.

9.2.4 Learning embedded in the Eco-Schools ethos

Following the global vision for Eco-Schools to promote learning for positive environmental change (Cincera & Krajhanzl 2013; Pauw & Petegem 2011; Ringdahl 2012), Vagoni ESC ran several programmes to develop agency for sustainable environmental management. Although the concept of the programme preceded wider community concerns about the impact of climate change, Gift explained how climate change was an issue that children had to engage with:

> *… kuvana vechikoro tiri kunyanyofokasa on adaptation. …because ndo scenario yavanayo iye zvino izvi kuti vaite cope…*
>
> [… the prime focus with children is on adaptation…because this is the situation children find themselves in, so they must cope…].

In CHAT terminology, the ESC served as a disturbance which helped children to question issues within their community which they had taken for granted (Engeström 2008a) and had considered normal practice (Spurling 2018). Nashley, one of the pioneering members and club coordinators at Vagoni, elaborated on how the ESC translated this aspiration into practical initiatives:

> *Club yedu inoita nezve environment, especially ino specialiser tongoti the ozone layer depletion, kuchinja- chinja kwemamiriro okunze zvazvinokonzera nezvimwe zvatisingazooni ne zvatinoona ne zvimwe zvatinonzwa. Tinowanzodyara miti kuti ti reduce the amount of carbon dioxide in the atmosphere. Because miti ino trapper carbon dioxide; tiri kudyara miti because vanhu kuno uku vanonyatsotema miti nokuti vanenge vachida huni. Carbon dioxide kazhinji inozokonzera kuti nyika ipise.*
>
> [Our club deals with environmental issues, let's just say it specialises in ozone depletion, the changes in the weather outlook, the impacts – some visible, some invisible – and the other things we get to hear. We are mainly planting trees to reduce the amount of carbon dioxide in the atmosphere. Trees trap carbon dioxide; this is the reason we plant trees because in this community

people cut lots of trees for firewood. Carbon dioxide eventually leads to global warming].

Although she conflated climate change with ozone depletion, Nashley explicated the interconnectedness of issues surrounding deforestation, livelihoods, tree planting and climate change in the practical activities that the school children could undertake. Besides tree planting, the Eco-Schools Club's other projects included, but were not limited to, herbal and vegetable gardening, waste management, composting and fireguard construction. Informed by the eco-schools' programme ethos (Cincera & Krajhanzl 2013; Lee 2017), the Vagoni ESC's learning programme was, as Thomas explained, project-based and driven by a problem-based child-centred approach informed by children's interests while also responding to the needs of wider society. Through this hands-on, minds-on approach, children practised what they were learning as they aimed to improve the quality of the environment and quality of life:

> *climate change…ma causes acho mazhinji, zvinhu zviri practical…tofanira kupa vana ruzivo kushandisa ... maoko vachiita zvinhu zvinokwanisa kuti vadzivirire kuti kunze... kusashanduka*.
>
> [The causes of…climate change, are mostly of a practical nature…we must empower children with knowledge and skills…to engage with practical activities to mitigate climate change].

Samantha proposed that the ESC sought to re-orient mindsets, to help children to embrace and adapt to change for their own survival because changes in the climate was a reality. The three club patrons envisioned the ESC as a platform for developing students' agency for positive environmental change.

Notwithstanding the consensus among the club patrons, the extent to which the object of the ESC could translate into the outcomes that patrons were seeking requires closer examination. Engeström (2008a; 2016) reminds us that division of labour within activity systems may create tension as objects fail to converge. I therefore turn now to students' motives for joining the ESC and how tensions between club members created ruptures which weakened the influence of the ESC on developing agency of both members and non-members.

9.2.4.1 Misalignment of objects of the ESC as a barrier to learning

Some children, such as Lesley, joined the club as they sought to improve their knowledge of environmental and sustainability issues, engaging with environmental stewardship and making a positive impact in the school and at home.

> *Ndakangoonawo kuti ukajoinawo maClub anoitwa pachikoro senge iyoyi iyi unowanawo ruzivo, zvinozotibatsirawo mararamiro edu… Ndinokwanisa kubatsirawo amai vangu because tinorarama nokurima.*
>
> [I realised it's good to join school clubs like this one because you gain knowledge that helps you in life…I can help my mother because we survive on farming] (Lesley).

Others appeared to be driven by curiosity and peer pressure:

> *Ndaingoitawo zvokunzwawo na vamwe kuti Eco-Schools Club inonakidza. Shamwari yangu [Wedzerayi] ndiye wakati kunonakidza*.
>
> [I used to hear from others that interesting things happen in this Eco-Schools Club. My friend, [Wedzerayi], told me it's exciting] (Jim).

And there were some like Nashley, who had not thought about joining but had encouragement from their teachers:

> *...Kubva pazonzi ma students ngaauye tikaenda ku [Miombo]...Tadzoka kubva tabvunzwa kuti moda kupinda mu club here ndikati ehe ...*
>
> [Students were invited to go to [Miombo]…When we returned we were asked whether we wanted to join the club and I said yes…].

However, Nashley was concerned that some club members were not committed to club activities. Participation in manual activities was motivated not by the desire to learn, but to book places on the next excursion; if the truth be told, gardening was not cool at all.

> *vanhu vazhinji, kazhinji havadi kuenda ku garden. Vanozongoda club nokuda kwekuti kana zvava kunzi tava kuenda out. Ku garden kunobhowa uku, kunobhowa ndochokwadi. Kugarden kunobhowa...kumbo digger…mozonzi huyai nemanyowa...* [most people don't like to go to the garden. They only want to participate when it's time for excursions. Gardening is boring, it's

boring, that's the truth. Gardening is boring…come to think of the digging…then you are asked to bring manure…]

Thus, while some students shared the consensus among the patrons about the object of the Eco-Schools Club, variations in the degree of commitment and the source of motivation could be seen among students. The data resonates with Engeström's (2008a) theorisation about the subjectivity of the objects of any activity system; that is, even though the stated aims of the ESC may be clear, the objects from the perspectives of the different participants could vary. Such discoordination may cause ruptures in the normal flow of work (Engeström 2008a).

Below I cite examples of how the ruptures manifested.

9.2.4.2 The ESC is manual labour and embarrassing

While the teachers imagined they were nurturing a generation of students with practical and survival skills, some students, particularly girls, conceptualised the activities as manual work to be avoided. Compounding that, children voiced concerns that they were ridiculed by non-members who viewed practical activities as demeaning. Nashley lamented that such treatment from non-members acted as a barrier for some students to join the club, let alone participate in club activities:

> *kuenda ku garden kunonyadzisa… tinosekwa…ukaonekwa uchinhonga mapepa vanhu vanotokuseka vachifunga kuti unopenga*.
>
> [going to the garden is embarrassing… we are ridiculed…when people see you picking up litter they scorn you as they take you for a dunce].

Some disconnections between the patrons' descriptions of the nature of learning in the club and what children experienced was observable and may have contributed to the varying degrees of participation. Additionally, assessment of the club activities by club members Mike and Nashley suggested the ESC was mainly about manual labour. This brought mockery from non-members, as Nashley bemoaned:

> *ndaibhowekana nevanhu vaingotaura kuchikoro kungoti, club yenyu yakadhakwa. Vamwe vachimbotitsvinyira kuti, ka club kenyu ketumadomasi… vamwe vaingoti, haa, munoshandiswa kugarden kwenyu*.

> [I was turned off by people at school who said this club of yours is drunk [pathetic]. Some would scorn us saying, this little tomato club of yours…some said you are being exploited in that garden of yours].

In the local context, the phrase '*kudhakwa*', literally 'drunk', is slang used to describe situations that are pathetic and hopeless. Some non-members viewed the Eco-Schools Club as a group of hopeless people, while others viewed it as exploitation.

The Mutema community being a predominantly horticultural community where tomatoes were liberally grown and sold cheaply by the roadside to the locals, there was not much economic value attached to growing tomatoes, for they were ubiquitous. Likening the ESC to a little tomato business thus trivialised the ESC, potentially undermining some of the ESC's potential to take a whole-school and whole-community approach, taking leadership in mobilising fellow students, families and the wider community to adopt pro-environmental climate action. This demanded the further analysis in the sections to follow of the efficacy of the ESC as a tool for influencing others to act against climate change.

9.2.4.3 The ESC is not a priority

I observed that for most students, attendance at club activities was irregular. Each time I held focus groups with students, one or two members would be missing or would come late. While they attended all activities, Nashley's and Lesley's lack of punctuality was noticeable. Nelson had decided to prioritise preparing for his final end of secondary school examinations, but there were no apparent reasons for Farai's and Wedzerai's absences. For Mike, his unreliable participation may be explained by a mismatch between his expectations about the club activities and what was on offer:

> *dai club yedu iyi taiwana more time yema discussions. Tinowanzongoenda kundodiridza ku garden, mongopedza moenda. Zvinodawo nguva yokuti tinombogara sevana tose tichi discusser…*
>
> [I wish we could get more time for discussions during club time. We normally go to the garden to water the plants and go. We need time to meet as students and discuss…]

Not only were some students inconsistent in their participation in ESC activities, but participation by the club patrons was also irregular. On my visits to the ESC, which

all coincided with the school timetable, the three club patrons were rarely all there at the same time. Sometimes, none of the three would be present because they were engaged with other activities, even though the time was specifically allocated to clubs. Some of the challenges were likely related to structural issues regarding how government policy positioned school clubs in the school curriculum. Samantha complained that the time allocated for clubs is limited. In the Zimbabwean context, school clubs are categorised as extra-curricular activities, and hence are not prioritised on the school timetable. (Chineka & Chabikwa 2015).

By the time I exited the research site, the education system in Zimbabwe had become heavily focused on high-stakes examinations. Non-examinable subjects and activities including school clubs, therefore, suffered neglect despite their potential to contribute to the development of life and survival skills (Chineka & Mukundu 2017; Mukundu, Chineka & Madzudzo 2017). Thomas added that it was not just clubs that were ascribed a lower social status, but subjects with a practical component generally. It is within this context of competing interests, both of the individual participants and the education system as a whole that the ESC exists. As illustrated above, the children's participation can be interrupted or discouraged altogether by perceptions among some peers about the value of the ESC, or simply through pressures from other demands of the school. Patrons too struggle to negotiate time to devote to the ESC amidst school days that in reality leave little time to support extra-curricular programmes.

9.2.4.4 The numbers are insignificant

Out of a total enrolment of 581, only 30 students were ESC members, translating to a low of 5%. The club patrons agreed this was just a drop in the ocean compared to the total school enrolments. Consequently, the overall impact of the club tended to be limited, and not helped by negative perceptions propagated by some non-members, as noted earlier. There was, however, wider perception among teachers and children alike that knowledge about climate change should be shared widely. A common vision for the ESC was for the club to be a role model within and outside the school and to reach out to the community, explained Thomas. The ESC, for instance, had embarked on litter management where members held awareness campaigns and placed litter bins in strategic positions within the school grounds. Despite these efforts

Nashley lamented that it was difficult, even with what was espoused as a shared vision, to get school children to act in ways that could achieve this vision:

> *Club yedu hatisati tanyatsosvika chaipo patiri kuda especially pachikoro pano apa vanhu vanongorasa rasa mapepa pose pose. As a prefect, I try kuti vanhu vanhonge mapepa. But at the end of the day unongoona mapepa azara pese pese. Inhau yokuti kufunga kwedu kwakasiyana, saka zvinonetsa kuti tienderane. Saka ini ndaifunga kuti tikatanga ku leader by example isusu tiri mu club tichinhonga marara tirisu as a club, maybe tine pfungwa dzakati fananei mu club yedu.*
>
> [as a club, we have not been able to achieve what we desire especially in this school because littering abounds. As a prefect, I try to make them clean up. But, by end of day, the whole place would be littered with papers. This is because we don't share a common vision. I think as the ESC we need to lead by example since our thinking is different from non-members'].

Despite these limitations, the Vagoni Eco-Schools Club engaged with diverse projects directed at addressing climate change and related environmental sustainability issues within the school and the community.

I next discuss the affordances and limitations of children's agency in influencing adult decisions with regards to climate change education, learning and adaptation.

9.3 Intergenerational learning: Children assuming the role of technical experts

Children influenced adults' learning mainly through intergenerational discussions between children and adults; informing and modelling solutions as children implemented at home what they learned at the ESC; and informing and telling through song, poems and dance.

Firstly, I analyse the learning that was mediated through song, dance, drama and poetry.

9.3.1 Community outreach through the arts

Club coordinators believed that more could be achieved if more people got involved in environmental stewardship, but the first step was to empower people with knowledge. There was a belief among Eco-Schools Club coordinators that people only practised that which they knew; hence, they argued that whole-school and community mobilisation for climate change mitigation and adaptation depended on more knowledge. The Vagoni ESC thus engaged in diverse local community outreach programs as Zvisineyi elaborated:

> *Kufunga kwedu isusu ndokwekuti pose pakaungana vanhu, vanofanira kuziva nezve environment yavo ndozvakanyanyokosha*.
>
> [The way we see it, whenever people gather, they must be made aware about their environment, that is the most important thing].

Zvisineyi further explained that the range of strategies and themes they chose to focus on depended on the availability of time and the issues of concern within the community respectively:

> *Kana time iripowo we can organize a play, about the environment. Tichingotarisa kuti kudunhu redu mazuvano zvii zviri kuda kunyanyoitwa awareness. Senge last year rava kundopera kwakanyanyonetsa vanhu vaitema miti sitereki. Zvinhu zvanga zvakaoma for real nokuda kwokuti mvura yanga yanonoka kunaya. So vanhu vaitsvaga huni dzokutengesa kuitira kuti vararame. Dzimwe nguva tinoitawo ma poems, ma quiz, debates, fashion shows ne public speaking.*
>
> [If there is adequate time, we organise plays about the environment. We look at issues of major concern in our community. Towards year-end last year, there was massive deforestation. Things were tough as the rains were delayed. People were cutting trees to sell as firewood. Sometimes we do poems, quizzes, fashion shows and public speaking].

The ESC's community outreach programmes were thus modelled on information transfer approaches where members of the community were on the receiving end. The ESC adopted the ABC (Shove 2010a) model which is premised on the belief that once people are knowledgeable and incentivised, they will adopt pro-environmental

climate change behaviours. Critics of this model, however, have argued that being knowledgeable (in a purely cognitive sense) about the science of climate change does not guarantee engagement with climate change.

While they acknowledged the primacy of knowledge, these members also admitted that sometimes people engaged in unsustainable practices not necessarily out of ignorance, but for a range of reasons as discussed in Chapters 6 and 7; sometimes ignorance is a choice that people make (Ungar 2000). People do not always practise what they know, and, in this community, the reasons varied from lack of alternatives to complacency and negative attitudes towards environmental sustainability and concerns and lack of community.

This takes me to the section where I discuss the intergenerational learning between children and their parents or guardians.

9.3.2 Intergenerational discussions between children and adults: Grandiose ideas, small voices

Except for Fiona, Danai and Lemuel, parents mostly remained distant and disengaged from their children's activities at the Eco-School Club. Danai was a member of the School Development Committee with extensive experience of working on projects that bring the school and the community together to discuss children's learning. However, despite engaging in debates with her son, Danai had not adopted any climate change advice from her son, as she believed she was more experienced.

> *…pamwe munotozonetsana kuti aiwa kukuraka hakusi kuziva. Isusu kuchikoro tinodzidziswa tichidai…ini ndobva ndati ah isusu takazvibvira kare tatokura nazvo… zvonzi aiwa zvinhu zvinoita zvichishanduka…ehe ndiri kuzviona kuti vari kudzidziswa zvinhu zvakanaka…chandinonyanyofarira haazoita nguva yakwanda yokuti akadzoka kuchikoro anosvikotamba*.
>
> [sometimes we fight as he tells me age does not guarantee knowledge. In school, we are being taught this…and I tell him we have always done things this way…and he will say things keep changing…yes, I can see they are being taught lots of good things…what I like most is that he doesn't get too much time to idle].

The one thing that mattered most about her son's participation in the ESC was that

Farai was kept busy, leaving him with little room to engage in mischief. Danai took the ESC for a haven where her son was mentored into a responsible youth. The rest of the parents confirmed they had not meaningfully engaged their children/dependents in discussions regarding what they learnt at the ESC because they just did not think it was important to do so or because they did not think it was in their place or they did not have the time.

Revai's son Mike, for example, confirmed her son Mike had many times made efforts to engage her in what he learned at the Eco-Schools Club. Although she acknowledged the benefits of her son's involvement with the ESC, Revai was withdrawn from her son's activities and could not connect Mike's learning to the ESC.

> *kazhinji kacho ndinogona kunge ndakatobatikana nemabasa angu… unomboti aiwa, chimbomira, but ane chido zvekuti…Ipapo inini ndopandisingazonyatsonzwisisa kuti zvimwe zvinhu zvaanozenge achiita, tozoziva kuti ndezvo ku club here kana kuti. Nokuti pane zvimwe zvaakambouya achiita so, tudzimba twaiswa zvima lights here kudii, dii…zvino isusu vamwe tinoona kuti varikudzidza havo but isusu vabereki tisu tisingazotosimbarara navo zvedu kuti tione kuti zvamirasei.*
>
> [I'm normally busy …so I dismiss him, but he is very enthusiastic…so, I'm not sure whether those things are coming from the club or…because at some point he came with miniature houses, where he installed lights… I can see he is learning but as a parent I have not made a deliberate effort to get involved].

As exemplified by Revai, parents never considered their children part of the solution to challenges they faced at the hands of climate change. None of the parents mentioned children as sources of learning for adaptation, even though their children possessed a wealth of knowledge, skills and competencies on the subject.

Compounding the lack of concern from his mother, Mike witnessed damaging activities taking place in the community, but lacked a voice and feared for his safety:

> *kunyangwe ukadovaudza havambozviteerera. Sometimes vanogona kutozokurova futi vakaona wava kutaura izvozvo zvinenge zviri opposite ne*

zvavari kuita. Nokuti vanenge vava kutoona kunge … iwe ndiwe uri wrong... semwana vanotokuonera pasi kuti zvaunenge uchitaura hazvina nemusoro.

[even if you tell them, they won't listen. They may even beat you up the moment they realise you're opposing them. Because they tend to think…you are the one in the wrong…as a child they look down upon you and what you say is regarded as nonsense].

While Mike believed in wide sharing of knowledge even outside his family, he was constrained by hostile community members who viewed children and their views as nonsensical, as there was no shared vision between what the Eco-Schools Club sought to achieve and what community members valued. As Engeström (2008a; 2016; 2018) explains, such intersubjectivities in objects create ruptures in the normal flow of work.

Below, I cite two illustrative cases of how, despite being technically competent, children's ideas were disregarded.

9.3.2.1 Nelson: It is child's play

A long-serving member of the ESC, Nelson was also a club coordinator. He had participated in several workshops organised by Miombo as part of the Eco-Schools Programme. Over the years, Nelson had participated in the Eco-Challenge, and this had engendered in him pro-environmental climate action. Although he interacted with information from several sources, Nelson confessed his participation in the club made an impression on his attitudes towards environmental sustainability. While acknowledging that change is a slow and complex process, Nelson explained the club influenced his lifestyle choices, the ways he managed resources and his attitudes towards life in general.

...zvandaimbosiita kumashure uku, nyangwe ndichimboitawo zvimwewo… zvanga zvakanyanya...muti chaiwo ndanga ndisingakoshesi. Then ndaingotiwo futi zvinhu zviri normal…kana kuti zvinhu zvakangonaka kushandisa ma pestcides...kungopisa everyday kuti kana ndangofunga kuti ndava kupisa. Ndaingoonawo zvingori normal kuti paivhimwa vanhu vaingopisa....

[…even though I haven't changed completely…but I think I was worse off

before [joining the club]. I didn't value trees. I thought it was normal…and plausible to use pesticides…burning wantonly whenever I felt like burning. I thought it was normal for people to burn as they hunted...]

He planted trees in his spare time, especially fruit trees, a hobby he adopted after Thomas, one of the club patrons, advised him that club members must perpetuate at home what they learnt at school. A walk through the Mhere garden confirmed Nelson's assertions: his aunt, Lydia, showed me the apple trees Nelson grew and confessed the Eco-Schools Club had made an impact on her nephew:

> *kare akanga asingadaro. Saka nokufamba kwenguva akazomboti mumwe musi gore rapera pamberi apo, akati ndokumbirawo pokuisa muti wangu, muti wacho ndauona ndinogona kuutora pamu apple wenyu*
>
> [in the past, he was not like that. But, with time he said to me one of these days, about three years ago, may I have space to plant my trees, I can get the seeds from your apple tree over there].

While Lydia acknowledged the range of projects her nephew implemented at home, she had not meaningfully engaged with him on matters regarding the ESC. In fact, Lydia dismissed her nephew as a joke:

> *mazuva ekutanga zvaingoita kunge dambe and handina kumbozivawo kuti zvinhu zvavari kudzidziswa kuchikoro… [Nelson] munhu asingataure- taure saka aingoda kuita zvinhu zvake chinyararire… Iye manje manje uno akangoti Mama ndiisewo mihomba yangu miviri…Ndikamuti iwewe wakazogona kuisa muhomba rinhi unozogona here kudiridza? …ndaitomuseka kuti apa ndarasa mbeu yangu asi ndakatozoona kuti handina kurasa mbeu yangu. Muchapaona henyu kana tabuda, Tsunga yake iri kunyatsoita zvakanaka*.
>
> […in the beginning, it appeared like child's play and I didn't realise this was something he learned in school… [Nelson] is reserved so he does his things quietly… Just recently, l he asked for a portion to make two seed beds…I questioned his ability to make seed beds and whether he was prepared to water the beds…I mocked him, I thought my seed will go to waste, but I realised it

wasn't wasted after all. You shall see when we go outside, his crop is doing well].

I observed that Nelson's crop was doing well, and he elaborated that growing his own food allowed him to learn by doing as he practised at home what he learned at the Eco-Schools Club.

> *pakuzvirimira ma vegetables edu tinodzidzawo zvakawanda uyezve ndokuti ti practice wo zvatinonge tichidzidza…zvino increaser food security. Uyezve ma plants atinenge tarima …anotora carbon dioxide. Saka the moment yatinobhenawo ma fuels akawanda anenge achi producer carbon dioxide, then anokwanisa kuto receiver that carbon dioxide paanenge achiita photosynthesis.*
>
> [we learn a lot as we grow our own vegetables, it's also a way for us to practise what we learned…it increases food security. Additionally, the plants we grow… absorb carbon dioxide. The moment we burn fossil fuels, they produce lots of carbon dioxide, then plants absorb that carbon dioxide as they photosynthesise].

Although he admitted that his knowledge about climate change was incomplete, Nelson demonstrated climate change literacy in the several intervention projects he engaged with, both at school and at home. His aunt Lydia, however, took Nelson for a joke and like Revai, she remained distant. These cases illustrate how parents were disconnected from children and their projects because they did not see any personal relevance in the project as they did not see children as sources of learning. In their study, Williams, McEwen, and Quinn (2017) concluded that parents did not see relevance in a project because of its location in a formal school setting; parents viewed it as a school project and just one of those things children do in school.

Next, I present Nashley's experiences.

9.3.2.3 Nashley: It is convention that children have no voice

Another stalwart and coordinator of the ESC, Nashley is also a member of the climate mappers programme, a programme hosted by a local UN agent to promote climate change learning among school-going youths. A walk through the Gwenzi homestead coupled with conversational analysis provides tangible evidence of critical literacies

Nashley developed over the years as a direct result of her participation in the ESC. (Refer to Chapter 5 for a more detailed discussion.) When she joined the club, Nashley went there for the fun:

> *first time pakatanga -tanga club yedu…ndaingonofarawo ne vamwe ini. Hapana chandaitombonzwisisa*
>
> [When the club started…I went there for the fun of it. I didn't understand a thing].

However, as a result of what she learned from the club, Nashley became a changed person:

> *ruzivo rwandinowana rwakandichinja zvikuru, because ini ndakanga ndisotomborina basa nazvo ini...*
>
> [knowledge from the club changed me in a big way because I used to have this carefree attitude].

Being a part of the Eco-Schools Club expanded not only her knowledge on climate change, but also her networks for interaction to learn about climate change mitigation and adaptation. More importantly, it changed her perceptions towards practical subjects, something she had really hated before:

> *Kare ndaingoti hazvina kana basa, asi iye zvino izvi neruzivo rwandinarwo, munhu akada kuziva nezve club yedu ndomu explainira zvandinoziva zvese. And then zvaka leader kuti nditaure nevanhu vakawanda pachikoro tichi share ma ideas nevamwe…garden nda ndisingarifarire zvachose… asi pandakazopindawo mu environment, ndava ku learner more about plants, ne zvaanobatsira pa climate change. Ndakabva ndachinja kana zveku garden ndakabva ndada kubva ndachinja zvangu prac kubva ndaenda ku Agriculture.*
>
> [I never bothered to explain our club to non-members, but that has changed as I have become knowledgeable. I want to share the knowledge with others. It changed the way I interact with fellow students, so ideas can be shared widely…I really hated gardening… but, when I joined the environmental club, I started to learn more about plants and their value in climate change mitigation. I then changed, I began to appreciate gardening and I picked

Agriculture as a subject].

As Nashley's attitude towards engaging in manual activities changed she began to grow a variety of plants in her family compound.

> *Inini ndinongo believer kuti every plant yandinodyara ichango trapper wo carbon dioxide ichi reducer the amount of carbon dioxide in the atmosphere…*
>
> [I believe every plant traps carbon dioxide and reduces the amount of carbon dioxide in the atmosphere].

Figure 17: Some of the plants Nashley grew (*peach tree, banana tree, herbal garden*; *Photographs taken by researcher 2016)*

However, despite the climate change literacy she demonstrated, convincing her aunt Fiona to adopt her advice was nightmarish:

> *Amai pane nyaya… unovaudza vongoti eho… Usafunge kuti vanozokuudza futi. Pomboita kanenge kagakava musati manyatsoita zvinooneka.*
>
> [As for my mother [Fiona], it's a mammoth task… you tell her, and she simply says okay…Don't even think she'll talk to you about the subject again. We fight before we effectuate anything].

Fiona conceded that owing to the way she was socialised, listening to children was an act of defying the status quo.

> *Kungoti chete vanhu kana tichikura vabereki munoziva vabereki tanga tingori netsika yokuti haa zvinotaurwa ne mwana hazviteererwe.*
>
> [We grew up being told that, and as parents it's convention that things said by children shouldn't be listened to].

Even though she might appear to have acknowledged her niece's advice, when it came to acting on the knowledge regarding planting, Fiona would not allow it:

> *.. zvinoti netsei…ukavaudza vanongoti eho. Wava kudyara vobva vati haa wava kuita sei futi apo*!
>
> [...it's complex. If you tell her [Fiona] she simply says okay. When you try and plant she will say, hey, what do you think you are doing!] (Nashley).

The two cases I cited are just illustrative examples but, overall, children voiced concerns that their ideas were disregarded, they had no place in family decision making and cultural conventions made it difficult for children to challenge adult decisions. These observations resonate with research evidence suggesting that while children's agency is acknowledged, it is critical to locate children's agencywithin the socio-cultural context in which it occurs (Malone 2013). While reverse mentoring works in contexts where children have a voice, in contexts where cultural values supress children's voices, the approach may need to be reviewed.

9.3.2.3 Children's ideas are risky

Except for Wadzanayi, who believed children's views must be respected for they are

based on technical knowledge, the view shared among parents seemed to be that information coming from children must be assessed for its merit. Due to the sensitive nature of the impacts of climate change in this community, parents were especially mindful about adopting advice that increased their vulnerability to food insecurity. As Beula elaborated:

> *Kana dzidziso ichibva nokumwana ...unogona kuti rega ndimboedzawo zvataurwa nemwana, kudzidza hakuperika. Asi hauzoisika ndima hombe nekuti anogona kukupinza nzara. Saka next time unenge waona dzidziso iya yaita yaakudaka pahombe…*
>
> [when advice is coming from a child…you may want to try it, learning never ceases. But, you don't plant an extensive portion because that advice may plunge you into hunger. Once you have proof, you may plant extensively].

Beula's daughter, Lesley, bemoaned the struggles of convincing her mother to change planting dates, and how her ideas were deemed madness.

> *unogona kuti Mama ngatimbomireyi kudyara, mvura iyi haizikanwe, inogona kusadzokazve. Ivo vanobva vatoti haiwa zvokupiko kupenga uku. Ini handiteedzeri zvako unotipinza nzara…but pane pa one pavakanditeerera. Kubva vangoti dyara chako chibage apo. Ivo ndokutanga kudyara munda wese kubva vandosiya kaportion kadiki-diki. Ndopandakazodyara mvura payakanaya kechitwo. Changu chakatoita kudarika chavo vakatoona kuti zvinobatsira*.
>
> [I tell my mother to delay planting for the rains may go for good. She says spare me your madness. Your ideas expose us to hunger… only once, she listened to me. She said plant that portion. She planted the whole field except for a very small portion. I planted when it rained the second time. My crop did better than hers and that's when she realised it works].

Although she allowed her daughter to experiment, Beula was mindful of the risks involved. As discussed in Chapters 7 and 8, the need to feel safe set limits to adaptation in this community where climate change was a typical livelihood dilemma. Considering that technical experts could not be wholly trusted (Chapter 8), children's ideas were considered even more suspect.

9.3.2.4 Vocal children are labelled arrogant and rebellious

Wedzerayi's conceptualisations of climate change reflect the interaction between local knowledge systems and technical scientific knowledge:

> *… zviri kukonzerwa nevanoita nezvema industry kunobuda hutsi ikoko. Ndozvatinoudzwa na…Ms [Zvisineyi]. Vana Gogo vanongoti…vanhu vaa kushereketa…varoyi…mishonga…zvimwe…hazvitaurike…mvura haizombonaye*.
>
> [It [climate change] is caused by those who engage with industrial activities that release smoke. This is what Ms [Zvisineyi] tell us. My grandmother says…people are being whammy…witches… sorcery, voodoo…some of these things are unintelligible…it just won't rain].

Cultural norms governing how children talk to their elders presented peculiar challenges to the ways Wedzerayi reconciled the dissimilar sources of information:

> *vana gogo vanongoti zvamadzidza kuchikoro izvozvo nezvatiri kukuudza zvakangofanana… iwe ukazovaitisa nharo vanobva vati uyu handisisina basa naye uyu. Havazotora care newe. Vanongoti, uyu ane nharo uyu. Zvimwe ndongotambirawo*
>
> [my grandmother says what we learn in school and what she says is the same thing…if you argue with her, she loses compassion in you and stops caring for you. She labels you arrogant, so I just accept some of the things she says].

It was not just Wedzerayi who encountered knowledge dichotomies; that was common across the cohort of children participants, as discussed in Chapter 6. Children blamed it on '*vabereki vanenge vane zvavo zvavanoziva…*' [parents have their own ideas]. Samantha, one of the teachers, conceded that intergenerational cognitive dissonance was part of why elders dismissed children's ideas:

> *vabereki vane language yavo saka kazhinji havazoda kunzwa language yedu yatinoshandisa isusu…vane mafungiro avo nemaitiro avanoita zvinhu zvavo. Pamwe pacho unonzwa vachiti mhepo iyi kuita kwayo ndofunga pane munhu afa. Zvimwe zvacho zvichipesana nezvatinodzidzisa ku club.*

[parents have their own language and ordinarily wouldn't want to listen to our language…their own ways of thought, and their own ways of doing things. Sometimes you hear them say the way this wind is blowing indicates someone has died. Some of these views contradict what the club is teaching].

Thus, the explanations offered by science were in some circumstances incompatible with those enshrined in local knowledge systems. This engendered epistemological tensions, as technical scientific knowledge clashed with local knowledge systems. Notwithstanding the desirability for meaningful interactions to synchronise the knowledge systems, children's agency is compromised by cultural conventions that regard vocal children as arrogant, rebellious and disrespectful. There was a shared view among children that convincing elders to adopt children's ideas was nightmarish. Children's responses were punctuated with the phrases:

- *sevana zvinonetsa…* [it's never easy because we are children …]
- *semwana haungaudze vabereki zvekuita…* [as a child you can't tell your parents what to do…]
- *vabereki havanzwisise* [parents just don't get it…]

Children wished their parents could change certain practices but knew unfortunately that they had no place in family decision making. Nelson watched as his family engaged in unsustainable practices because he thought challenging his guardian's decisions might be interpreted as disrespect:

...handingakwanise kuti ndochinja ma plan anenge aita vabereki ... zvinhu zvinoti netsei… Ndinoita kunge, hameno, ndava ku dis-respector here. Saka zvinoti netsei.

[…I cannot change my parents' plans…it's difficult... appears like disrespect. It's complex].

This takes me to the section where I discuss how some of these challenges are linked to a lack of meaningful parental involvement in the ESC.

9.3.2.5 Lack of meaningful parental involvement

Although views varied, there was a wider perception among parents that the home and the school must create healthy environments that enabled children to freely

express themselves. Lydia singled out mutual openness, love and trust as important precursors to successful sharing of information between children and their parents. Lemuel had had a history of following up on his children's schooling to help them succeed. However, Lemuel was concerned about how some teachers' negative attitudes towards parental involvement weakened home-school interactions:

> *Hapana vhiki rinopfuura ndisina kusvika kuchikoro…Ndinotoshuvira kuona murairidzi wemwana wangu ega -ega kuti andiudze kuti zvinhu zvemwana wangu zvakamira sei. Asi dambudziko nderokuti vamwe varairidzi variko vanongoda kutambira vana vechikoro chete. Havadi kutambira iwe mubereki.*
>
> [Barely a week passes by before I go to the school…My wish is to see each one of my child's teachers. But, the problem is some teachers want to entertain just the student. They don't want to entertain the parent].

Save for Nashley and Lesley, children professed superficial engagement in climate change discussions with their families. Some children had been ESC members for up to three years, but no meaningful engagement had happened between children and their parents until the onset of the study. Parents mostly referred to the ESC as "*club yenyu"* [your [the researcher's] club]; they associated the research with the ESC and imagined the ESC as my brainchild. Lesley had been a member for a year, but her mother had not been aware:

> *ndakanga ndisina, kumbovaudza kuti ndine club yandiri kuita*".
>
> [I hadn't told her [Beula] about the club].

For this reason, her mother Beula thought the Eco-Schools Club was recently introduced:

> *zve club izvi makazvitanga manje manje ka izvi pachikoro pano vanga vasingambozviitiba*
>
> [the club is a recent development, there was no such thing in this school].

Beula, Jerina, Ranganayi, Wadzanayi and Sarudzayi became familiar with the ESC only when their children handed them consent forms to participate in the present study. Parental involvement in the ESC was minimal and, in some cases, nonexistent. While the three patrons wished to take the club to the community, Thomas cited

weakened school-community links as a barrier and was grateful that the research project served as a pathfinder to improved school-community collaboration.

> *Vana vechikoro vaiti toda kuwaniswa mikana yokupinda mu community tichitaura nenyaya dze environment asi taishaya pekutangira. Mai ava vakativhurira nzira sokuti iye zvino chirongwa chedu chava kuzikanwa nevabereki…*
>
> [Children have always wanted to take environmental education to the community, but we didn't know where to start. This lady [researcher] paved the way for us, because our programme is now known among parents].

While most parents believed they had a role to play in determining what children learned in school, Jerina and Wadzanayi believed children's learning must be left to the experts. Jerina for example had not seriously engaged her nephew Garikayi but had often mocked and discouraged him from implementing his project of raising guinea fowls as she did not see value in what Garikayi was doing.

> *Handinyatsoona kuti zvingade kuongororwa asi ndinongoona kuti vanhu vanozvidzidzsisa vanenge vakazvidzidzira. Saka iwe kuti uzoongorora nokuzvichinjinura kuti ngazvidzidzwe so handioni zvichinyatsoita… inini kutaura chokwadika, handina pandakanyatsogara naye pasi ndichimubvunza, kana naiye achinyatsotsanangura. Asi chandinoona, akabva kuchikoro, anoda zvekusima miti. Izvozvi izvi ari kugadzira cage yake, hanzi ndoda kuita hanga. Woti uri kusweronetsekana nokugadzira cage unodzidiiko hanga. Zvikanzi nhai tete, ko handi rimwe zuva mukabata hamudye, ndotoseka zvangu kuti aiwa ungabate tungani… asi ndozotoona kuti aiwa, ini ndini ndava kutomukanganisa zvaafunga kuti ndoda kuchengeta hanga regai aite.*
>
> [I don't think there is anything to analyse, I think those people who teach are specialists. So, for you to want to analyse and suggest changes, and propose how to teach, I don't see how it works...to be honest with you, I have never sat him down. But, what I've noticed is, [Garikayi] enjoys planting trees. Right now, he's making a cage, to keep guinea fowls. I asked him, why taking the trouble nurturing guinea fowls. And he said, Aunt, one day you'll eat the

> guinea fowls, and I laughed thinking how many would I require [to serve a meal] …but, I realised, I was demotivating him, since he wanted to keep the guinea fowls, let him do so]

As discussed above, club patrons assumed an expert approach as they delivered packaged solutions to the parents; parents thus mainly viewed children and their activities as just one of those things children do in school. As Engeström (2008) explained, such an approach to development where solutions are imposed on the grassroots do not always work; often the vison is not shared as objects fail to align. Thus, interventions are bound to be rejected or altered in practice. Engeström instead argued for the emergence of new forms of work where grassroots views are acknowledged as legitimate perspectives. Thus, from this perspective, the ESC was challenged to explore strategies for effective collaboration between the home and the school if the ESC was to make a real impact on how community members respond to climate change.

Next, I discuss the learning resulting from the formal school curriculum.

9.4 Formal learning settings and the limits of academic knowledge

Although my initial plan was to study the influence of the ESC, I observed that the formal school curriculum also mediated the learning that took place as people adapted to climate change. Children in their third and fourth years of secondary schooling learned about climate change in the formal school curriculum, mainly during geography lessons. Although Lemuel, Ranganayi and Beula went to school before climate change became a topical issue, these adults said they had some knowledge of the climate and weather patterns as a consequence of the education they received during their formal school years. Since my research site was a secondary school, my analysis of the formal curriculum is limited to the Ordinary Level course.

9.4.1 Silo mentality, limited content, abstract and examinations driven curriculum

Despite government efforts to incorporate climate change into the formal school curriculum, there were concerns among teachers that climate change coverage in the

formal school curriculum was cosmetic and driven by examinations. Thomas explicated:

> *teacher anenge angangokwanisa kuti anenge achitaura nezve climate change munhu either ange ari ku teacher geography, science ne agriculture…mamwe ma subjects ese hakuna...tiri kungovaticha se topic irimo mu syllabus kuti zvingopfuura kuti nda cover syllabus. Kana zvikazouyawo end of year as an exam mwana anokwanisa kupindura mibvuzo*.
>
> [only those teaching either geography, science or agriculture cover climate change… all other subjects have nothing …we are teaching it [climate change] as a topic in the syllabus for the sake of syllabus coverage and for examinations].

There was consensus among the three teachers that the curriculum in its current form was too theoretical and did not adequately prepare children to act on climate change. Samantha suggested a re-orientation of the ways the education system is structured and the ways the curriculum is conceptualised and delivered:

> *education yedu dei yaita from theory to practice. Vana vachinyatsozvitsvaga. Tisangogumira kuti tiri mu class totaura tosiyana nazvo. Panyaya ye climate change tine zvakawanda zvinoita integrate muma subjects, tikaita hukama hwakakwana hatizo eliminate kuti ah izvi ndezve geography, ah izvi ndezve chemistry.*
>
> [the desirable thing is for our education system to move from theory to practice. Children must research. Learning mustn't be classroom bound. Climate change offers possibilities for inter-disciplinary teaching; if we develop positive inter-disciplinary linkages we won't create the silo mentality where we say this knowledge belongs to geography, or chemistry].

It was not just teachers who castigated the formal school curriculum but some parents too, especially the few who had gone through formal schooling up to secondary school level. Beula thought the curriculum was irrelevant to the present needs as she expected the formal curriculum to intervene in mitigating climate change:

toda kuziva zviri pano pa ground pari zvino kuti weather iyi iri kunetsa iyi todii torarama sei. Zviri kubatika zvatinofanira kunge tichiita, history hatirambe asi kwete zvenhoroondo zvatakasodzidza nesuwo kudhara.

[We're not interested in history, but we want to know how to deal with problems on the ground, how do we handle the changed climate and how do we survive under these changed conditions. What practical actions should we take, we don't condemn history, but we're not interested in hearing about stories that we also heard during our school days].

Beula rubbished the current school curriculum as teaching "*nhoroondo*" (stories and histories), implying the school curriculum had not changed much since she left school three decades back. The observations resonate with previous research on the formal curriculum in Zimbabwe which has shown the limitations of the school curriculum in addressing climate change (Chineka & Chabikwa 2015; GoZ 2016). However, by the time the study was concluded, a national curriculum review process was at an advanced stage. Brian, the officer in charge of Geography and Environmental Science in the Curriculum Development Unit reported the new curriculum was designed with the concerns raised above in mind:

In the new curriculum, we've taken climate change and environmental education as cross cutting themes, just mainstreaming it in all learning areas [subjects]. However, climate change concepts are more in learning areas such as geography and agriculture…

It remains to be seen how the new curriculum will fare against the criticisms levelled.

9.4.2 Inadequate teacher preparation, complacency and limited government support

Over and above the inadequacies related to the conceptualisation and delivery of the formal school curriculum, there existed several other constraints, including but not limited to lack of resources and inadequate teacher preparation, as the teachers were trained before climate change became a topical issue. While she argued for the teaching of climate change across the curriculum, Samantha also admitted teachers did not have what it takes to handle climate change:

…ruzivo rwachona hatina… Information iyoyo haisati yanyatsobatika.

[we don't have the knowledge…That information is still missing].

Teachers concurred that the Ministry of Primary and Secondary Education (MoPSE), the parent ministry responsible for education provision in the country, paid lip service to issues regarding learning for climate change mitigation and adaptation. While Zvisineyi described the support from the MoPSE as minimal, Thomas felt totally unsupported:

so far, hapana, hapana, hapana…information on climate change yatinonyanya kuwana, hatiiwane from ma… textbooks atinoshandisa. Tinoiwana fanika muma magazine sekuti maenda kunana [Miombo] kuma workshop. But muma schools chaimo ukada kuzvitarisa, information on climate change hamuna, hamuna, hamuna zvachose!

[so far, nothing, nothing, nothing…the information we have on climate change, isn't coming from … the recommended text books. We get information from magazines, like when we go to [Miombo] for workshops. In the schools, there is no information on climate change, there is nothing, nothing and completely nothing].

Thomas further argued that the felt impacts of climate change had not been dramatic enough to attract the MoPSE's attention:

Ministry of Education climate change muzvikoro haisati yava kunyanyokosheswa zvachose because tikada kutarisa… ichiri kuitwa kunge sechinhu chisina basa nemhaka yekuti maybe hachisi kunyanya kuuraya... zviri kuonekwa semaurayiro aiita HIV and AIDS".

[the Ministry of Education does not value climate change at all because … climate change is treated like a nonevent probably because it has not killed as many people as what happened with HIV and AIDS].

Samantha and Thomas castigated the MoPSE for behaving as if climate change was inconsequential and nonexistent. The teachers made it explicit that the support they received to enhance both formal and informal learning was from players outside the parent ministry, mainly the Environmental Management Agency (EMA) and

Miombo. The situation prevalent in the Vagoni School resonated with research evidence suggesting that although the education sector has been identified as a key enabler for successful climate change adaptation, a revolution in education provision is required if it is to meaningfully contribute to solving the complex environmental and sustainability challenges of contemporary society posed by climate change (Mochizuki & Bryan 2015).

Next, I analyse the learning attributable to the research process.

9.5 Learning from the research process

The design of the research did lead to some unplanned affordances. While the essence of my study was not to influence change but to observe, document and analyse the existing conditions in the community, the ethnographic approach the study adopted created new, albeit temporary, spaces for learning in the interactions between the researcher and other members of the community facing similar challenges.

As already indicated, a critical step in the cycle of expansive learnings is questioning and reflecting on assumptions taken for granted (Engeström 2010; Haapasari et al 2016; Shove 2015). While as a researcher, I was not teaching the participants about climate change, my questions about what they did to secure food sources and how they understood their changing environment provoked critical reflection and curiosity about what was known about climate change. Thus, through the research process, participants gained new knowledge about climate change which they could add to their repertoire of knowledge that would inform their changing practices.

Beula was initially sceptical about the link between deforestation and climate change:

> *ndinopokana nevari kutaura kuti tiri kukanganisa pakutema miti pakubika nokuti kubviranokubvira tichakura taibika sadza mvura yainaya, yainaya sei isu tichibika?*
>
> [I challenge those saying cutting trees for firewood is contributing to the changed rainfall patterns because since time immemorial, we cooked, and it rained properly, how come it rained and yet we cooked?].

Interestingly, in the last focus group, Beula confessed to have changed her views on the linkages between climate change and deforestation:

> *Patakasangana ndakatoona kuti uku kuchinja kwekunze kwekuti tinofanira kuchinja mbeu nokusatema miti. Taifunga kuti kupisa pamwe huswa*

hazvikonzerese, taingoti mvura inobva mudenga. Taifunga kuti kutema miti hakukonzerese. Tanga tisingazive kuti miti ine chekuita nekunaya kwemvura...

[as we met, I realised the climate is changing, we must change what we plant, and we mustn't cut trees. We thought burning grass didn't matter, we believed rains come from heaven. And we thought deforestation isn't a contributor. We didn't know trees influence rainfall patterns…].

Secondly, the research process created a networking platform where participants felt supported and empowered to act in response to climate change from an informed perspective. Additionally, the research process developed the agency not only to question the taken for granted (Engeström 2010; Haapasari et al 2016; 2018), but also to innovate farming practices. Jerina confessed:

handaimbonyanya kuzviisa mumusoro kuti ko mvura iyi zviri kumboita seiko…unenge uchingoti payanaira ipapo ndizvozvo ndopandinongodyarira. Asi mukukurukura ikoko ndomaunozoona kuti zveshuwa zvinhu zviri kushanduka…Taingoona kuti ehe mvura yashanduka asi tisingazvifungi kuti zvakakoshera papiko… chinhu chandakanyatsoona mukukurukura uku chandakanyatsobata inini gore rino … ndakatoona kuti ndoita mimera miviri zvinobatsira…

[I never fussed about the changed rainfall patterns…I just thought I'll plant when it rains. But as we deliberated on these issues, I realised things had changed for real, and things made sense…of course we noticed rainfall patterns had changed, but never bothered to question the implications…what I've taken out of these discussions and what struck me strongly is that this coming season…I will plant in two stages…].

Even more desirably, the research project strengthened social networks for improved learning among people sharing common problems. Fiona was not indigenous to Mutema, and hence was poorly networked socially. As a result of the research process, she learned as she networked:

pane vamwe vanhu vandakanga ndisingambotaura navo but takazongotanga kutaura tese because tasangana… mbambaira tanga tisingazive marimirwo adzo asi takatodzidzawo mukutaura nevamwe.

[there are people I never interacted with, but we are now networked…I didn't know how to grow sweet potatoes, but I leant through interacting with others].

The study interfaced the school and the home, creating spaces for greater intergenerational communication between children and their parents (see section 9.3.2.5). To this end, the research created a forum for discussion about climate change between children and their parents, the school and its community, a gap that may have contributed to the limited voice that children had in influencing their parents about climate change mitigation.

Next, I discuss the salient issues in this chapter.

9.6 Summary: Locating children's agency within the socio-cultural context

In this chapter, I analysed how children learned and how they influenced the adaptations that adults made. The Eco-Schools Club created opportunities for children to learn from their teachers, peers and other professionals in and outside their school. Children learned through projects, excursions, debates, quizzes, drama, song and dance, public speaking, research and competitions, notably the Eco -Challenge. I demonstrated in this chapter that although children's experiences varied depending on their unique personalities and circumstances, their participation in the ESC enhanced the ways they conceptualised climate change and how they responded to its impacts. Children demonstrated agency for climate change adaptation through local innovations implemented both at home and school.

Although children demonstrated technical competence, their parents dismissed children and their activities as child's play. None of the parents mentioned children as a source of learning for climate change adaptation. Only one family mentioned implementing adaptations based on children's initiatives. Children's ideas remained peripheral. In the few cases where children could experiment, their experiments were not incorporated into family decision making regarding what adaptation choices to

adopt. My study thus confirms findings from Williams, et al (2017), who concluded that parents did not see relevance in a project because of its location in a formal school setting; parents viewed it as a school project.

Children's ideas were ridiculed, in extreme cases perceived as madness and only to be taken up at parents' own risk. Children were disempowered to argue with their parents due to cultural norms that labelled children who do so disrespectful and rebellious. Children were disenfranchised to lobby for whole community involvement due to structural issues that made it complex for the Eco-Schools Club to interface with the community. This resonates with research evidence suggesting that while children's agency is acknowledged, it is critical to locate children's agency within the socio-cultural context in which it occurs (Malone 2013). Children do not always succeed in influencing change because adults are the key decision makers in contemporary society (Stephens 2008), where children's agency is not always perceived as socially competent (Malone 2013)

While the ESC offered opportunities for improved learning for climate change mitigation and adaptation, several challenges compromised its effectiveness as a tool to help the community members adapt to climate change. While the club patrons maintained that the ESC adopted a hands-on, minds-on approach, the data suggest that club activities were predominantly characterised by a hands-on approach. Consequently, the ESC became associated with manual work. This created apathy and a sense of resentment from those students who preferred alternative learning styles. Students shunned practical work and were ashamed as they were ridiculed by non-members. Compounding that, both teachers and students prioritised academic activities at the expense of club activities due to policies that valued academic subjects.

Intergenerational cognitive dissonance often engendered epistemological tensions. A major challenge for educational interventions in this community, therefore, is to draw connections between abstract, scientific knowledge and context-specific knowledge to generate practical knowledge that addresses problems of mutual concern (Engeström et al 2016, Mukute et al 2018). While synchronising the two knowledge systems is ideal, the nature of interactions between the school and the home resembled what Engeström (2008a) refers to as coordination: the normal scripted

flow of interactions where individual actors follow their scripted roles while concentrating on the successful performance of their assigned tasks.

Parental involvement remained peripheral for several reasons, including but not limited to: negative teacher attitudes; parents' access to social and psychological resources such as time; parents' assumptions and attitudes about their roles; structural factors related to a school culture that does not value parental involvement. Teachers adopted a specialist perspective as community members passively received climate change knowledge through poems, songs and drama. This in some instances led to disengagement due to lack of a shared vision. These observations strengthen Engeström's (2018) proposal to forge new forms of work, which deprofessionalises specialists and accounts for the creativity of the grassroots.

The design of the research did lead to some unplanned affordances. While the essence of my study was not to influence change but to observe, document and analyse the existing conditions in the community, the ethnographic approach the study adopted, created new, albeit temporary, spaces for learning in the interaction with the researcher and other members of the community facing similar challenges. The study interfaced the school and the home, creating spaces for greater intergenerational communication between children and their parents. To this end, the research created a forum for discussion about climate change between children and their parents, the school and its community, a gap that may have contributed to the limited voice that children had in influencing their parents about climate change mitigation.

While as a researcher, I was not teaching the participants about climate change, my questioning about what they did to secure food sources and how they understood their changing environment provoked critical reflection, and curiosity about what was known about climate change. Thus, through the research process, participants gained new knowledge about climate change.

This chapter concludes my data presentation. In the next chapter, I discuss the findings from the study.

Chapter 10: Summary of findings: Transitioning to a well adaptive community; Possibilities and constraints

10.0 Introduction and flow of chapter

In this chapter I summarise the key findings from the study. Using the analytical and theoretical lenses of Engeström's (1987; 2016) cultural historical activity theory (CHAT) and sustainability transitions, the study has investigated how people in a largely agricultural community in the Global South learn and adapt their everyday practices to mitigate the impacts of climate change on their lives. What has been found in the research as shown in Chapters 5–9 is that while the community can be understood as a single activity system motivated by the need to ensure food security, there are in fact several mutually interacting and sometimes competing and/or conflicting activity systems within this larger activity system that need to be considered.

CHAT suggests that expansive learning can lead to radical and sustainable transformations of an activity system's long-standing socio-material practices (Engeström 2009). Expansive learning is typically brought about by some disturbance to the activity system. This study considered impacts of climate change as disturbances to the everyday practices, particularly those related to food security and livelihoods, and investigated community members' responses to these disturbances as processes of learning. Chapters 6–9 have illustrated how community members learn through adapting their traditional practices (often by trial and error) and producing new practices.

As discussed in Chapter 6, the most profound impact of the changing climate in the research site was food insecurity, and climate change became synonymous with *nzara* (hunger/starvation as a consequence of drought); thus, learning and adaptation was motivated by the imperative to find alternative approaches to food security. *Nzara* became a metaphor for climate change, and the object (Engeström 2010) for adaptation was to evade *nzara*. Ultimately, the value community members placed on any adaptation was judged on its ability to secure yields, and the sustainability of the change was likewise based on the likelihood that it could bring food security.

In the first part of the chapter, I highlight key findings from the study. This is followed by a detailed discussion of the findings, starting with the historically unquestioned rules that were being questioned. I move on to discuss how learning and change took place as community members managed disturbances. This is followed by an analysis of the places and spaces that afforded learning and change before I discuss how climate change adaptation might be conceptualised. I close with a summary of the salient issues from the chapter.

This takes me to the section where I highlight the key adaptations that were taking place as community members pursued this object of evading *nzara*.

10.1 Key findings: Learning and the emergence of new practices

In this section, I capture what I found to be changing. I further discuss how the changes took place in greater detail under each of the headings in sections 1–8.

- Learning new practices – new practices emerged as community members questioned and reflected on current practices; current farming practices no longer yielded the results expected of them; yields kept diminishing, creating severe food insecurity. Food insecurity precipitated changes in practices; the object for adaptation was to evade food insecurity.
- Introducing new tools – innovations in farming technologies were introduced as existing farming technologies were no longer yielding results expected of them.
- Introducing new rules – where, when and what crops are grown changed as climate change was rendering current farming systems less productive. As the unsustainability of farming became apparent, community members shifted away from farming to incorporate other ways of sustaining livelihoods, e.g. social entrepreneurship.
- Reconfiguring the division of labour within the community – a reversal of roles as children worked to support families and reverse mentoring as children assumed the role of technical experts. *Vauyi* (immigrants) adding to the community's cultural diversity and introducing adaptations that challenge dominant community conventions.

- Merging the boundaries of learning – while different spaces and places afforded learning, the boundaries were permeable as information flowed across social networks. Additionally, some sources were deemed more credible than others and some within the community were more likely to be heard than others.
- Innovating – innovations were diverse, representing the diversity found in the community and the socio-material infrastructure available to them. However, community members preferred making their own innovations rooted in context and expertise rather than depending on externally designed innovations from children and external experts. Children expanded their knowledge from the same sources as technical experts, but children's views were regarded as risky.
- Adapting – While practices in a community were found to be transformed, the desired outcome was not always achieved at the first attempt but required continuous revisions due to the intractability of climate change. Adaptation may thus be viewed as an iterative and transformative lifelong learning process. Additionally, the changes taking place were mainly incremental adjustments; rarely did radical transformations occur.

As discussed in the theoretical tools developed in Chapter 3, the point of departure in expansive learning is critiquing the taken-for-granted knowledge and practices. Cycles of expansive learning are continuously driven by the existence of contradictions, dissatisfaction with the status quo and the desire to transform. This takes me to the section where I discuss some of the unquestioned rules in the community under investigation.

10.1.1 Questioning and reflecting as key ingredients to learning

A key stage in responding to a disturbance that influences the possibilities of expansive learning, as acknowledged in CHAT and studies of sustainability transitions, is that of questioning. In other words, critical reflection to make meaning of what is being experienced is a necessary ingredient in learning that could lead to a radical transformation of the current practices (e.g. Haapasari et al 2016; O'Donoghue 2018). The possibility of expansive learning has also been shown in the literature to be dependent upon how local knowledge is valued and reinforced

(Boillart & Berkes 2013; Bolden et al 2018; Naess 2013; Nudumoli et al 2018; Pesanayi 2016). My study has found that community members had developed certain mindsets and practices to guide how they live, how they interact with nature and how they cope with hardships such as drought. When local knowledges, beliefs and taken-for-granted 'rules', such as what crops to plant and when, remained unquestioned, opportunities for learning and change became elusive, even in the case of what would appear as obvious failures of existing practices. However, the study also found that as people questioned these taken-for-granted practices, their agency in effecting change emerged not only in their discourses about their livelihoods but in their actions. Equally, blind acceptance of expert advice was not seen to lead to sustainable change.

The kinds of new practices that were emerging in response to the disturbances were found to be dependent upon what was being questioned and who was doing the questioning. Identifying how power and labour were distributed within the activity systems offered insight into whose voices could be heard, whose tended to be silenced, and what could or could not be questioned. For example, through the Eco-Schools Club (ESC) children learned about the causes of climate change and how to adapt and mitigate its impacts. However, due to their status in families and society, children's voices were suppressed, hence making children fail to question adult practices. As Engeström (1999; 2018) theorised, in any activity system, some actors hold privileged positions and wield power to dictate solutions.

Table 5 summarises some salient examples of what was questioned and learned by community members, as highlighted in Chapters 6–9.

Table 5: Practices under threat and what people learn informally as they reflect on the practices

What is being questioned	What is learned
The efficacy of scientific knowledge in solving climate change	**Climate change exposing the fallibility of science, interventions from technical experts not always yielding expected results: learning to evaluate sources of knowledge; not to take anything for granted and to design own informal experiments**
The efficacy of local knowledge belief systems	Climate change making some of the local knowledges obsolete as they no longer yield expected results: learning to evaluate sources of knowledge, not to take anything for granted and to design own informal experiments
Planting once instead of in stages in light of erratic rainfall patterns	Rainfall patterns becoming erratic, crops failing not because of inadequate rains but because of planting mistimed in relation to the rainfall patterns; learning to plant in stages.
Sole dependence on farming in light of persistent crop failures	Climate change is rendering farming less productive: learning to sustain livelihoods from other sources, e.g. social entrepreneurship, informal trade and informal employment.
Sole dependence on rainfed farming in light of erratic rainfall patterns	Erratic rainfall patterns and temperature extremes placing pressure on rainfed farming, crops persistently failing, yields diminishing: learning new skills and

	techniques of using irrigation under resource constraints, e.g. growing maize in kale fields
The sustainability of slash and burn agriculture in view of their environmental impacts	Uncontrolled burning to clear land for farming eventually destroying forest resources and adding to carbon dioxide emissions: learning to bury instead of burn crop residue, using crop residue for composting and mulching
Heavy and sometimes sole dependence on maize in view of its vulnerability to climate change	Maize persistently failing as it is highly vulnerable to droughts: learning to grow and eat other crops, e.g. foreign but drought tolerant cassava.
Continued growing of drought prone maize cultivars in light of persistent droughts and continued crop failure	Traditional maize cultivars are highly drought prone and late maturing. The optimum rain season is now shorter: learning to adopt new short-seasoned and drought tolerant maize cultivars.
Use of conventional farming technologies e.g. chemical fertilisers, monoculture in light of erratic rainfall and prolonged dry spells associated with climate change	Climate change rendering some conventional farming technologies obsolete; because of the prolonged dry spells, fertiliser burn is common: learning to adopt strategies that promote moisture retention, e.g. zero tillage; compositing, diversifying crops to spread risk.
The optimum planting period, especially when to begin planting in view of the erratic nature of rainfall patterns	Rainfall patterns are shifting, and the first rains are coming later: learning to plant post the 'normal' planting period.

In the next section, I discuss the major ways through which disturbances to the existing system manifested and how learning and change took place as participants managed the disturbances.

10.1.2 Nature of disturbances

As Engeström (1999, 2008a, 2010) theorised, critical reflections of the status quo provoked by climate change-induced disturbances led community members to see contradictions within the elements of the farming activity system. Many of these disturbances were secondary to the change in climate: for example, attempts to question and adapt existing practices were giving rise to novel approaches or to people assuming new roles, thus disturbing the configuration of the existing activity system. Moreover, these secondary disturbances were not mutually exclusive. The secondary disturbances mainly manifested as changes in rules and tools defining normal practices; changes in the community composition and social relations and a reconfiguration of the division of labour. The interconnectedness of the disturbances is illustrated in Figure 18.

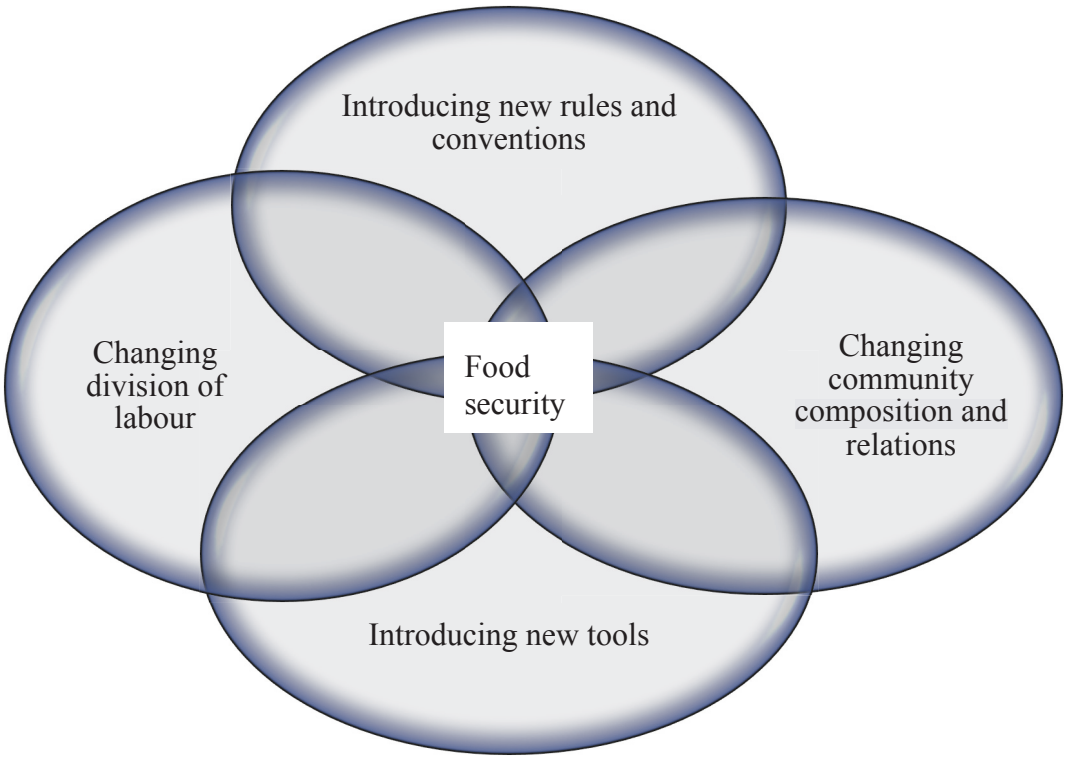


Figure 18: Nature of disturbances

Changes in the climate patterns were found to have led people to break conventions and informally experiment with diverse ideas as they pursued their object of evading *nzara*. Most obvious were new farming practices. Using Engeström's (2008a) disturbance management framework explained in Chapter 3, I illustrate in the next four tables how learning and change were occurring as people managed climate change-induced disturbances. As discussed in Chapter 3, learning in my study context is conceptualised as changes in practices. In each of the tables, the extreme left column captures the disturbance management techniques (source of learning), the middle column illustrates how learning occurred and the extreme right captures examples of the outcomes of learning (changes in practices).

10.1.2.1 Introducing new tools

Table 6 illustrates how learning and change were taking place as new tools were introduced into the farming system. People not only implemented innovations but also evaluated the merits of the innovations, thus learning through reflecting on and transforming their practices. While community members drew upon their local knowledges rooted in context and experience, learning was also seen to occur through the injection of external technical and scientific knowledge (Chapters 7–9). However, technical experts engaged members of the community only superficially. The nature of interactions depicts what Engeström (2008a) called coordination and cooperation (Chapter 8) because the way in which innovations were conceptualised and delivered involved community members only peripherally.

I observed that external experts adopted a technical specialist perspective and exploited existing structures to perpetuate the dominance of technical scientific solutions over locally grown innovations. Technical experts determined the objects for climate change adaptation and stirred an agenda that sought to drive community adaptations in specific directions (Chapter 8). They relied on existing social engineering machinery such as opinion leaders, farmer education and extension services, competitions and field days to perpetuate the dominance of the technical specialist perspective over local knowledges. Where community members were engaged, the goal was not to incorporate their views, but to win them to cooperate (Chapter 8 and 9). The local Agricultural Extension Officer for example explained

that farmers were not compelled to comply with innovations, but labelled farmers who defied specialist advice arrogant, misguided and headed for disaster (Chapter 8).

Table 6: Introducing new tools

Sources of learning	Processes of learning	Outcomes of learning
Using authority: Technical experts using their positions and existing structures such as farmer extension services to introduce innovations in farming technologies	Introducing new content/knowledge and updating current models of farming and environmental management through: Workshops Lectures Informal discussions Competitions Demonstrations Look and learn tours Research and extension Individualised tutorials Supervision, monitoring and evaluation	Skills, competencies and knowledge base expanded, e.g. re-introducing conservation farming, learning to keep weather diaries Miseducation and cognitive dissonance emerged, e.g. rejecting, altering or partially implementing innovations Old tools abandoned, e.g. discontinuing traditional maize cultivars New tools adopted, e.g. growing short-seasoned maize cultivars
Innovating: Community members designing own and trialling innovations proposed by external experts	Reflecting on and questioning existing practices through:	New tools adopted; e.g. trialling short-seasoned maize and nurturing own seed.

Sources of learning	Processes of learning	Outcomes of learning
	Implementing and evaluating informal experiments	New and old simultaneously adopted e.g. growing both new and old maize cultivars
Complaining: **Community members expressing concerns regarding innovations, e.g. new seed varieties, but no formal structures for airing grievances**	Critically evaluating own practices Evaluating innovations recommended by technical experts	Further innovation and/or innovation abandoned if new tools do not yield satisfactory results
Negotiating: **Negotiating meanings and spreading risk e.g. new seeds commonly shared among peer networks to manage risk and to create a moral economy**	Reflecting on and modelling practices of more successful farmers Eavesdropping on public conversations Observing and coping from a distance Asking questions, debating and deliberating through peer and social networks	Knowledge base expanded, e.g. understanding the characteristics of new seeds Risk management incorporated e.g. sharing seeds; learning from others, especially more successful farmers; and starting small to manage risk. Changing and continuous nature of learning is acknowledged

Additionally, climate change interventions were driven by multiple, loosely connected organisations, each of which considered its own primary aims. In some cases, this led to miseducation as interventions were fragmented. While civil society organisations enabled learning for climate change adaptation, their approach to development differed from governments' developmental trajectories. Whether they collaborated with government or worked in isolation, NGOs incentivised communities through food handouts and cash transfers. Government, in contrast, did not normally incentivise, firstly because they could not afford it and secondly, because they doubted the sustainability of such developmental approaches. Thus, government-driven initiatives risked suffering neglect due to ruptures in the intersubjective understanding of and flow of information (Engeström 2008a) between the grass roots, government and civil society.

Even more important, in some instances, the interventions proposed by technical experts were not congruent with the community's life-worlds. As expected, I observed that this misalignment of objects for adaptation leads to neglect or partial uptake of innovations. While both experts and community members' activities were oriented towards the goal of climate change mitigation and adaptation, the objects of specific interventions pursued by some expert groups were not always what members of the community regarded as their most pressing needs. Roncoli (2006) observed that often farmers think in terms of the short term and the local but scientists think in terms of the long term and the global. While technical experts emphasised environmental sustainability, community members' most immediate needs were to evade starvation.

Engeström (2008a) warned that when objects fail to align, there are bound to be some ruptures in the normal flow of work. Thus, community members' everyday knowledge and practices were observed to come into tension with scientific and technical knowledge when external experts entered their community to provide advice as shown in Chapters 8 and 9, creating cognitive dissonance which in some instances led to disengagement. When interventions failed to acknowledge the community members' experiential and contextualised knowledge systems, the experts were bound to be misinterpreted, ignored or altered in practice.

This study has found, as did previous studies (e.g. Lotz-Sisitka & Mukute 2012; Nidumolu et al 2018; Pesanayi 2016), that local community members possessed a wealth of local knowledges on climate change and local sustainability issues rooted in context and experience, which they drew upon as they adapted to the impacts of climate change. The findings confirm that people find solace in doing what is collectively perceived as right. People tended to model their adaptations on what they hear and see others doing. Neighbours, family, friends and members of the wider community serve as important sites for learning and change. The practices of others thus form a key mediator and an important site of learning for climate change mitigation and adaptation.

Additionally, learning happens through people's self-critical evaluation of their own practices as the taken-for-granted ones fail to yield the results expected of them. In this way, the informal learning and change in a community is collective and takes place within a collective zone of proximal development (Engeström 2000; 2010); until this ZPD is established, expert advice and information alone cannot provoke learning.

10.1.2.2 Introducing new rules and conventions

A pervasive finding from the study was that while adjusting practices was important, successful adaptation additionally entailed developing distinct dispositions towards the practices. As the participants would say, "*iye zvino haungodayare, unotanga wamboongorora*", literally translated to mean 'you can no longer take planting for granted, you first assess and evaluate feasibility'. The findings suggest that successful adaptation entails a high sense of self-organisation, reflexivity, flexibility and innovativeness (Chapters 7 and 8). While in a few cases adaptation to climate change has been found to occur as an intentional and planned process, it has also been found to occur incidentally as people negotiated changes in their everyday lives.

Table 7 summarises the learning that occurred as people managed the disturbances to their normal practices due to changing rainfall patterns.

Table 7: Introducing new rules

Sources of learning	Processes of learning	Outcomes of learning
Innovating: **e.g. Reconfiguring planting regimes**	Learning accidentally and incidentally as people experience life	Planting regimes reconfigured e.g. 'late planting' and planting in stages Ways of growing crops changed, e.g. scaling up irrigation to include crops normally grown under rainfed Polyculture adopted
Avoiding confrontation: **Some innovations are acknowledged but ignored, e.g. small grains**	Disengagement Following blindly Reflecting on own and others' practices	Innovations that may offer advantages ignored because of typical constraints, e.g. they are not convenient, are regarded as primitive, are not the preferred food choice; there are no markets, resources and technical competence
Complaining: **Rainfall patterns becoming confusing, even technical experts failing to predict events with certainty**	Questioning the taken-for-granted knowledge and practices through: Observing and reflecting on natural systems, e.g. rainfall patterns Informally experimenting	Sources of knowledge evaluated as both science and local knowledge systems no longer yielded results expected of them Focus shifted from farming: e.g. social entrepreneurship,

Sources of learning	Processes of learning	Outcomes of learning
	Analysing historical trends in yield patterns	Informal trade, Informal employment Acknowledgement that adaptation is but trial and error learning
Engaging in open conflict: Knowledge power relations among social circles and between technical experts and the community members	Exchanging information Deliberating Discussing informally Asking questions Informing Discussing intergenerationally between children and parents	Skills, competencies and knowledge base expanded: Kinds of crops grown changed Drought tolerant crops introduced, e.g. cassava Small grains re-introduced Way crops are grown changed, e.g. planting late and adopting Conservation farming technologies
Negotiating: Negotiated meanings between married couples, children and their parents, technical experts and the community members as innovations are introduced	Exchanging information Deliberating Discussing informally Asking questions Discussing intergenerationally between children and parents	Expanded skills, competencies and knowledge base: New farming technologies introduced, e.g. re-introducing conservation farming techniques Location of the farming activity

Sources of learning	Processes of learning	Outcomes of learning
		changed, e.g. wetlands and streambank farming
Accepting responsibility: e.g. Lack of foresight, poor planning and planting out of synch with rainfall patterns contributing to food insecurity	Critically evaluating own practices	New skills learned e.g. Forward planning; sourcing inputs and preparing land in advance as optimum planting period has been shortened; keeping weather diaries (Sometimes yields diminish due to poor planning); diversifying sources of livelihood e.g. through informal trade
	Paying attention to and reflecting on past, present and future trends in crop yield patterns	Focus shifted from farming, e.g. Social entrepreneurship; informal trade; informal employment

10.1.2.3 Changing community composition

Table 8 illustrates how some families who were importers of knowledge introduced foreign but sustainable innovations that have been incorporated by indigenous members of the community.

Table 8: Importing knowledge

Sources of learning	Processes of learning	Outcomes of learning
Innovating: ***Vauyi* importing literacies that are integrated into their farming practices**	Observing and reflecting on family history and tradition passed on across generations Informally experimenting	Expanded skills, competencies and knowledge base: Shifted to orchard farming New rain water harvesting techniques introduced, e.g. growing plants on raised beds Maize substituted by cassava as the main food
Negotiating: **Initially imported by *vauyi*, some practices e.g. cassava growing learned by indigenous members of the community as they interact with the 'foreigners'.**	Reflecting on and modelling practices of immigrants	Expanded skills, competencies and knowledge base, and changed attitudes: Changed dietary composition/food preferences Diets restructured to include foods brought by *vauyi*, e.g. cassava.
Engaging in open conflict: ***Vauyi* challenging cultural conventions, e.g. market gardening and heavy reliance on maize**	Reflecting on and questioning cultural conventions	New perspectives into farming and food choices emerged, e.g. foreign but drought tolerant cassava
Using authority: ***Vauyi* hold privileged positions in modelling imported literacies e.g. cassava growing.**	Reflecting on and modelling practices of immigrants Discussing informally Joining look and learn tours	Foreign crops introduced, e.g. foreign but drought tolerant cassava slowly adopted by other community members

Although ethnomethodologies such as what this study drew upon focus on the situatedness of the everyday practices in the research site, the histories of some of the

families in this study have shown that not all local practices are necessarily locally produced; aspects of everyday practices in one context can 'travel' to other contexts (Brandt & Clinton 2002). *Vauyi* were found to be open to change because they were not as firmly bound to the community's cultural conventions as were the indigenous community members. Of significance is how *vauyi* challenged the growing of the community's staple, a practice that some indigenous members of the community would not trade for anything.

As discussed in Chapter 7, the Mheres served as local 'experts' in cassava farming; other members of the community not only learned from this family, but also received free seed to start their own experimental plots. Using the lens of Engeström's (2008a) three Cs typology, the nature of the interactions between *vauyi* and locals indicated transitions from coordination to reflective communication. There was evidence suggesting that both *vauyi* and some locals were reconceptualising scripted rules regarding the centrality of maize as a staple. Through their interactions with the locals, meanings around the staple were negotiated, and there was evidence of a shift in objects from increasing the yields of maize to diversifying the crops grown and hence food choices. The Mheres did not force cassava on the locals; their crop served as a disturbance to the local knowledge systems that prompted learning and change. The family capitalised on their expertise and the willingness of other community members to unlearn old practices and learn new practices. This joint learning influenced the expansion of the ZPD as cassava farming was slowly integrated into the adaptations as people pursued their shared object of evading *nzara*.

10.1.2.4 Reconfiguring division of labour within the community composition

While children showed technical competence, cultural norms regarding the position of children in families and the community meant children were marginalised in community affairs.

Table 9 summarises the learning that takes place as a consequence of children's agency.

Table 9: Reverse mentoring

Sources of learning	Processes of learning	Outcomes of learning outcomes/Emergent practices
Negotiating: **Isolated cases of parents adopting advice from children**	Intergenerational discussions between children and adults	Expanded skills, competencies and knowledge base, changed attitudes: Social roles reversed as adults acknowledge children's ideas (very rare); and children working to support families
Innovating: **Children experimenting with ideas, notably orchard farming**	Project based learning as children implement at home what they learn at the ESC Learning through peer networks, competitions, field visits, debates, quizzes, making models, practical work, song, poems and dance.	Expanded skills, competencies and knowledge base: Children experimenting as they champion innovations both at school and at home, (projects with no significant impact on the household's overall food security) mainly tree planting, vegetable and herbal gardening and reducing burning

Sources of learning	Processes of learning	Outcomes of learning/Emergent practices
Complaining: Children voicing concerns, but their ideas generally side-lined and ridiculed as nonsensical.	Sharing information through intergenerational discussions between children and adults Authoritative silencing as children observe cultural norms	Children's agency thwarted as they felt they had no control over household decision making and for fear of being labelled arrogant and deviant.
Avoiding confrontation: **Parents acknowledging children's ideas but not acting on them**	Exchanging information through intergenerational discussions Silently engaging with innovations	Children's ideas acknowledged, but shelved Projects silently implemented by children without much parental involvement
Sources of learning	**Processes of learning**	**Outcomes of learning**
Engaging in open conflict: Assertive children challenging parents' decisions	Exchanging information through intergenerational discussions between children and adults Critically evaluating family practices	Expanded skills, competencies and knowledge base: Children challenged cultural conventions and assumed the role of technical experts
Using authority Children assuming the role of technical experts	Children informing and modelling solutions	Expanded skills, competencies and knowledge base: Reverse mentoring in **i**solated cases where parents acknowledged children knew better than them and allowed them to inform

Where children were allowed to experiment, parents did not regard these projects as important because they had no significant impact on the household's overall food security. Children therefore experimented independently of the other household members, and in as far as farming was concerned, children's ideas and knowledge generally posed little disturbance to adults' farming practices. Thus, contrary to the optimism about intergenerational learning in research literature from the Global North (e.g. Cutter-Mackenzie & Roussel 2019; Haidaa et al (in press); Fielding 2011; Hass and Collins 2018; Istead and Shapiro 2014; Williams et al 2017), this study suggests that this optimism may need to be attenuated in communities such as this in the Global South.

This takes me to the section where I discuss the spaces and places in the community that afforded learning.

10.1.3 Permeable the boundaries of learning

Community members were found to interact with knowledge from three broad categories of sources (Chapters 6–9):

1. abstract scientific knowledge as technical experts intervene;
2. children, through the ESC, assuming the role of technical experts; and
3. local knowledge rooted in context and experience.

However, as discussed in Chapters 7, 8 and 9, the boundaries between the knowledge sources were permeable. Information originally shared through technical forums flowed into social circles. Additionally, some traditional practices like conservation farming technologies were being re-introduced by external experts. Even more importantly, the data highlighted the incompleteness of each of the knowledge systems in offering solutions to the climate crisis (Chapters 7–9), rendering monolithic approaches and any single knowledge system inadequate. Thus, the study suggests that the adaptations necessarily have to be a blend of different knowledge systems. The interactions of the diverse places and spaces for learning is represented diagrammatically in fig 19.

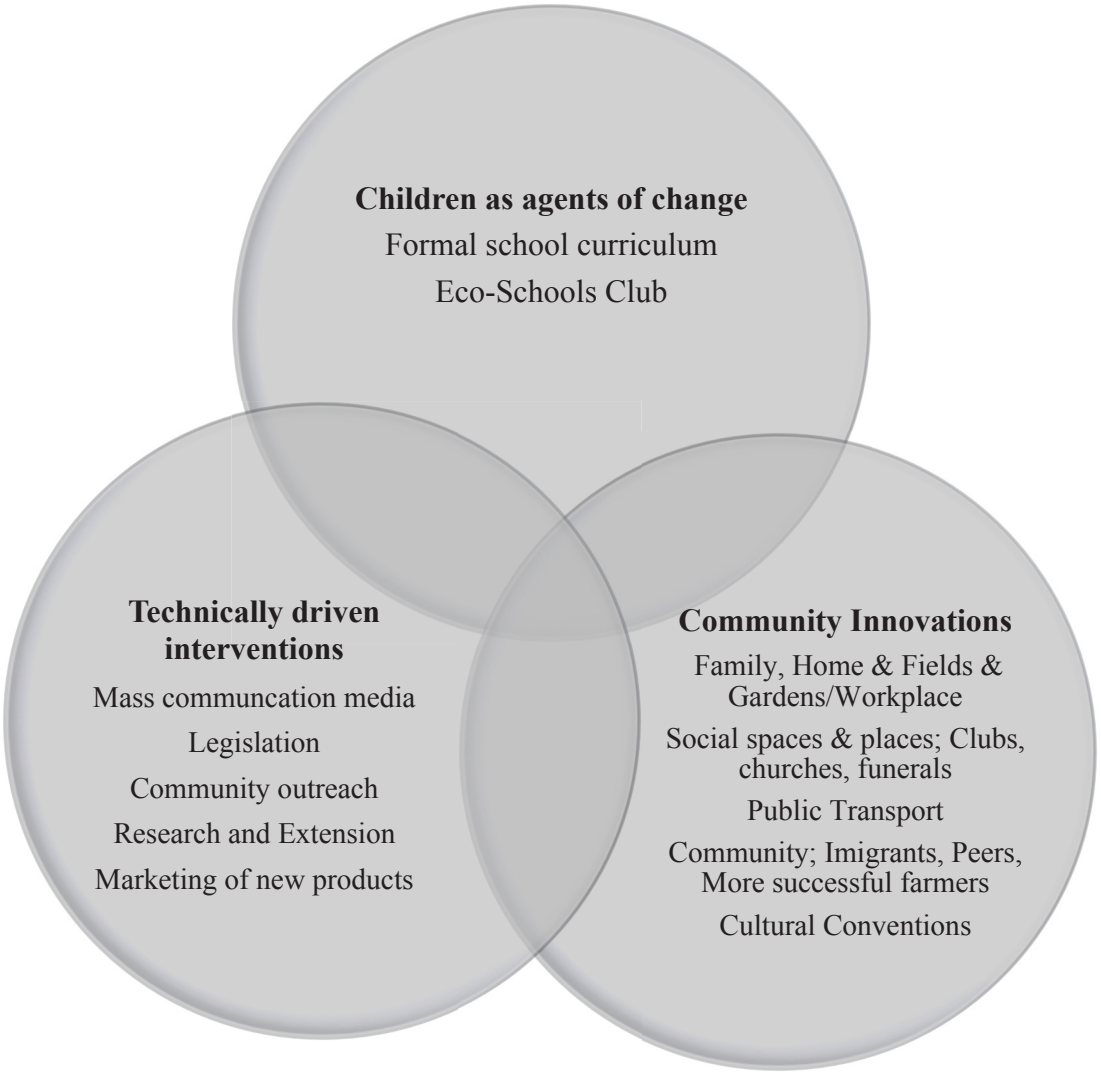


Figure 19: Permeable boundaries of learning

While all of these spaces and places create affordances for learning and change, some are deemed more credible than others. Community members were observed to be cautious of adopting changes which had the potential to further compromise their chances of survival. Knowledge was therefore questioned even when it originated from trusted sources because even traditionally credible sources of information were beginning to be questionable. This had resulted in the rejection and modification of some technically driven interventions to manage risk. Additionally, technically driven interventions sometimes manufactured new risks that further compromised people's vulnerabilities to climate change (Chapter 8). Technical scientific knowledge was thus viewed with skepticism and innovations based on such knowledge were adopted with caution.

Information and advice carried high stakes and was thus subject to critical scrutiny, sometimes revealing conflicting information between various sources. Some of the considerations people gave included the following:

- **Utility**: the worthiness of knowledge is judged on its practical merit, mainly for improving yields of the staple crop (Chapters 7, 8 and 9). Information was more likely to be adopted if it had already been tested and trialed and there was tangible evidence to support its merit, e.g. more successful farming, individual experimentation or successes over multiple generations.
- **Authority**: people holding positions of authority in society, e.g. politicians, government and traditional leadership and seasoned technical experts, e.g. Agricultural Extension Officers, wield authority to dictate solutions (Chapter 8).
- **Authenticity**: information coming from trustworthy sources and people, e.g. the radio and church ministers, was generally regarded as authentic; information from children was perceived as risky, while that from business could be perceived as a marketing gimmick (Chapters 7 and 8).
- **Familiarity**: Innovations were more likely to be accepted if they easily aligned with what was already known (Chapters 7 and 8).

These criteria, however, were not universal; they were applied contingent upon individual households' experiences, available resources and internal social relations. I observed the centrality of worldviews in influencing learning and change. Meaning-making processes were mediated by several tools and symbols, including values, beliefs, language, history, cultural conventions and rules governing normal practice (Chapters 5 and 6). These meaning-making tools complicated the learning, including the community members' conceptualisation of climate change, because for some, the scientific view of climate change contradicted their own understanding of their environment (Chapters 6 and 8).

Some scholars have argued that climate change often does not align with traditional worldviews, and hence creates cognitive dissonance (Adger et al 2012). While science explains rainfall patterns in terms of relief patterns and atmospheric processes, local cultural beliefs in this community associated rainfall with *Mwari*

(God) and *Vadzimu* (ancestral sprits). Thus, some members saw solutions to the climate crisis as lying with *Mwari*, who has the ultimate solutions to men's problems. This in some instances created both anxiety and apathy among those participants with strong religious beliefs, while in the majority of cases, it provoked questioning about the efficacy of science as a universal truth. In extreme cases, participants dismissed the role of science and human agency in addressing climate change and argued instead that it was up to *Mwari* to resolve the climate crisis (Chapters 6 and 7). Thus, some took a fatalistic approach to adaptation as they surrendered everything to invisible superpowers.

This takes me to the section where I examine the nature and extent of the innovations community members engaged with.

10.1.4 Innovating in diverse ways

Chapters 5 to 9 have shown how the 'normal' practices of each family were shaped by the family's histories and relations inside and outside of the community and their material resources. Although the boundaries of learning are permeable, the study has found that members of the community preferred designing and implementing their own innovations rooted in context and experience rather than wholly adopting externally designed innovations based on foreign ideas. Where people adopted externally driven interventions, they did so only after an iterative process in which either people experimented on a smaller scale, or they had seen others successfully implementing similar innovations. As discussed in Chapters 7 to 9, it could take several years before an innovation was formally adopted.

Some families were more inclined to innovations than others and each household's uniqueness determined the nature and extent of innovations adopted. Those families daring enough and confident in their abilities as innovators broke the rules and introduced innovations that defied science and or cultural conventions (Chapters 7 and 8), e.g. shifting planting dates. In a community where agriculture formed the backbone of livelihoods, such defiance of the scripted practices was akin to lunacy and was, in some cases, a source of tension between married couples and between technical experts and the community groups (Chapter 7).Some adaptations were common across all households, but some were unique to specific households owing

to the diversity that exists in a given community as explained in Chapter 5. Table 10 summarises the adoption by the eight households of key innovations that were observed in the community.

Table 10: Nature and extent of innovations

Nature of Innovations	Community Innovations	External Expert Innovations	Child Driven Interventions
Reducing hectarage	8	0	0
Working and trading informally	8	0	0
Restructuring meals and meal timetables	8	0	0
Reducing food waste	8	0	0
Planning and organisational skills	7	1	0
Practising polyculture	6	2	0
Sharing seeds	6	0	0
Engaging with social entrepreneurship	6	0	0
Growing foreign but drought tolerant crops	4	0	0
Harvesting rainwater	4	0	0
Practising conservation farming	3	0	0
Nurturing own seed	3	0	0
Raising small animals	3	0	1
Reducing burning of crop residue	3	1	4
Cultivating along streambanks	2	0	0
Turning to the wild for survival	2	0	3
Establishing orchards	2	0	2
Irrigating	2	0	0
Planting late	1	4	1
Growing short seasoned maize	1	4	0
Planting in stages	1	4	0
Farming in drained wetlands	1	0	0
Keeping weather diaries	0	1	0
Children working to support families	0	0	2

Among the key factors influencing the adaptations people made are the following:

- Access to income and other resources, e.g. land, water and electricity: Some innovations were beyond the reach of many, e.g. installation of irrigation infrastructure. While some appreciated the benefits of irrigation, limited access to water and electricity forced them to restrict hectarage under irrigation. Land meant for farming was being converted into residential due to the influence of a nearby growth service centre. This restricted the diversity of crops grown as households prioritised maize, the staple crop, despite its vulnerability to drought.
- Geographical location: e.g. those living close to perennial water courses had unlimited access to water for irrigation while those living further inland relied on shallow wells that dry up in summer forcing them out of irrigation.
- Subjective experiences: Sometimes people stumbled into solutions accidentally as they experienced life; different people had different life encounters, hence unique adaptive tools. People developed unique resilience and creativity owing to histories of overcoming obstacles; e.g. loss of a job, past encounters with drought, living on less and being orphaned and or widowed at a tender age.
- Exposure to other communities and cultures: e.g. those well-travelled, with family outside the confines of the community and of foreign descent incorporated foreign concepts and technologies in their adaptations.
- Social networks: Knowledge was often shared among peer networks and peer networks influenced the adaptations people made, especially when, what and how to plant. Sharing of new seeds was especially common in peer networks.
- Family composition, histories and traditions: The family had a strong influence on what was valued as worthwhile knowledge and often knowledge was passed down across generations; power relations between married couples might derail uptake of innovations. In a highly patriarchal community, women's ideas were often under-valued.

- Age, physical well-being and caring arrangements: Some innovations like zero tillage entailed heavy manual work making them unattractive to the feeble, elderly and caring mothers.
- Food preferences: While small grains offer a viable alternative to maize, maize was generally preferred to small grain meals, which were said to be unpalatable and unsightly and to cause bloating, loss of appetite and/or diahorrea.
- Personality: Those more enterprising and creative devised more innovations through trial and error. Some individuals were more open minded and thirsty for knowledge than others, while some displayed defiant tendencies; some were more receptive than others, some were quicker to embrace change than others while others took time to analyse things before they would embrace change. The confident and daring attempted innovations that defied conventions. All these personality traits influenced the nature and extent of each household's adaptations.
- Cultural conventions: Religious and cultural beliefs had a strong bearing on what people believed to be true, hence the adaptations they made. Those who believed that a solution to climate change lay with God adopted a carefree attitude. Despite acknowledging advice from technical experts as reliable, having strong Christian beliefs made people view technical advice with scepticism. There existed cultural conventions enshrined in myths and taboos to guide land use and general environmental management; e.g., interfering with the natural state of wetlands was taboo. The kinds of crops grown and farming methods adopted were heavily influenced by cultural conventions.
- Legislation and environmental considerations: Despite the inadequacy of existing policies in guiding meaningful adaptation, government policies played a critical role in promoting learning for climate change adaptation. While legislation was sometimes disregarded, legislation that guided land use and general environmental management did exist.
- Government and donor aid: People tended to use what was made available to them because of poverty and because they trusted government and donors as

authentic sources of aid. Government and donors often donated agricultural inputs including maize seed to cushion the more vulnerable members of the community from food insecurity. Such seed was shared among social networks or in some cases sold cheaply. Eventually, it was this cheap and free seed that was commonly grown regardless of its characteristics. This perpetuated the cycle of poverty and food insecurity as most of the donated seed was the long-seasoned type and did not get to the people on time. There was also a view that government would not act in ways that compromised its people.

- Market dynamics: In typical cases where people were sustained by agriculture, crops with no ready markets, e.g. small grains, were neglected despite being drought tolerant. For the same reasons, new crops were generally snubbed.
- Convenience: Innovations were side-lined if they did not offer convenience, e.g. people would rather grow maize than small grains, for maize was less labour intensive.
- Technical competence: Driven by their organisational mandates, external experts from government, business and civil society steered different agendas that influenced the kinds of adaptations people make. E.g., the adoption of short-seasoned maize cultivars was strongly influenced by Agricultural Extension Officers, seed manufacturing companies and their marketing agents. People's adaptations are limited to what they know.
- Relationship with the community: While the original members of the community were locked up in cultural conventions defining normal practice, those families with a history of living outside the community defied community conventions as they challenged the concept of maize as a staple and gardening as the prime economic venture and introduced foreign but drought tolerant crops e.g. cassava while at the same time diverting attention from gardening to orchard farming (Chapter 7 and 8).
- Community cohesiveness: Some adaptations demanded collective action. The success of small grains farming for example required a greater sense of

community collaboration to spread the risk of crop losses due to predatory birds.

- Perceived status in society: Some innovations were snubbed as they were perceived as primitive and a preserve for the poor, e.g. conservation farming.

Thus, the material and symbolic infrastructure available to each family, coupled with the rules enshrined in cultural conventions and legislation, influenced each household's adaptive capacity. However, I observed that these factors did not work in isolation and neither did they work in a linear fashion. People may have had access to water but may not have had irrigation machinery. While legislation to guide sustainable adaptation exists, it may not be respected if people do not have alternatives. People may have the technical competence but may not have the resources to execute their plans. Some adaptations may be sustainable but may not be the preferred choice or may be unsuitable for certain groups of people, e.g. the elderly. A salient view from the research was that there seem to be no straightforward solutions and no one-size-fits-all solutions (see tables 5-8).

In the next section, I discuss in detail how the adaptations taking place might be conceptualised.

10.1.5 Conceptualising adaptation

While practices in a community were found to be transformed, this did not occur through a linear process; rather, the process involved a web of interconnected factors that were mutually constitutive because practices are interlocked (Shove & Spurling 2013; Spurling et al 2013). Thus, deciding on what adaptation route to take was mediated by a plethora of factors as discussed above, which in some cases complemented each other while in others they competed with and contradicted each other. Maize was highly drought prone, but it was the preferred food of choice and an identity marker. Most salient was the unpredictability of events forcing people to adapt their everyday practices, and the uncertainty of the impact of the adaptation. For community members, this meant that innovations were always a gamble rendering each an effort in trial and error. From a CHAT perspective, what eventually emerged as changes in practices was contingent upon several contestations that emanated from the multidimensionality of the activity systems and the diversity of

mediating artefacts available to the actors. In figure 20, I capture how the adaptations taking place might be visualised.

10.1.5.1 Adaptation as a complex interaction of a plethora of factors

While the object for adaptation might appear straightforward, I observed that adaptation was complicated by several socio-cultural political, economic and physical factors; being food secure means more than just having food.

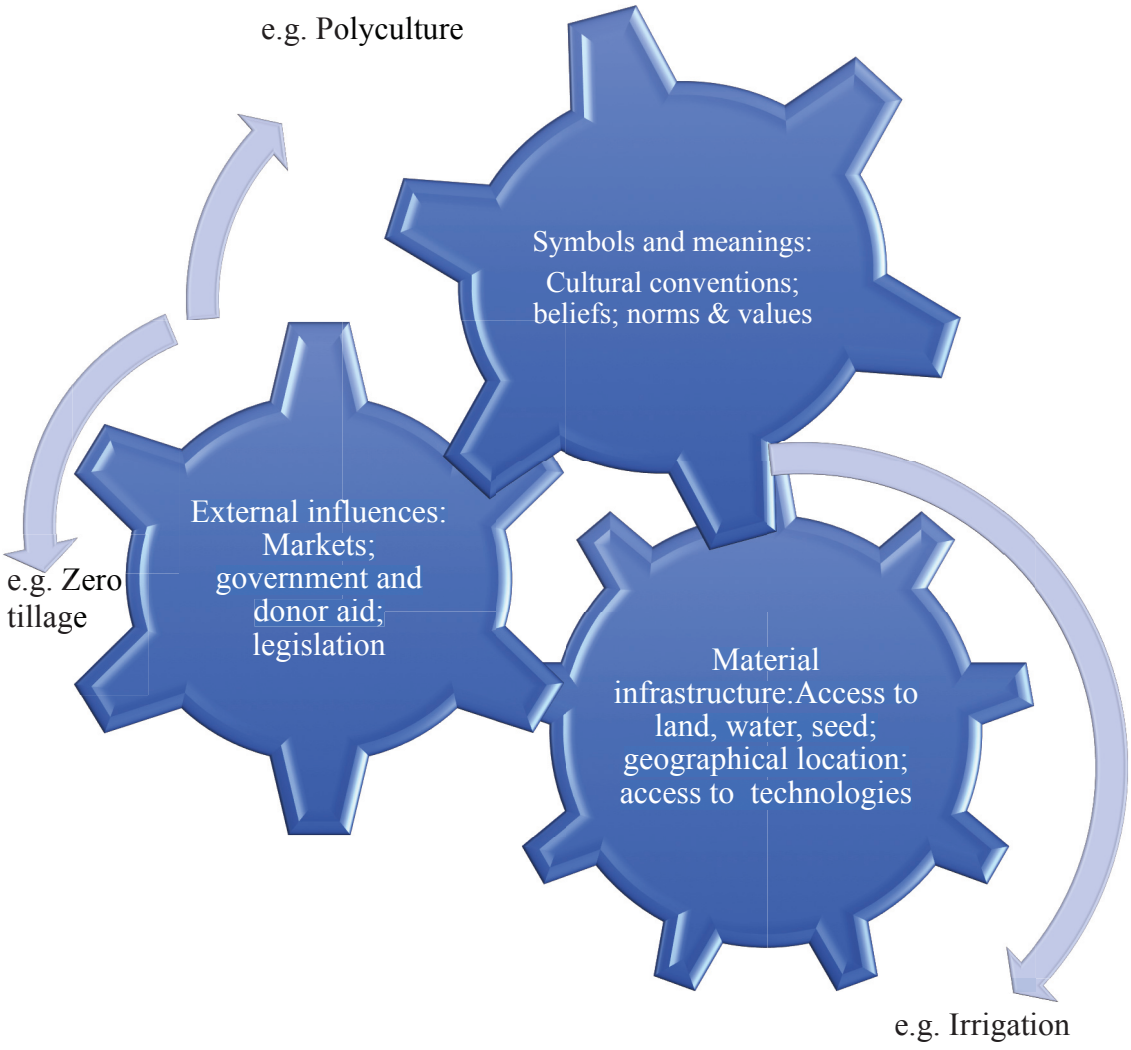


Figure 20: Adaptation as a complex interaction of a plethora of factors

As discussed in Chapters 5 and 7, cultural conventions restricted the meaning of food security to security of sufficient yields of maize, the staple crop. A focus on the material practices would suggest that adaptation is directed at improving food

security; however, this study has found that adaptation also has social implications on family dynamics and stability as well as social relations in the wider society. As illustrated in Chapter 5, climate change is a major source of socio-economic insecurities and contributes to a weakening of the social fabric. The arrows in Figure 20 indicate that depending on the outcome of the interactions among several factors, adaptation can take several routes, each with unique experiences and outcomes (see tables 5-8). While every household pursued a common object, they used different combinations of tools to achieve food security: one family grew both the long- and short-seasoned maize varieties, abandoned chemical fertilisers and staged their planting. Another family adopted short-seasoned maize, grew the maize on raised beds to harvest rainwater, intercropped maize and beans to spread risk and added cassava to their cropping. Another family continued growing the long-seasoned maize, but abandoned chemical fertilisers, reduced hectarage, reduced plant spacing, introduced irrigation and planted earlier than usual and in stages.

Figure 20 illustrates that some practices were more difficult to change than others. Some take longer than others, for example the decision to focus attention away from maize farming and to shift planting dates proved more difficult than the decision to abandon monoculture. I observed how existing systems, which may be unsustainable, are stabilised through lock-in mechanisms which create path dependency, making it difficult to dislodge existing systems (Geels 2011; Shove & Warde 2005; Spurling et al 2013). Additionally, some innovations demand more material resources than others. For example, setting up irrigation infrastructure has financial implications, but changing meal timetables has no cost implications.

10.1.5.2 Adapting as an iterative lifelong learning process

A solution to one problem may create new risks, as in the case of adopting a new variety of maize seeds discussed in Chapters 7 and 8; in CHAT terms, this could be understood as cycles of expansive learning that were ignited by new and emerging disturbances. As an example, Figure 21 illustrates the cycles of expansive learning experienced by the community members when they experimented with recently introduced short-seasoned maize varieties. The figure shows how the experimentation underwent the various stages of expansive learning identified by Engeström in his model of expansive learning (1999). While practices in a

community were found to be transformed, the desired outcome was not always achieved at the first attempt but required continuous revisions due to the intractability of climate change. Adaptation may thus be viewed as an iterative and transformative lifelong learning process.

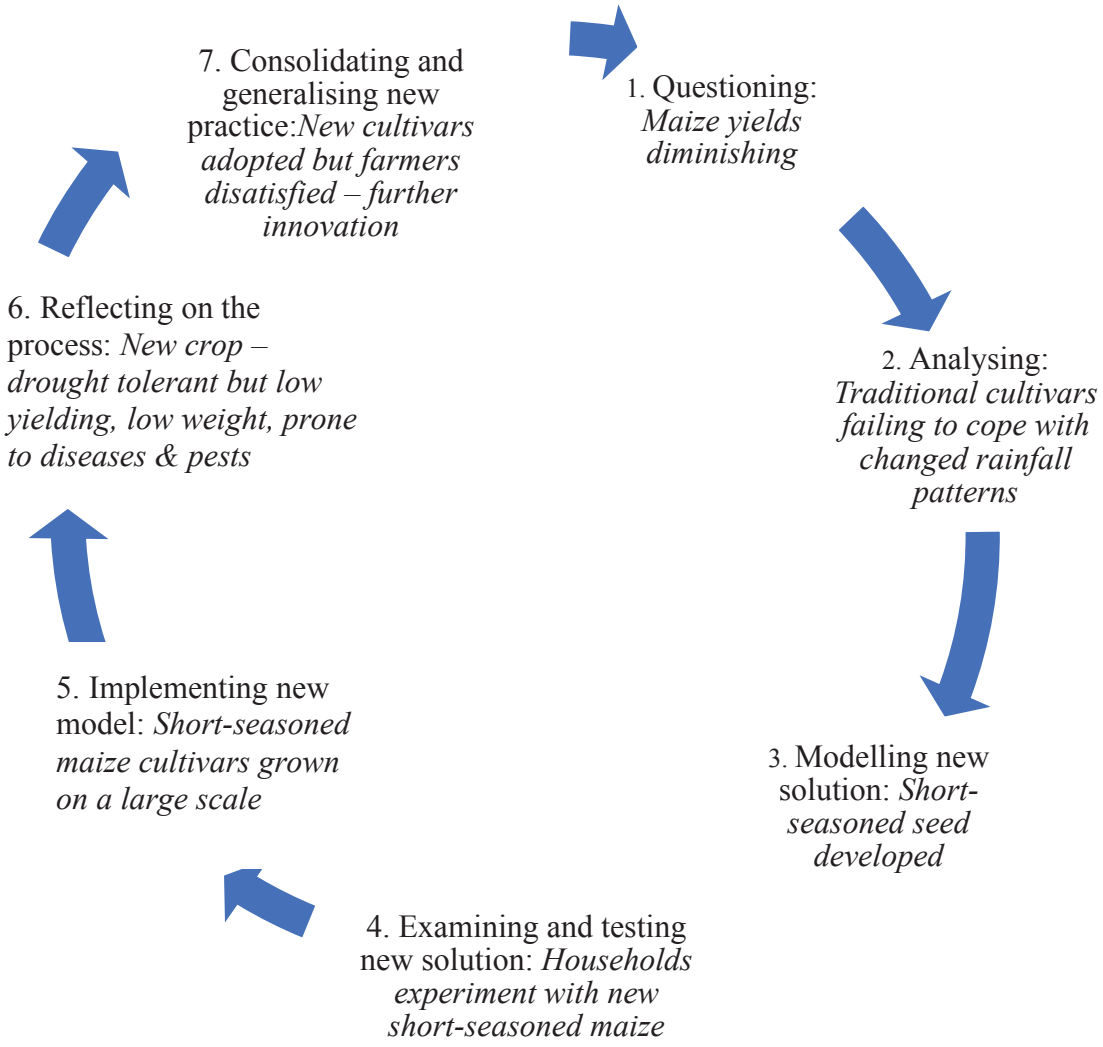


Figure 21: Cycles of expansive learning as participants trial new maize cultivars

Sometimes cosmetic changes were introduced as an expedient measure to attend to an immediate problem. References for instance were made to "*gore ratakadya hacha*" (the year we ate *hacha*), suggesting that once the situation returned to normal, the innovation would be abandoned. Additionally, if people were economically comfortable or had resources in abundance, they adopted a *laissez-faire* approach. Deliberate and labour-intensive measures such as rainwater harvesting and related

water conservation technologies were commonly practised by those with reduced access to water. I observed that radical, sustained change occurred when existing practices became unviable and people had little alternative but to engage with new knowledge and approaches. The study suggests that despite the scientifically established imperative for radical steps to mitigate the risks of climate change, transforming long standing practices, particularly where livelihoods are at stake, can be expected to be incremental as the collective ZPD is expanded at each step.

In the next section, I present a summary of the chapter.

10.6 Summary: Affordances and barriers to adaptation

In this chapter, I presented the key findings from my study which investigated how people in a largely agricultural community in the Global South learn and adapt their everyday practices to mitigate the impacts of climate change on their lives. Using the analytical lens of CHAT coupled with sustainability transitions orientations, the study illustrates that expansive learning can lead to radical and sustainable transformations of an activity system's long-standing socio-material practices (Engeström 2009). Such transformations in my study context were, however, rare. This study considered impacts of climate change as disturbances to the everyday practices, particularly those related to food security and livelihoods, and investigated community members' responses to these disturbances as processes of learning.

The object for adaptation was directed at improving yields to evade *nzara* and related socio-economic insecurities. Community members judged the value of an innovation on its ability to secure yields. A key stage in responding to a disturbance that influences the possibilities of expansive learning, as acknowledged in CHAT and studies of sustainability transitions, is that of questioning and reflecting on what has been taken for granted as normal practice. My study has found that as people questioned these taken-for-granted practices, their agency in effecting change emerged not only in their discourses about their livelihoods but in their actions. Learning and change happened through diverse spaces and places including, but not limited to, through mass communication media, within households and among neighbours and community members. The home, fields, gardens, churches, social clubs and community gatherings served as crucial sites for learning. People debated

options, experimented informally, pitted their practices against those of others, reflected on and evaluated their own practices and learned mainly through trial and error in a continuous search for sustainable solutions to food security.

While learning and change occurred in diverse spaces and places, the authority of knowledge within the community was being questioned as climate change exposed the fallibility of both science and local knowledges. Some sources of knowledge were regarded as more credible than others. Politicians, government and traditional leadership, churches, Agricultural Extension Officers and church leadership were regarded as authoritative. Children's ideas were generally regarded as risky, while those from business could be perceived as a marketing gimmick. However, the general approach was to treat all knowledge with scepticism even when the knowledge originated from trusted sources, because even traditionally credible sources of information were beginning to be questionable. What has been found from the research is that reflective questioning due to existence of these and other contradictions precipitates changes, which happen through iterative cycles of expansive learning which happens mainly through trial and error. The changes are captured in table 11.

Table 11: What is changing

1. N**ew instruments:** New **tools** which mainly manifest as innovations in farming technologies, e.g. developing and growing short-seasoned maize cultivars, re-introducing conservation farming technologies and irrigation. New **symbols and meanings**, e.g. reconceptualising the concept of decent food leading to incorporation of new foods in household diets; challenging the status of maize as an identity marker.
2. N**ew rules** which mainly manifest as changes in user practices: changing where crops are grown, e.g. streambank cultivation and wetlands farming; changing how crops are grown, planting in stages, late planting, reducing crop hectarage, practicing polyculture; changing the kinds of crops grown, e.g. growing foreign but drought tolerant crops, shifting from market gardening to orchard farming, shifting from maize to cassava; changes in diets and meal timetables, implementing measures to manage food waste.
3. **New social order (division of labour and community composition)**, e.g. children working to support families, reverse mentoring as children assume the role of technical experts and *vauyi* adding to the community's cultural diversity, hence adaptations.
4. **New objects**, e.g. shifting focus from farming to explore alternative sources of livelihoods such as informal work and trade, social entrepreneurship. Shifting focus from improving yields of maize and exploring alternative crops and foods.

However, the piecemeal developmental approaches that characterise the interventions further weaken community members' capacity to respond. Despite the existence of legislation, lack of alternatives drives community members to adopt unsustainable measures, e.g. draining wetlands to pave way for farming. Due to poverty, most households cannot afford to install irrigation infrastructure. Government interventions do not address structural issues like poverty and unemployment, economic challenges that weaken community members' ability to respond. In fact, some of the government interventions, e.g. donating drought prone

maize seed and delivering farming inputs late further deepen community members' vulnerability to climate change.

The findings suggest that while the role of external interventions is acknowledged, agency is not imposed from outside; agency emerges mainly from within. The findings point to the critical role of individual agency to precipitate collective transformation. The learning starts with individuals but due to social interaction among community members, the collective ZPD emerges due to negotiation of multiple knowledge systems, through multiple voices which are also governed by multiple rules and mediated by multiple tools. The emergent ZPDs manifest as changes in the local rules and tools leading to shifts in the objects of the activity system, hence changes in practices as summarised in table 7. What is collective about the ZPD is the object of achieving food security. While practices change within the collective ZPD, there is an upper limit to development because of the exigency of community members to feel safe. Climate change is a typical livelihoods dilemma; hence community members were observed to be cautious of adopting changes which had the potential to further compromise their chances of survival.

Additionally, community members resisted innovations that were regarded as culturally unacceptable. On many occasions, participants responded to the question of what climate change was by referring to popular opinion rather than articulating what they themselves believed to be true (Chapter 6). Although the boundaries of learning are permeable, the study has found that members of the community preferred designing and implementing their own innovations rooted in context and experience rather than wholly adopting externally designed innovations based on foreign ideas they knew little about. Thus, the collective might be conceptualised as a Zone of Safety Development. The exigency to feel safe thus sets an upper limit to development and this probably explains why radical transformations were found to be rare.

Except for efforts directed at reconceptualising the choice of maize as a staple, and attempts to shift attention away from farming, the bulk of the changes were incremental adjustments that help community members to build resilience but do not seriously engage with altering the superstructures that perpetuate the sources of unsustainability. Additionally, some innovations manufacture new risks, driving

further cycles of expansive learning. Adaptations are thus in a state of a flux; this strengthens my use of CHAT as it is a useful theoretical tool for analysing learning in continuously changing contexts.

In the next chapter, I draw conclusions from the key findings, and argue for the contributions these findings make to knowledge in climate change education, learning and adaptation research.

Chapter 11: Conclusion: Reconceptualising climate change adaptation

11.0 The case for my research and research questions

In this closing chapter, I first review the aims of my research and the research questions, and argue how my findings contribute to knowledge in climate change education, learning and adaptation research. I also highlight several implications for educational interventions, and while acknowledging the limitations of my study, make some recommendations as my concluding remarks.

Adaptation to climate change has become an undeniable reality that is now intricately linked to human existence and the health of the planet. I sought to understand what propels people to change and adapt their everyday practices in response to climate change, and what learning occurs in this process. Against a backdrop of human-induced unprecedented rise in global temperatures and the consequent irreversible environmental damage, it has become an imperative to reduce communities' vulnerability and increase their resilience to the impacts of climate change (Abid, Schilling & Scheffran 2016; Campbell et al 2016; Carr 2018; Davies -Reddy & Vincent 2017; Peters 2018). I was particularly interested in investigating the possibilities of adaptation in terms of what Engeström (1987; 2016; 2018) calls 'expansive learning', that is, radical and sustainable transformation of everyday practices, in response to climate change.

My study focused on climate change adaptation and learning in a community in Zimbabwe where serious climate change-induced threats to livelihoods and food security have been observed. As a science educator from Zimbabwe concerned about communities making sustainable transitions to their changing environment, I sought to investigate the affordances for and barriers to people's learning about, and acting around, the impacts of climate change**.** As mentioned above, I was particularly interested in the possibilities of expansive learning.

The overarching research question was:

How are everyday practices changing in response to the impacts of climate change**?**

This question was supported by sub-questions:

3. What are barriers to and affordances for expansive learning?
4. To what extent is there evidence of expansive learning, that is, learning leading to a radical and sustainable transformation of everyday practices?

A survey of the literature in Chapter 2 established, firstly, that while the impact of climate change is felt no less in the Global South than in the Global North, research on learning and adaptation to climate change is dominated by studies conducted in the Global North, and the fewer studies undertaken in the Global South are largely undertaken by researchers from the Global North. Secondly, the literature review indicated that while there are a growing number of studies in climate change education and learning (CCEL) and adaptation, there are fewer studies that focus on the informal learning among individuals and communities as they adapt their everyday practices.

The study afforded me an opportunity to produce research in the Global South undertaken by a researcher who brought knowledge of the socio-political and cultural context of the research site. My study investigated how people in a largely agricultural community in Zimbabwe learn to change and adapt their everyday practices to mitigate the impacts of climate change. I was particularly interested in whether and how children's learning about climate change created possibilities of intergenerational learning in the community. The establishment of Eco-Schools Clubs (ESC) in several school communities in Zimbabwe, including in the site of my research, provided an opportunity to explore intergenerational learning as a learning dimension.

Review of research on informal learning in and through everyday practices suggested that an ethnographic approach would be most suitable for this study, one that would generate 'thick descriptions' of the changing everyday practices and the socio-cultural dynamics surrounding them. As outlined in the research design described in Chapter 4, the ethnographic approach afforded a socio-cultural perspective on learning and change, which could complement other techno-scientific studies and more psychologically focused studies of climate change adaptation. By conducting the research in the participants' first language (Shona) I was able to notice and interpret cultural and linguistic nuances; these emerged in expressions used by

participants where literal translations of interview data would lead to misleading interpretations (see, for example, Chapters 6 and 7), and in understanding why voices of certain groups in the community (for example, children) were not engaged with in the way that literature from the Global North would suggest (Chapter 9).

It was anticipated, based on studies in the Global North, that intergenerational learning would be evident within families as children gained scientific knowledge about climate change mitigation and adaptation through their Club activities. However, the study has found that the ESC was not a dominant source of learning in the families and the wider community (Chapter 9). This was particularly the case when children brought home ideas that related directly to the most strongly felt impact of climate change: threat to food security, referred to as *nzara* in the local language. While practices changed within the collective zone of proximal development (ZPD), there was an upper limit to development; the community members needed to feel safe in doing something differently.

Community members were found to be most cautious about innovations around food growing practices given the severity of the impact on livelihoods should these innovations fail to yield what they promise. Moreover, few families had the economic resources to simply experiment, and even they were reluctant to give up their existing practices without evidence that the innovation was safe. Additionally, community members resisted innovations that were regarded as culturally unacceptable (Chapters 7, 8 and 9).

Studies of climate change adaptation reviewed in Chapters 2 and 3 also suggested the importance of sustainable transitions. Placing a focus on learning for sustainable transitions suggested the need to differentiate between learning that led to changes that could be easily reversed and learning that led to more long-lasting change. Additionally, a sustainability transitions perspective differentiates between changes that perpetuate the current unsustainable norms and changes radically challenging existing superstructures that perpetuate unsustainability. The concept of expansive learning, developed by Engeström in his third generation Cultural Historical Activity Theory (CHAT) (Chapter 3), provided a theoretical model of the kind of learning that leads to sustainable transitions: learning that radically and sustainably transforms the social and material configurations of existing practices.

Using CHAT as a model for analysis entailed attending to the dynamics of a number of elements that interacted in the process of adapting everyday practices: the tools (both material and symbolic) used by community members to make meaning of their experiences of climate change and what suggested innovations might offer; the historical 'rules' and conventions that have guided their everyday practices; the social relations in the community and the assumed roles of different groups (for example, children, adults, indigenous members, immigrant members, external experts); and the division of labour, including decision making within households.

While CHAT offers a viable tool for analysing learning that has led to radical transformation of the social and material configuration, not all radical changes align with sustainability trajectories. For instance, I found that not all adaptations were sustainable, as some posed environmental risks. In its present form CHAT is limited in analysing sustainability transitions in the sense that it does challenge the dominant discourses of capitalism that perpetuate unsustainability in the ways knowledge and goods are produced, distributed and consumed (Engeström 2016; Mukute et al 2018).

11.1 Findings from the study and responding to the research questions

In Chapter 10, I summarised the key findings from my study. In this section, I synthesise these findings as a response to the research question: *How are everyday practices changing in response to the impacts of climate change?*

The study has found that the community had developed different understandings of the concept of climate change. What was salient among the different understandings was that the participants' search for understanding about climate change was motivated by the urgent and immediate threats it was posing for the community. Climate change learning was developed in and through community members' negotiation of disturbances to their everyday practices, most notably, practices for achieving food security; climate change was synonymous with the local term *nzara*, a word signaling hunger due to crop failures. Thus learning and change to adapt to the impacts of climate change was most noticeable around innovations to sustain food

security in light of continued crop failures as rainfall patterns changed in unpredictable ways.

As a high-level response to the main research question, the study has found that everyday practices were changing in response order to mitigate the threats to *nzara*. The changes were evident in:

- Agricultural practices: time of planting, location of farming activity, use of a variety of seeds, range of crops and techniques of farming, for example, irrigation, polyculture and use of organic fertilisers (Chapters 7 and 8);
- Eating habits, as the traditional staple crop failed under severe and more frequent droughts (Chapter 7);
- Sourcing economic security as agriculture became a less reliable source of adequate income (Chapter 7);
- Social relations, particularly within households when the traditional 'bread winner' could no longer support the household through farming (Chapters 5 and 6).

The changes mainly involved re-crafting existing practices (changing the components, or elements, which make up practices) to improve food security. The changes were incremental and made cautiously.

I address the sub-questions supporting the main question in turn.

11.1.1 Barriers to and affordances for learning?

What are the barriers to and affordances for expansive learning?

The study has found multiple knowledge systems co-existing in the community which served to present both barriers to and affordances for learning. Until approximately nine years ago, this community had been able to sustain its food security by growing maize, their staple crop, and many residents engaged in market farming to increase their income. Despite occasional droughts and other natural disasters, knowledge about farming inherited from the community elders served the community well, until the weather patterns became so unpredictable that people started to question the wisdom of following conventional rules.

While the study found that the imperative to achieve food security was a strong motivation for many community members to question and change their taken-for-granted approaches in farming, this alone did not result in change. Within the conventional practices were embedded historically held beliefs and cultural practices that could not be overturned or challenged by any individual. A major barrier to learning and change, which presented peculiar unsustainable challenges to community members, was how maize was regarded not just as food but as an identity marker. As discussed in Chapters 5 and 7, cultural conventions restricted the meaning of food security to the security of sufficient yields of maize, the staple crop, making other foods invisible. Compounding that, shifting planting dates was akin to lunacy. While the realities of climate change compelled community members to shift planting dates, planting after October (which had been regarded as normal) was still being referred to as "*kurimira kumashure/kunonoka kudyara*" (late planting) and not as planting in the optimal period. Participants commonly blamed crop failure on "*mvura yakanonoka kunaya*" (the rains were delayed) and this goes to illustrate how in some instances change was acknowledged but resisted (Chapter 9).

Additionally, change required viable alternatives. Some of the alternatives came from 'experts' from outside the community whose authority had to first be established within the community. As discussed in Chapter 8, some of the suggested innovations from these experts required 'unlearning' to enable adoption, such as conservation farming which older members of the community had learned during the period of Western colonialism as 'primitive'. Some required resources beyond the reach of community members (e.g. irrigation) while some innovations were culturally unacceptable or did not offer convenience (e.g. small grains farming was considered labour intensive and the meals were considered unpalatable and off-putting).

A major barrier to learning and change, however, was found to be the uncertainty of any innovation as a safeguard to what the community members were experiencing. Many of the community members could not afford to make significant changes and find that these changes failed. Moreover, each innovation could manufacture new risks, unknown prior to its implementation. Access to expert advice was found to be ample. However, before any advice could be considered worth adopting, it had to be diffused within the community and interrogated within the local social networks. In

some instances, members would share the outcome of a cautious, small scale trial of an innovation to inform the community's deliberations about a larger scale trial. These community-based interactions could be understood as the establishment of a collective zone of proximal development (ZPD) in which community members' knowledge about possible innovations developed. The collective ZPD was found to be a significant factor in effecting changes in the community because individual households felt a sense of security if others were also willing to experiment with a different approach. Thus, the collective ZPD could be conceptualised as a zone of proximal 'safe' development (ZPSD) as the need for assurance that it was safe to embark on the innovation appeared to set an upper limit on development.

As mentioned above, one anticipated source of learning was the children in the community who were participating in the ESC that had been established to engender environmental consciousness and knowledge in school children. While research reports in the Global North have documented case studies of intergenerational learning as a result of initiatives similar to the ESC, they are contrary to the findings of my research. Two reasons for this were found. The first was the traditional status of children as sources of new knowledge within the community, and the second was the criticality of the issue that the knowledge would impact on.

Children in the community have traditionally not been seen as agents of change (Chapter 9); they were not expected to provide advice on important 'adult' issues such as methods of achieving food security. In particular, presenting information that was contrary to what the adults believed could be viewed as being disrespectful to their elders. The two reasons were found to be interrelated; some of the new knowledge that children brought home was not dismissed by the adults so long as it was not related to issues critical for livelihoods. Thus, for example, children's views that planting trees and reducing burning mitigates climate change led those changes to be implemented in households without any resistance from the adults.

11.1.2 Evidence of expansive learning

To what extent is there evidence of expansive learning, that is, learning leading to a radical and sustainable transformation of everyday practices?

The study has found that learning was incremental; while everyday practices were being transformed, the transformation occurred through a number of cycles of learning. The learning arose from trial-and-error experimentation on innovations following suggestions informed by advice from external experts, successful initiatives by migrant members of the community who had transferred practices from their previous community into their new community, and advice gained when community members interacted with other communities. In some instances, learning was self-regulated and happened accidentally and incidentally as people experienced life.

What made the learning observed in the community an example of expansive learning was the process preceding the adoption of the new practices: the questioning of and reflection on their existing knowledge and practices and the evaluation of the proposed innovation within a collective ZPSD. In this way, community members collectively gained new knowledge that they expressed in changed practices, and which in the process altered some of the other elements of the existing practices, such as the tools they used (changes in seed variety), time for planting, the sources of 'trusted' knowledge and/or roles within households and the community. These changes in the supporting elements of the everyday practices meant that however small the changes were, and however quickly these changes became unviable or inadequate, the cycles of expansive learning stayed in motion. However, in a context where the driver for learning and change – that is, climate change – was itself intractable, achieving any single sustainable practice is unlikely. Instead the likely future is a continuing cycle of learning and change.

11.2 Contribution to research

My study contributes to research in seven principal areas.

Firstly, while climate change adaptation is a widely researched area, a solution to the climate crisis has yet to be found, if indeed it ever will be, and people and their communities are continuing to find ways to adapt and survive in the changing environment. My study thus adds to the body of literature that seeks to assist people and communities to reduce vulnerability to climate change.

Secondly, climate change adaptation has historically been dominated by the tools and methodologies of the physical sciences. The social science of climate change is arguably still an emerging field, though fast emerging given the growing imperative for action. (See for example, initiatives such as Climate Justice Research Centre https://www.uts.edu.au/research-and-teaching/our-research/climate-justice-research-centre and journals dedicated to the social aspects of climate change such as Weather, Climate and Society https://www.ametsoc.org/ams/index.cfm/publications/journals/weather-climate-and-society/). My study therefore adds to the body of knowledge in this growing field.

Thirdly, while the impact of climate change is felt no less severely in the Global South than in the Global North, the number of studies undertaken in the former is more limited; see Chapter 2 for a review of the relatively few exceptions of research undertaken in the Global South. Moreover, studies that focus on the informal learning that occurs in people's everyday practices are even rarer. Additionally, adult learning in climate change adaptation is under-researched, compared to formal education among children as shown in Chapter 2. My study adds to the scholarship in the field of adult learning as well as in the field of learning and adaption to climate change, particularly in the context of the Global South.

Fourthly, although intergenerational studies of learning have been conducted before, children's agency in climate change learning and adaptation research is generally an under-researched area. While a few studies have investigated children's agency in environmental and climate change education as discussed in Chapter 2, the contexts of many of those studies are formal education settings in the Global North. In contrast, my study has focused on informal and non-formal contexts in the Global South and identified some of the assumptions from other studies that are not generalisable to these contexts.

A fifth area of contribution is in the theoretical lens and resources that I brought to this research. While there are a few studies that have examined learning for climate change adaptation in the Global South, including in Zimbabwe (e.g. Mukute et al 2018; Mukute & Lotz-Sisitka 2012; O'Donoghue 2018; Pesanayi 2016), it is more difficult to find research that combines CHAT, sustainability transitions and an ethnographic approach to examine people's informal learning as they adapt to climate

change. My study adds to the repertoire of research approaches for examining learning within context-specific sustainability transformations. Additionally, some studies (e.g. Mukute et al 2018; Lotz-Sisitka et al 2017) have begun to consider the inadequacies of CHAT in informing sustainability transitions research; while CHAT analysis is premised on learning that leads to radical transformations, CHAT is blind to challenging the superstructures that perpetuate unsustainability. CHAT is blind to the fact that capitalism is the root cause of unsustainability (Mukute et al 2018). Not all radical transformations will drive society towards a more sustainable trajectory. My study thus adds to the body of knowledge that strengthens Engeström's (2016) call for a fourth generation CHAT. My study contributes to this field of inquiry, particularly in my proposal of the notion of a ZPSD as a more nuanced notion of the collective ZPD, as discussed above.

My study makes a sixth contribution by affirming the value of the researcher's deep cultural and linguistic competence of the research site. As an in-situ study involving observations of everyday practices and extended interviews conducted in their local language, the research has been able to generate thick descriptions of learning and change. My proficiency in the local culture and language enabled the culturally significant meanings embedded in certain expressions and words to be noticed and explored as part of the research. For example, when community members said *gore rino mvura haina kunaya* (which would be literally translated as 'it did not rain this year'), they did not necessarily mean *it did not rain that year*. They meant instead, *the rains did not fall within the expected planting period, so it was as if there were no rains*. My study thus strengthens the case for ethnographic approaches in research so that the significance of particular language used by the local participants are noticed and interpreted in context; in this case revealing the cultural and historical meanings underlying the participants' voices.

Finally, as shown in Chapter 2, climate change adaptation research has historically been dominated by discipline-specific approaches. My study adds to the emergent field of research that seeks to cross the disciplinary divide as I examined climate change learning and adaptation through a multidisciplinary perspective by drawing from the fields of science, technology and society (STS), the public understanding of science, intergenerational studies of learning, environmental and sustainability

studies and climate change adaptation studies. The insights from this range of fields strengthen the possibilities for dialogue between the social sciences and the scientific fields in pursuing effective learning interventions to mitigate the impacts of climate change.

11.3 Limitations and affordances of the research design

While my study was in-depth and yielded thick descriptions from the field, it leaves a number of questions unanswered, thus opening up possibilities for further research. In this section I discuss the limitations of the study, while simultaneously identifying areas for further research.

The study was an *in-situ* study of a particular local community, hence specific findings from the study are not directly generalisable or transferable to other settings. This is, as acknowledged in Chapter 4, a recognised feature of ethnographic studies. On the other hand, as I have discussed in Chapter 10 and earlier in this chapter, the particularities of the community, for example, the traditional belief systems, the relationships between new and established members of the community, and the physical geography of the research site each influenced how climate change has had impact on the community. Thus, the aspect of the findings that can inform other studies seeking in-depth understanding of the informal learning and change in everyday practices, is the value and criticality of in-depth *in-situ* study in the community.

The study was limited in the number of households that could be included in the study. The focus on, and restriction of community participants to, families of children involved in the Eco-Schools Club provided a purposeful and practical mechanism to select a manageable number of research participants. Consequently, this study has not examined the learning and adaptation among families that were not involved with the ESC, and therefore what, if any, other forms of learning and adaptation were unfolding in those households remain unknown. Furthermore, a more longitudinal study in the community could examine how the knowledge gained from the ESC may be informing children's own practices in other domains of their lives even if their learning about food production was not taken up by the adult members of their households. An additional area that a longitudinal research could examine is how the

knowledge children gained in the ESC is built upon and used when these young people reach the status of adulthood in the community.

The period of *in-situ* study was five months and did not cover the full annual cycle of farming that participants described in interviews. A more extended stay in the community would generate a deeper understanding of the dynamics of people's negotiation of unanticipated changes in weather patterns and their impact.

The design of the research did lead to some unplanned affordances. While the essence of my study was not to influence change but to observe, document and analyse the existing conditions in the community, the ethnographic approach the study adopted created for some participants new, albeit temporary, spaces for learning in their interactions with the researcher and other members of the community facing similar challenges.

As discussed in Chapter 9, the study interfaced the school and the home, creating spaces for greater intergenerational communication between children and their parents. To this end, the research created a forum for discussion about climate change between children and their parents and between the school and its community, gaps that had existed and which may have contributed to the limited voice, limited though it was that children had in influencing their parents about climate change mitigation.

As already indicated, a critical step in the cycle of expansive learning is that of questioning and reflecting on taken-for-granted assumptions. While as a researcher I was not teaching the participants about climate change, my questioning about what they did to secure food sources and how they understood their changing environment provoked both critical reflection and curiosity about what was known about climate change. Thus, through the research process, participants gained new knowledge about climate change which they could add to their repertoire of knowledge about climate change that would inform their changing practices.

11.4 Implications of the findings

This study offers insights on how educational interventions for climate change adaptation might be modelled if the goal is to develop collective agency for radical and sustained changes. I have argued, based on my findings, that whether initiated by children or by technical experts, the current models of community interventions that

treat community members as the receivers of packaged solutions, subjugating the innovativeness and creativity of community members, do not always work in the context of climate change. Although climate change has been found to be the driver for many of the changes in everyday practices, particularly in food production, the knowledge base guiding the changes are complex, contested and intractable. In traditional non-Western contexts as was the case in my study, this is further complicated by the existence of knowledge pluralism; the local knowledge of community members does not always align with technical scientific knowledge. Compounding that, cultural conventions suppress children's voices.

I discuss implications in three key areas:

1. External interventions for effecting productive learning and change
2. Increasing the impact of the Eco-Schools Club and similar initiatives
3. Science education policy and practice

11.4.1 External interventions for effecting productive learning and change

The findings suggest the effectiveness of external interventions in enabling productive learning and change may be enhanced in six major ways, not to be treated in isolation for they are intersecting:

- Using community networks to establish a collective ZPD
- Participating in the negotiation of old and new knowledge, existing and innovative practices
- Acknowledging learning as incremental
- Acknowledging knowledge and innovations within the community
- Deprofessionalising the experts
- Acknowledging limitations of piecemeal developmental approaches

11.4.1.1 Using community networks to establish a collective ZPD

Firstly, the findings suggest that if the goal is to influence radical and sustained changes, there is need for greater and deeper community involvement in formulating solutions for climate change adaptation. A major finding from the study was that community members were more comfortable designing their own innovations rooted

in context and experience and were rather skeptical of adopting abstract technical advice they knew little about. Additionally, community members found security in doing what others were doing or what had been proven to work through learning from others. While the authority of knowledge was being questioned, some sources were more credible than others, either because they wielded authoritative positions in society or because their knowledge was otherwise deemed authoritative. More successful farmers, some migrant groups and traditional, government, political and church leaders wielded authority to influence learning and change. Often, technical experts rode on the backs of these 'elephants' to inform and model innovations. Technical experts working collaboratively with local leadership identified local issues of concern and introduced innovations that challenged the status quo, leading to sustained changes in practices (Chapter 8).

However, the activities from various expert groups were loosely connected with each organisation representing its primary mandate. Often, this created confusion which sometimes led to miseducation among community members. As discussed in Chapter 8, non-governmental organisations (NGOs), for example, incentivised community members to participate in interventions, but government did not; this led to the neglecting of government interventions. Sometimes community members did not see personal relevance in interventions, because not everyone in the community understood the interconnectedness of the issues surrounding climate change (Chapters 5 to 9).

Even more significant, some thought it was not their responsibility to mitigate climate change; government had to do it. Others relegated solutions to supernatural forces of nature; whether people adapted or not, it was up to God to resolve climate change (Chapter 6). It thus becomes critical to meaningfully engage community members for three significant reasons: firstly, to gain their trust, secondly to negotiate contradictions between scientific knowledge and local knowledge and lastly to create a commonly shared vision between experts and community members, while syncronising the objects of various expert groups.

My study thus reconfirms the view that when dealing with complex issues where actors are loosely connected, new forms of work must emerge, with actors focusing on reconceptualising their own roles within the community and what has been

assumed as their shared objects (Edwards 2007; 2017; Engeström 2016; 2018 Engeström and Sannino 2017; Lotz-Sisitka et al 2017; Mukute et al 2018). When both the script (unquestioned practices) and the objects (motives for adaptation) are reconceptualised, so are the interactions between participants, thus potentially changing the dynamics and division of labour in the activity system. Knowledge is thus co-created and co-owned. Thus, from this perspective, intervention strategies need not only focus on transforming the current activity, but also explore possibilities for collaboratively challenging and transforming conventions and the social institutions that sustain such conventions. It closely follows that technical experts and community members need to meaningfully collaborate and co-design interventions in an environment where all views, including the layman's views, are acknowledged as different ideas are infused and blended in to create new knowledge owned by and acceptable to all.

11.4.1.2 Negotiating the old and the new knowledge and practices

Secondly, in this study context, where valuable local knowledges have been lost due to the social engineering machinery of the colonial past, there is a need to redress epistemic injustices of the colonial past that glorifies Western ways of knowing while relegating local knowledges to the margins. Conservation farming technologies and small grains farming, for example, offer viable solutions to food security, but have been lost to modernity mainly because the colonial discourse regarded everything local, including the indigenous knowledge systems, as inferior, unauthentic and primitive (Pesanayi 2016; Shizha 2011). In Chapter 8 I discussed how such lingering colonial legacies sometimes created resistance to bringing back traditional practices when the current practices afforded favourable social standing, or alternatively, when the traditional practices were perceived to be due to poverty or lack of 'modern' or Western knowledge and methods. In cases like these, successful climate change adaptation means re-thinking what ordinarily had been regarded as normal practice and may also mean normalising what had been regarded as abnormal. Adoption of conservation farming technologies, for instance, entails doing the unthinkable: abandoning the convenience of modern agricultural practices and learning to do things the harder but more sustainable way.

The findings therefore suggest that successful adaptation demands more than re-crafting existing practices through for example adapting farming practices and introducing technological innovations in farming; adaptation demands unlearning the dominant discourses that perpetuate unsustainability and re-learning old habits while learning new skills, which leads to the adoption of more sustainable practices (Chapter 7). Adaptation needs to go beyond transforming existing practices to replace and reconfigure existing patterns of production and living, especially food choices; while efforts at increasing the productivity of maize, the staple crop, cannot be downplayed, sustainable food security can be achieved through supplementing or even replacing the staple with small grain meals, which of course have been relegated to the colonial past.

11.4.1.3 Learning as incremental

The third important consideration is to acknowledge that solutions to climate change are iterative, not absolute, and radical transformations are rare. The findings illuminate the affordances and barriers presented by science and technology in helping community members sustainably adapt to climate change. As discussed in Chapters 7 and 8, being food secure entails improving the adaptive capacity at all levels through investing in the material infrastructure, e.g. more research in seed technologies and investing in irrigation infrastructure. However, community members acknowledged that finding a sustainable solution to climate change is complex, enduring and accomplished through trial and error. The study has illustrated how climate change created a sense of panic and confusion as people no longer knew the best time to plant (Chapters 6 and 7). Compounding that, even traditionally credible sources of knowledge sometimes misled community members as events could not be predicted with certainty.

Moreover, some innovations manufactured new risks, driving further cycles of expansive learning. In a context where the driver for learning and change, that is, climate change, is itself intractable, achieving any single sustainable practice is, however, unlikely. Interventions thus need to take this into account; instead of imagining interventions as solutions, interventions need to be reconceptualised as sources of continued learning, as the likely future is a continuing cycle of learning and change. Consequently, when external experts take innovations to community

members, it may be useful to present interventions as work in progress instead of as absolute solutions, to avoid giving community members false hope which in turn leads to the rejection of externally designed interventions.

People chose to change certain practices while ignoring others. Often cosmetic changes were introduced as an expedient measure to attend to an immediate problem. The study has shown that adaptations involving radical transformations were rare. The study suggests that despite the scientifically established imperative for radical steps to mitigate the risks of climate change, transforming long standing practices, particularly where livelihoods are at stake, can be expected to be incremental as the collective ZPD is expanded at each step. However, there can be an upper limit to development as community members' skepticism about adopting innovations that are likely to further compromise their already threatened livelihood is avoided. I found, as Mukute et al (2018) found in a study with organic farmers in selected Zimbabwean communities, that there is tension in the desirability of charting new ground on the one hand, and the fear of embracing new possibilities on the other. This was expressed by community members in statements such as:

- "*vasingateereri vakakohwa*"

  [those who are defiant harvested]

- "*zvinongoda kuti munhu ungoita zvawafunga*"

  [you must listen to your instincts]

- "*ukateedzera Madhumeni unokuvara*".

  [you will face the consequences if you blindly follow advice from AEOs]

Increasing community members' capacity for more radical adaptation approaches may therefore be contingent upon community members collectively reaching the realisation of the imperative for such change, and risks of the status quo. Radical adaptation requires that open-minded and reflexive people be daring enough to challenge conventions while venturing into the unknown. Among the community members, such acts of challenging conventions were akin to lunacy; those who dared challenge convention often attracted scorn from other community members. People

were often scared to be the pathfinders, but once innovations were successfully implemented, others followed suit. The challenge for effecting sustainable adaptation and transitions then becomes designing interventions that build a collective agency to assess and take risks.

11.4.1.4 Acknowledging local knowledge and innovations

Fourthly, my study argues that the success of innovations is largely dependent on the extent to which external interventions acknowledge local knowledge and innovativeness. I found, as had previous studies (Boillat & Berkes 2013; Naess 2013; Pesanayi 2016) that prescribing solutions to community members does not always work. The study has demonstrated that there is no one right way of conceptualising climate change; a community can be a diverse and multi-voiced entity that can hold a plurality of perspectives regarding climate change. Adaptation is therefore multifaceted and multidimensional. The data has illustrated that while, on the one hand, knowledge pluralism may serve as a mediating artefact that enables learning from others, a failure to acknowledge the existence of alternative knowledges may be counterproductive. Both sustainability transitions and CHAT acknowledge that due to the multidimensionality that characterises activity systems, it is not unusual for objects to misalign. As discussed above, I found that sometimes local knowledges and beliefs contradicted science, and this created apathy towards change (Chapters 6, 8 and 9) and was a major source of tension between community members and technical experts.

This has implications on how interventions ought to be conceptualised, designed and implemented. While the value of technological innovations cannot be downplayed, my study reconfirms the limits of science in resolving the climate crisis. I observed that analysing issues from a purely physical science perspective makes some of the concerns about adaptation invisible. While the object for adaptation might appear straightforward, I observed that adaptation is complicated by several socio-cultural political, economic and physical factors. For example, being food secure meant more than just having food; cultural conventions restricted the meaning of food security to security of sufficient yields of maize, the staple crop. What became evident was that food insecurity is partly a result of attitudes towards food preferences as well as cultural notions that position particular foods as a status symbol and a form of cultural

identity. Interventions that did not align with these and other long held views and beliefs were often resisted.

These observations reaffirm the argument that it takes more than technological shifts to adapt sustainably because climate change has other dimensions that lie beyond the scope of 'normal' science. It thus becomes critical to pay attention to the socio-cultural context within which knowledge is generated. While improving the yields of the staple cannot be downplayed, successful adaptation also entails making non-technical changes, such as shifting socio-cultural perspectives regarding food choices. My study thus strengthens the argument to move towards a 'post normal' science where research and scholarship transcend the disciplinary divide (Kønig, Børsen & Emmeche 2017; Mukute et al 2018; Fam, Palmer, Riedy, & Mitchell 2016), and the laymen's views are acknowledged as legitimate perspectives. In view of the knowledge pluralism existing in a community, interventions for climate change adaptation need to create opportunities for negotiating meanings as the objects of adaptation are aligned and re-aligned in a continuous search for sustainable solutions. The diversity of home-grown solutions that community members devised shows that there is more than one correct way of going around the challenges posed by climate change; hence interventions may not be presented as packaged solutions.

11.4.1.5 Deprofessionalising the experts

The fifth contribution the findings make relates to the limitations of adopting a specialist approach in interventions. A key finding from the study is that community members should not be treated like illiterates simply because they could not articulate the complex science behind climate change; community members possessed a wealth of expertise and demonstrated understanding of climate change in their local adaptations. Over and above the rejection of innovations emanating from misalignment of objects, the data illuminate the incompleteness of each of the knowledge systems in offering solutions to the climate crisis, rendering monolithic approaches inadequate. Consequently, it becomes desirable to draw connections between abstract, scientific knowledge and context-specific knowledge to generate practical knowledge that addresses problems of mutual concern. While the desire to combine the knowledge systems was plausible, technical experts adopted a specialist approach in which community members' views were subordinated. Community

members were perceived as needing to be told what to do and their rejection of technical advice was often regarded as a catastrophe Interventions may need to move away from this notion of educating communities to a notion of learning with communities, where learning is not restricted to community members, a concept Engeström (2008a) coined deprofessionalising the experts. It becomes imperative for technical specialists to unlearn those habits that make them fail to connect with the people they are meant to assist.

11.4.1.6 Acknowledging limitations of piecemeal developmental approaches

Lastly, the study reconfirms the view that adaptation may remain a futile task if the structural issues that weaken communities' ability to respond to climate change remain unaddressed. As discussed in Chapters 7 and 8, community members' adaptive capacity was weakened by structural issues like poverty and weakened government support. I observed a vicious circle wherein poverty weakens people's ability to respond to climate change while at the same time, climate change further deepens poverty as people fail to secure enough yields. Often external expert innovations adopted a piecemeal approach, which often created apathy among community members. Some of the proposals being suggested by technical experts were not feasible for farmers to adopt. Participants explained that most often, technical experts offered advice but not the materials that the implementation of the proposed innovations required. For example, the potential of irrigation to improve yields could not be denied, but the installation costs of irrigation infrastructure were beyond the reach of many.

Even more important in a community where farming doubled up as both as source of food and income, community members were sceptical of trialling crops where markets were not guaranteed or worse still where market prices were lower. Interventions thus need to address the whole spectrum of factors that set barriers to adaptation, because if communities do not get the relevant support, adaptation may remain some distant and far-fetched reality.

While community members are applauded for innovating to evade the brunt of food insecurity, not all local innovations aligned with the tenets of sustainability

transitions; examples are streambank cultivation, the altering of wetlands for agricultural purposes and the use of chemical fertilisers and pesticides to improve crop yields. For these participants, whose motive for adaptation was to evade *nzara*, environmental sustainability on its own was not sufficient to motivate people to adapt their practices. While technical experts emphasised environmental sustainability, community members on the contrary were mainly worried about securing yields; it did not matter how it happened. Generally, the widely adopted conventional farming technologies were informed mainly by capitalist ideologies (Mukute et al 2018) which are driven by improving yields and profits without much consideration of the wider sustainability concerns. Food security was thus achieved at the cost of environmental sustainability.

As discussed in Chapter 8, conservation farming technologies wield potential to improve yields while simultaneously promoting sustainability transitions, but such technologies were adopted only peripherally because they lacked the convenience of conventional farming methods and were stigmatised as primitive and a preserve for the poor. Transitioning to sustainability thus demands reconfiguring the whole farmer education and extension system to reflect farming technologies that are consistent with sustainability transitions. However, efforts at sustainable farming practices including polyculture, composting, mulching, isolated cases of zero tillage and rainwater harvesting that were evident among some households need to be harnessed and upscaled, laterally (involving more people) and vertically (improving how it is done) for they offer a window of hope to move the farming activity system towards more sustainable trajectories. Technical experts thus may need to identify such local initiatives and use them as nodes from which such sustainable practices may spread to other community members.

Efforts to promote sustainable farming practices could be scaled through existing structures that have been working well with promoting the conventional but unsustainable farming practices. Competitions such as Green Shows and the Master Farmer programme, another initiative through which community members learned from more successful farmers, may need to be redesigned to introduce a category for farmers who produce through climate smart technologies to be recognised and

rewarded and to serve as ambassadors for promoting sustainable farming technologies among community members.

This takes me to the section where I discuss the implications of the findings on children's agency.

11.4.2 Increasing the impact of the Eco-Schools Club and similar initiatives

As discussed in Chapter 9 and earlier in this chapter, children's agency was compromised for two reasons: the disregard of children's knowledge due to the traditional status of children within the community, and the criticality of the issue that the knowledge would impact upon. Two key issues thus emerged as priorities for improving the effectiveness of the Eco-Schools Club:

- Engaging the adult community more
- Working with the children to create community knowledge

11.4.2.1 Engaging the adult community more

Climate change adaptation is a typical livelihood dilemma; adaptation involves high stakes decisions, too important to entrust children with. While the Eco-Schools Club works well in developing children's agency, it has not been an effective way to influence adults' everyday practices in this community. I argue that children's agency in influencing adults' decisions is highly contextual. Eco-Schools is a concept that was developed in the Global North where, arguably, children have greater voice. However, in traditional communities in Zimbabwe, cultural conventions suppress children's voices in important community decisions. Compounding that, parents were not meaningfully engaged with club activities. As discussed in Chapter 9, the ESC adopted information transfer approaches, notably poems, drama, songs and dance, to communicate climate change information to community members.

Parents mostly took an observer role because they did not think that the subject of these performances was important, were too busy to pay attention, did not consider it learning, thought it was a waste of time and resources or simply dismissed it as child play. In some cases, parents were disconnected from children and their projects because they did not see any personal relevance in the project. They did not see

children as sources of learning. In extreme cases, parents were not aware of the existence of the ESC until the onset of my research project. Some parents associated the ESC with a failing education system and hence viewed the children and their school-based views with contempt.

A key finding from the study is that while children may influence parental decisions in other aspects of life, when it comes to 'real' issues, children have no place in family decision making. My study strengthens the contingency of a critical perspective on the power of a children's programme to have wider community impact, as has been argued by some scholars who have found that programmes targeting children are not always successful (Damerell, Howe & Milner-Gulland 2012; Malone 2013; Satchwell 2013; Walker 2017) because adults are the key decision makers in contemporary society.

In view of these considerations, the Eco-School Club may influence adult adaptation, contingent upon three major changes:

- Firstly, while the ESC addresses issues with greater relevance to the community, its success is not measured in terms of the relevance of the issues being addressed; rather, the success of the ESC is dependent on the faith that adults have in child-led interventions. The influence of children and the ESC thus can be improved through greater and more meaningful parental involvement in the design and implementation of climate change education and learning programmes. This is critical, especially considering that the exigency to feel safe sets an upper limit on development, and that people prefer designing their own innovations rather than depend on externally designed innovations.

- Secondly, it becomes critical to address cultural issues that view children as socially incompetent and thwart children's voices, for instance by improving relations between children and adults so that children can communicate their ideas without fear of reprisal. The teachers and other adults involved in the ESC may be able to show the collective learning that they have experienced with the children in the ESC, to affirm the value of the knowledge that the children are developing.

- Lastly, technical experts rode on the backs of influential people in society such as traditional leaders, church leaders and opinion leaders. The ESC may explore the possibility of approaching community innovations from a similar angle, forging partnerships with key people in society who could serve as trusted brokers between the ESC and community members.

11.4.2.2 Working with children to create community knowledge

Considering that children and the Eco- Schools Club drew expertise from the same sources as technical experts, most of the issues raised in 11.4.1 remain relevant to the ESC, mainly the desirability to draw connections between abstract scientific knowledge and local knowledges rooted in context and experience and desisting from adopting specialist approaches. For improved learning, the ESC must meaningfully engage community members in collaborative learning processes where community members' views are acknowledged and where community members participate in identifying priority intervention areas. To improve its effectiveness, the ESC must generate what Engeström and Sannino (2017) called socially impactful knowledge – 'knowledge that can be turned into transformative action' (p. 81) – and what Dedeurwaerdere (2014) called socially robust knowledge – knowledge that bridges the gap between scholarship and practice. One way the ESC could achieve this would be to desist from informing and telling, and instead to use the local community as sites for climate change education and learning. Community members may serve as resources persons to bridge the gap between academic and lay knowledge in processes where all knowledges are acknowledged as legitimate perspectives. The success of the ESC may improve if community members perceive children and the ESC as working with them rather than working on or against the community.

11.4.3 Science education policy and practice: Recognising knowledge pluralism

If the goal of educational interventions is to assist people and communities to make radical and sustained changes to their everyday practices, a number of challenges that currently constrain the education system from achieving this goal need to be addressed. Chief among the challenges are structural issues related to government policies and limited access to resources. As discussed in Chapter 9, as a tool for

addressing climate change, the education system is compromised by its adoption of a formal school curriculum which is too abstract, examinations driven, and decontextualised. Curriculum document reviews, and discussions with teachers and the officer in charge of climate change education and learning in the national Curriculum Development Unit confirm evidence from previous studies (e.g. Chineka & Chabikwa 2015; GoZ 2016) that revealed that climate change coverage in the formal curriculum is superficial.

Despite calls for crossing the disciplinary divide, the silo mentality and discipline-specific approaches still prevail as found by climate change and sustainability researchers such as Fam et al 2016; Lotz-Sisitka et al 2017; Siegner 2018; Spurling 2018 (see Chapter 3). Owing to the country's colonial history, the curricula at all levels of education, including farmer education and extension services, have been developed along Western ideologies while local knowledges continue to be subordinated (Chapter 9). Additionally, policies guiding climate change education and learning are informed by international policies where Western perspectives of knowing are dominant. Even more importantly, the Eco-Schools programme has its origins in the Global North. Little effort has been made to incorporate indigenous ways of knowing into the education system, and in the isolated cases where efforts to incorporate local knowledges have been made, such innovations are stigmatised as discussed above.

Owing to the colonial injustices of the country's past, local knowledges are subordinated, and the entire spectrum of the local knowledge and belief systems as represented in taboos are the subject of ridicule. My study has suggested that this has led to loss or disregard of local knowledges which are potentially useful in providing sustainable solutions to climate change. There is sustainability entrenched in some cultural conventions; for example, it was taboo to alter wetlands as they were perceived as sacred. Additionally, traditional practices like conservation farming and small grains farming that have suffered subjugation at the hands of colonialism, were proving to offer sustainable solutions to climate change and yet their uptake was peripheral as they were stigmatised as primitive and a preserve for the poor. This is further complicated by the existence of tensions and contradictions between the explanations offered by Western science and some of the historically held

worldviews. This is not helped by an education system that, more than three decades after independence, both formally and informally continued to reflect the epistemic injustices of the colonial past (Chapter 9).

In Chapter 9, I outlined how, because climate change education and learning is relegated to informal initiatives such as school clubs, the ESC was not a priority on the school timetable as government policy positions school clubs as extra-curricular activities. Due to its hands-on orientation, the Eco-Schools Club was often viewed as dirty manual work and in extreme cases as exploitation. Compounding that, the ESC suffered neglect due to government policies that prioritise academic subjects and examinations rendering non-examinable activities invisible. Additionally, resources for climate change education and learning were scanty, and this was compounded by limited vocabulary in Shona, the local language, to explain climate change concepts.

Despite these limitations the education system has potential to influence change. Some strategies that may help to realise these potentials are outlined below:

It is critical to acknowledge knowledge plurality as a precursor to learning. There is greater need to incorporate indigenous knowledge in the formal curriculum so that its status is elevated and comparable with technical scientific knowledge. Additionally, there is a greater need for a review of education policies regarding teacher education and training and teacher professional development; teacher education must align with current trends and teacher professional development must be seen as continuous and lifelong learning.

Even more important is the need to redress education policies that prioritise academic subjects at the expense of practical subjects and passing exams at the expense of skills development. Climate change education and learning may benefit from the development and provisioning of more resources, including developing more climate change vocabulary in local languages. These developments may be complimented with a revamp of the school curriculum so climate change is taught in cross-disciplinary teams across the whole curriculum instead of existing in isolated pockets of subjects and activities where it is often taken as an extra-curricular activity. It goes without saying that improved learning for climate change adaptation entails reorienting teaching methodologies so that learning takes a hands-on, minds-on

approach, is not confined to the classroom and the school, is socially engaging and takes a project-based approach directed at solving real-world problems.

Appendix 1: Consent form (Students)

"Learning in a changing climate: An ethnographic study from the Global South"

I _____ agree to participate in the research project "social mobilisation for mitigating the impacts of climate change" UTS HREC approval reference number 2015000301 being conducted by Raviro Chineka, email Raviro.Chineka@student.uts.edu.au; mobile +61 [redacted] or +263 [redacted] of the University of Technology, Sydney for her degree of Doctor of Philosophy in Education. This research is not funded.

PURPOSE OF RESEARCH

I understand that the purpose of this study is to learn firsthand from people in the community how everyday practices have been changing as a result of the long-term changes in the earth's climate. The study also seeks to find out how and, what learning is taking place through these changes.

WHAT THE RESEARCH INVOLVES

I understand that I have been asked to participate in this research because I belong to the Marikopo High School Eco-Schools Club (ESC) whose main purpose is to advance environmental awareness and, promote responsible living. I agree that:

I will talk to Raviro as she observes me carry out my routine club activities. I will participate in 3 such observations with each session lasting about 45 minutes. Observations may be photographed, while interviews will be audio recorded.

I will take part in 3 group interviews lasting on average 2 hours. Group interviews will be video recorded and, will be conducted within the Marikopo school premises.

The research is confidential. Raviro will not tell anyone what I told her. If I take part in group interviews, I will be respectful of responses and confidentiality of my peers.

I will receive a copy of my interview transcripts and check it and let Raviro know if I want to change any parts or add more information.

Results from the study will be published in journals and other academic publications but, Raviro will not use my real names.

RISKS AND INCONVENIENCE

Although the research has been carefully designed to minimise risk and inconvenience:

I may experience some level of anxiety, embarrassment and discomfort because I will be aware that I am being observed and being recorded.

Participating in the study will inconvenience me as it entails a time commitment of approximately 20 hours spread over a period of 1 year.

MINIMISING RISK AND INCONVENIENCE

To minimise levels of risk and inconvenience, Raviro undertakes to:

Tell me about interview and observation times ahead of schedule

Conduct interviews in open spaces within school grounds during school hours

Not tell anyone what I told her.

IF I HAVE CONCERNS OR A COMPLAINT

I am aware that I can contact Raviro on +61 [redacted] or +263 [redacted] or her supervisor Dr Keiko Yasukawa on +612 9514 3478 if I have any concerns about the research. I may also contact Ms Munyanyi the Marikopo High School EE Club patron on 263 771 259 809 or Mr Chimanikire the Programme Director for Mukuvisi Woodlands Environmental Education Centre who have provided their support to receive me in the community on +263 773 840 320.

I also understand that I am free to withdraw my participation from this research project at any time I wish, without consequences, and without giving a reason.

I agree that Raviro has answered all my questions fully and clearly.

I agree that the research data gathered from this project may be published in a form that does not identify me in any way.

_____ ____/____/____

Signature (participant)

Signature (parent/guardian)

_____ ____/____/____

Signature (researcher or delegate)

NOTE:

This study has been approved by the University of Technology, Sydney Human Research Ethics Committee. If you have any complaints or reservations about any aspect of your participation in this research which you cannot resolve with the researcher, you may contact the Ethics Committee through the Research Ethics Officer (ph: +61 2 9514 9772 Research.Ethics@uts.edu.au) and quote the UTS HREC reference number. Any complaint you make will be treated in confidence and investigated fully and you will be informed of the outcome.

Appendix 2: Information sheet (Students)

Learning in a changing climate: An ethnographic study from the Global South

(UTS APPROVAL NUMBER 2015000301)

WHO IS DOING THE RESEARCH?

My name is Raviro Chineka and, I am a PhD research student at the University of Technology Sydney (UTS) in Australia. My supervisor is Dr Keiko Yasukawa.

WHAT IS THIS RESEARCH ABOUT?

I want to learn firsthand from people in the community how the shared, routine and everyday practices have been changing as a result of the long-term changes in the earth's climate within your community. This is why I want to learn from you and spend some time in this community.

IF I SAY YES, WHAT WILL IT INVOLVE?

- You will participate in 3 group interviews; lasting on average 2 hours. Group interviews will be conducted at Marikopo High School and, will be video recorded.
- Let me talk to you as I watch you carry out your normal EE club routines. I will visit you 3 times, over a period of 1 year in your school or any other appropriate spaces where club activities normally take place. Visits will last about 45 minutes.
- During observations, pictures may be taken. Interviews will be audio-recorded and transcribed.

ARE THERE ANY RISKS/INCONVENIENCES?

- The research has been carefully designed to minimise risk and inconvenience. However, you may experience some level of anxiety, embarrassment and discomfort because I will ask you to give me personal and private information about how your normal routine has been changing due to long term changes in the earth's climate.
- If you have suffered any losses and or hardships as a result of these changes, you may experience emotional distress through narrating your stories.
- My study is purely for academic purposes; I will be talking to you in order to learn from you but, I will not be in a position to solve the problems that you face due to the changing climate.
- Participating in the study will inconvenience you as it entails a time commitment of approximately 20 hours spread over a period of 1 year.

- Your daily schedules may be disrupted by my visits and, you will travel to Marikopo for all group interviews. Results from the study will be published in journals and other publications but I will not use your real names.

WHY HAVE I BEEN ASKED?

You are also chosen because you are a member of the Marikopo High School Environmental Education (EE) Club. You can tell me the information I need to know about how your EE club is addressing climate change within your school community.

DO I HAVE TO SAY YES?

You don't have to say yes.

WHAT WILL HAPPEN IF I SAY NO?

Nothing; I will thank you for your time so far and will not contact you about this research again.

IF I SAY YES, CAN I CHANGE MY MIND LATER?

You can change your mind at any time and you don't have to say why.

WHAT IF I HAVE CONCERNS OR A COMPLAINT?

If you have concerns about the research that you think I or my supervisor can help you with, please feel free to contact us on:

Ms. Raviro Chineka +61 (Australia) OR +263 (Zimbabwe) OR Dr Yasukawa +612 9514 3478

If you would like to talk to someone who is not connected with the research, you may contact the Research Ethics Officer via Research.Ethics@uts.edu.au, and quote this number (UTS HREC Approval Number 2015000301)

You may also contact Ms Munyanyi the Marikopo High School EE Club patron on

+263 771 259 809 or Mr Chimanikire, the Programme Manager for Mukuvisi Woodlands Environmental Education Centre on +263 773 840 320 who have provided their support to receive me in the community.

Appendix 3: Consent form (Teachers)

"Learning in a changing climate: An ethnographic study from the Global South"

I _____ agree to participate in the research project **"Learning in a changing climate: An ethnographic study from the Global South"** UTS HREC approval reference number 2015000301 being conducted by Raviro Chineka, email Raviro.Chineka@student.uts.edu.au; mobile +61 [redacted] or +263 [redacted] of the University of Technology, Sydney for her degree of Doctor of Philosophy in Education. This research is not funded.

PURPOSE OF RESEARCH

I understand that the purpose of this study is to learn firsthand from people in the community how everyday practices have been changing as a result of the long-term changes in the earth's climate. The study also seeks to find out the learning that takes place through these changes.

WHAT THE RESEARCH INVOLVES

- I understand that I have been asked to participate in this research because I am a patron of the Marikopo High School Environmental Education (EE) Club whose main purpose is to advance environmental awareness and, promote responsible living in the face of a changing climate. I agree that:
- I will talk to Raviro as she observes me carrying out my routine club activities. I will participate in 3 such observations with each session lasting about 45 minutes. Observations may be photographed, while interviews will be audio recorded.
- I will take part in 3 group interviews lasting on average 2 hours. Group interviews will be video recorded. All interviews will be conducted within the Marikopo school premises, preferably the staff room.
- The research data is confidential. Raviro will not tell anyone what I told her. If I take part in group interviews, I will be respectful of the confidentiality of my peers' responses.

- I will receive a copy of my interview transcripts and check it and let Raviro know if I want to change any parts or add more information.
- Results from the study will be published in journals and other academic publications but, Raviro will not use my real names.

RISKS AND INCONVENIENCE

- Although the research has been carefully designed to minimise risk and inconvenience:
- I may experience some level of anxiety, embarrassment and discomfort because I will be aware that I am being observed and being recorded.
- Participating in the study will inconvenience me as it entails a time commitment of approximately 20 hours spread over a period of 1 year.

MINIMISING RISK AND INCONVENIENCE

To minimise levels of risk and inconvenience, Raviro undertakes to:

- Tell me about interview and observation times ahead of schedule
- Not tell anyone what I told her
- Not use my real name or any other information about me in ways that can identify me
- Allow me to withdraw from the study at any time without giving any explanation

IF I HAVE CONCERNS OR A COMPLAINT

- I am aware that I can contact Raviro or her supervisor Dr Yasukawa if I have any concerns about the research. I also understand that I am free to withdraw my participation from this research project at any time I wish, without consequences, and without giving a reason.
- I agree that Raviro has answered all my questions fully and clearly.
- I agree that the research data gathered from this project may be published in a form that does not identify me in any way.

_____ ____/____/____

Signature (participant)

_____ ____/____/____

Signature (researcher or delegate)

NOTE:

This study has been approved by the University of Technology, Sydney Human Research Ethics Committee. If you have any complaints or reservations about any aspect of your participation in this research which you cannot resolve with the researcher, you may contact the Ethics Committee through the Research Ethics Officer (ph: +61 2 9514 9772 Research.Ethics@uts.edu.au) and quote the UTS HREC reference number. Any complaint you make will be treated in confidence and investigated fully and you will be informed of the outcome.

Appendix 4: Information sheet (Teachers)

Learning in a changing climate: An ethnographic study from the Global South

(UTS APPROVAL NUMBER 2015000301)

WHO IS DOING THE RESEARCH?

My name is Raviro Chineka and, I am a PhD research student at the University of Technology Sydney (UTS) in Australia. My supervisor is Dr Keiko Yasukawa.

WHAT IS THIS RESEARCH ABOUT?

I want to learn firsthand from people in the community how the shared, routine and everyday practices have been changing as a result of the long-term changes in the earth's climate within your community. This is why I want to learn from you and spend some time in this community.

IF I SAY YES, WHAT WILL IT INVOLVE?

- You will participate in 3 group interviews; lasting on average 2 hours. Group interviews will be conducted at Marikopo High School and, will be video recorded.
- Let me talk to you as I watch you carry out your normal EE club routines. I will visit you 3 times, over a period of 1 year in your school or any other appropriate spaces where club activities normally take place. Visits will last about 45 minutes.
- During observations, pictures may be taken. Interviews will be audio-recorded and transcribed.

ARE THERE ANY RISKS/INCONVENIENCE?

- The research has been carefully designed to minimise risk and inconvenience. However, you may experience some level of anxiety, embarrassment and discomfort because I will ask you to give me personal and private information about how your normal routine has been changing due to long term changes in the earth's climate.
- If you have suffered any losses and or hardships as a result of these changes, you may experience emotional distress through narrating your stories.
- My study is purely for academic purposes; I will be talking to you in order to learn from you but, I will not be in a position to solve the problems that you face due to the changing climate.

- Participating in the study will inconvenience you as it entails a time commitment of approximately 20 hours spread over a period of 1 year.
- Your daily schedules may be disrupted by my visits and, you will travel to Marikopo for all group interviews. Results from the study will be published in journals and other academic publications but, no reference shall be made to your real names.

WHY HAVE I BEEN ASKED?

You are also chosen because you are a patron of the Marikopo High School Environmental Education (EE) Club. You can tell me the information I need to know about how your EE club is addressing climate change within your school community.

DO I HAVE TO SAY YES?

You don't have to say yes.

WHAT WILL HAPPEN IF I SAY NO?

Nothing; I will thank you for your time so far and will not contact you about this research again.

IF I SAY YES, CAN I CHANGE MY MIND LATER?

You can change your mind at any time and you don't have to say why.

WHAT IF I HAVE CONCERNS OR A COMPLAINT?

If you have concerns about the research that you think I or my supervisor can help you with, please feel free to contact us on:

Ms. Raviro Chineka +61 [redacted] (Australia) OR +263 [redacted] (Zimbabwe) OR Dr Yasukawa +612 9514 3478

If you would like to talk to someone who is not connected with the research, you may contact the Research Ethics Officer via Research.Ethics@uts.edu.au, and quote this number (UTS HREC Approval Number 2015000302)

You may also contact Ms Munyanyi the Marikopo High School EE Club patron on

+263 771 259 809 or Mr Chimanikire, the Programme Manager for Mukuvisi Woodlands Environmental Education Centre on +263 773 840 320 who have provided their support to receive me in the community.

Appendix 5: Consent form (Parents/Guardians)

"Learning in a changing climate: An ethnographic study from the Global South"

I _____ agree to participate in the research project "Learning in a changing climate: An ethnographic case study from the Global South" UTS HREC approval reference number **2015000301** being conducted by Raviro Chineka, email Raviro.Chineka@student.uts.edu.au mobile +61 [redacted] or +263 [redacted] of the University of Technology, Sydney for her degree of Doctor of Philosophy in Education. This research is not funded.

PURPOSE OF RESEARCH

I understand that the purpose of this study is to learn firsthand from people in the community how everyday practices have been changing because of the long-term changes in the earth's climate. The study also seeks to find out how and, what learning takes place through these changes.

WHAT THE RESEARCH INVOLVES

I understand that I have been asked to participate in this research because I have lived in this area long enough to be able to give information about how my everyday practices have been changing due to the long-term changes in the earth's climate within this community. I am also chosen because my child/child living under my care belongs to the Marikopo High School Environmental Education (EE) Club whose main purpose is to advance environmental awareness and, promote responsible living. I agree that:

- I will take part in 3 video recorded group interviews lasting about 2 hours per session. I will travel to Marikopo High School for group interviews.
- Raviro will visit my home, work or other suitable social spaces 3 times during her study. She will observe me performing my everyday routines. During such observational study visits, I will describe and explain to her about my everyday practices and how they have been changing. Observations may be photographed and, narratives will be audio recorded.
- The research is confidential. Raviro will not tell anyone what I told her. If I take part in group interviews, I will be respectful of the confidentiality of my peers'

responses.

- Results from the study will be published in journals and other academic publications but, Raviro will not use my real names.

RISKS AND INCONVENIENCE

Although the research has been carefully designed to minimise risk and inconvenience:

- I may experience some level of anxiety, embarrassment and, discomfort because I will be asked to give personal and, private information about how my normal routine has been changing due to long term changes in the earth's climate.
- If I have suffered any losses and or hardships because of these changes, I may experience emotional distress through narrating my stories.
- The study is purely for academic purposes; Raviro will be talking to me to learn from me but will not be in a position to solve the problems that I might be facing due to the changing climate.
- Participating in the study will inconvenience me as it entails a time commitment of approximately 20 hours spread over a period of 1 year.

MINIMISING RISK AND INCONVENIENCE

To minimise levels of risk and inconvenience, Raviro undertakes to:

- Tell me about interview and observation times ahead of schedule
- Not tell anyone what I told her
- Not use my real name or any other information about me in ways that can identify me

IF I HAVE CONCERNS OR A COMPLAINT

I am aware that I can contact Raviro on +61 [redacted] or +263 [redacted] or her supervisor Dr Keiko Yasukawa on +612 9514 3478 if I have any concerns about the research.

I may also contact Ms Munyanyi the Marikopo High School EE Club patron on 263 771 259 809 or Mr Chimanikire the Programme Director for Mukuvisi Woodlands

Environmental Education Centre who have provided their support to receive me in the community on +263 773 840 320.

I also understand that I am free to withdraw my participation from this research project at any time I wish, without consequences, and without giving a reason.

I agree that Raviro has answered all my questions fully and clearly.

I agree that the research data gathered from this project may be published in a form that does not identify me in any way.

_____ ____/____/____

Signature (participant)

_____ ____/____/____

Signature (researcher or delegate)

NOTE:

This study has been approved by the University of Technology, Sydney Human Research Ethics Committee. If you have any complaints or reservations about any aspect of your participation in this research which you cannot resolve with the researcher, you may contact the Ethics Committee through the Research Ethics Officer (ph: +61 2 9514 9772 Research.Ethics@uts.edu.au) and quote the UTS HREC reference number, **2015000301**. Any complaint you make will be treated in confidence and investigated fully and you will be informed of the outcome.

Appendix 6: Information sheet (Parents/Guardians)

Learning in a changing climate: An ethnographic study from the Global North

(UTS APPROVAL NUMBER 2015000301)

WHO IS DOING THE RESEARCH?

My name is Raviro Chineka and, I am a PhD research student at the University of Technology Sydney (UTS) in Australia. My supervisor is Dr Keiko Yasukawa.

WHAT IS THIS RESEARCH ABOUT?

I want to learn firsthand from people in the community how the shared, routine and everyday practices have been changing as a result of the long-term changes in the earth's climate within your community. This is why I want to learn from you and spend some time in this community.

IF I SAY YES, WHAT WILL IT INVOLVE?

- You will participate in 3 group interviews; lasting on average 2 hours. Group interviews will be conducted at Marikopo High School and, will be video recorded.
- Let me talk to you as I watch you carry out your daily routines. I will visit you 3 times, over a period of 1 year in your home, work or any other appropriate social space. Visits will last about 2 hours.
- During observations, pictures may be taken. Interviews will be audio-recorded and transcribed.

ARE THERE ANY RISKS/INCONVENIENCE?

The research has been carefully designed to minimise risk and inconvenience. However, you may experience some level of anxiety, embarrassment and discomfort because I will ask you to give me personal and private information about how your normal routine has been changing due to long term changes in the earth's climate. If you have suffered any losses and or hardships as a result of these changes, you may experience emotional distress through narrating your stories. My study is purely for academic purposes; I will be talking to you in order to learn from you but, I will not be in a position to solve the problems that you face due to the changing climate.

Participating in the study will inconvenience you as it entails a time commitment of approximately 20 hours spread over a period of 1 year. Your daily schedules may be disrupted by my visits and, you will travel to Marikopo for all group interviews. Results from the study will be published in journals and other publications but, I will not use your real names.

WHY HAVE I BEEN ASKED?

Since you have lived in this area for a considerable period of time you are able to tell me how your everyday practices have been changing; what and, how you are learning due to the long-term changes in the earth's climate. You are also chosen because your child is a member of the Marikopo High School Environmental Education (EE) Club.

DO I HAVE TO SAY YES?

You don't have to say yes.

WHAT WILL HAPPEN IF I SAY NO?

Nothing; I will thank you for your time so far and will not contact you about this research **again.**

IF I SAY YES, CAN I CHANGE MY MIND LATER?

You can change your mind at any time and you don't have to say why.

WHAT IF I HAVE CONCERNS OR A COMPLAINT?

If you have concerns about the research that you think I or my supervisor can help you with, please feel free to contact us on:

Ms. Raviro Chineka +61 [redacted] (Australia) OR +263 [redacted] (Zimbabwe) OR

Dr Yasukawa +612 9514 3478

If you would like to talk to someone who is not connected with the research, you may contact the Research Ethics Officer via Research.Ethics@uts.edu.au, and quote this number (UTS HREC Approval Number 2015000301)

You may also contact Ms Munyanyi the Marikopo High School EE Club patron on

+263 771 259 809 or Mr Chimanikire, the Programme Manager for Mukuvisi Woodlands Environmental Education Centre on +263 773 840 320 who have provided their support to receive me in the community.

Appendix 7: Interview/Observation Guide

Key issues under consideration are:

1. How the everyday social practices in the community are changing in response to the impacts of climate change. (I focussed on just one practice) And;

2. The learning that occurs through these changed practices- who, what, why and how people learn.

3. The barriers and affordances to learning and change

Guidelines

I paid attention to the following:

A. The tools or resources the people are using to make meaning of how to adapt to climate change; – e.g.

- To what extent is western scientific knowledge part of their repertoire of tools;
- To what extent is their local knowledge and traditions part of their repertoire? What role does local knowledge play in assisting the community to adapt to climate change?
- What tensions exist between climate change science and contextual knowledge held by the members of the local community and, whether and, how science could be used to compliment the role of local knowledge in learning for climate change mitigation and adaptation.
- What other symbolic or material resources do they draw on?

B. What are the traditions, competencies and skills, material and symbolic artefacts, values and power relations that have led to the emergence of the existing everyday practices in the community? E.g.

- How have the historical, political, economic and cultural conditions shaped the existing practices?
- How have certain practices become socially embedded and, how are they normalised?

- Which practices are dying and, why?
- Which practices are sustained and why?
- Which practices are changing, which are being replaced and why?
- Who within the community is listened to; whose voices are dominant and, how has that influenced the practices that people adopt? What counts as knowledge and who defines what's worthwhile knowledge?
- What sustainability issues surround each of these practices and, how is the community dealing with such issues?
- If the desired goal is sustainable adaptation, what practices need to be questioned? How do such practices relate and, interlock and, how can they be unbundled?

C. What are the sources of resistance, and sources of strengths and resilience that the community can draw on as they learn to adapt to climate change (CC)?

- What support structures, infrastructures, institutions, materials resources, symbols and meanings does the community draw on and, how can they be strengthened to improve the community's adaptation to CC?
- What are the constraining factors, challenges, structural weaknesses etc. and, how can they be addressed? How will these same factors create possibilities of learning and change?

D. Since I worked with a community where there has been educational intervention about the environment and climate, I interrogated the following:

- What do people need to know, how do they know and why do they need to know in order to develop understandings about climate change that leads to radical and sustained changes of existing practices?
- What is learned and what is shared and how does the sharing occur as people adapt to climate change?
- What means should be used and what constrains people from taking action even if they have the requisite knowledge?

- How have the existing forms of educational interventions influenced the way the community adapts to climate change?
- How does the community interact with climate change information in general?
- If the desired goal is to educate for radical and sustained changes, what political, ontological and epistemological assumptions defining contemporary education need to be questioned?

E. I also was interested in understanding children's agency in climate change adaptation and whether and how children were influencing adult adaptations:

- What sort of intergenerational learning takes places between children and their parents and how does the learning occur?
- What are the barriers and affordances?
- How do adults interact with information they receive from children?

Summary

The study attempted to establish what the current practices in the community were, what it is that they wanted to change and what motivates community members to change their practices. I was also keen to investigate those aspects of their lives they wished to change but could not change. I endeavoured to ascertain the extent to which learning triggers transformation and how what triggered transformation.

In addition, the study attempted to investigate the different ways through which community members engaged with climate science; I assessed the barriers and opportunities to engagement and established the kinds of social relationships that were particularly useful.

For technical experts

1. What is the structure, focus and rationale of [name of organisation and programme] and to what extend is climate change education a component of the programme?

2. What information are you making available to schools, how accessible is the information and how is the information communicated?

3. What sort of message(s) are you spreading and what contradictions and controversies exist?

4. What do children need to learn to be active participants in mitigating the impacts of climate change?

5. What climate science literacy(ies) do people require to enable them to adapt in a sustainable manner?

6. How should climate change education be modelled and delivered if the focus is to enable sustainable adaptation among communities.

7. What support structures exist and how can they be strengthened to improve your climate change education programme?

8. Your vision for climate change education for the nation.

Appendix 8: Examplar statements of how and what learning occurs

Sources of learning	**Actions and processes of learning**	**Examples of expressions and actions**	**Examples of Outcomes of learning**
Innovating	e.g. Critically evaluating own practices Learning incidentally	*"...hapana kwatakambozvidzidziswa kuti kudiridzira kunobatsira... takangodzidza toga isu...mushure mokunge tamborohwa nenzara yakaomara".* [… We were never taught that irrigation helps…it was something we learned on our own… after we experienced severe hunger] (Ranganayi)	Irrigation adopted
Negotiating	e.g. Debating and deliberating among neighbours	*"...kubvunzana...Tinodzidzisana... Fanika muriwo iye zvino izvi kwanga kune kakonye... kanga kambochemedza vanhu makore apfuura aya... patakazoziva mushonga uyu maingonzwa ari pano ati dai mambonotenga abha".* […we ask each other …We share knowledge… on pests…what pesticide to use …] (Sarudzayi)	Improved pest and disease management

Complaining	e.g. Analysing and evaluating the success of innovations Questioning the authority of knowledge Questioning the taken-for-granted knowledge and practices	*"Zvokuti Madhumeni tinganyatsovatevedzera, tiri kufa. Ndozvauraya vanhu nenzara. Nokuti unobva wanzi rimai ka short term measure kachibage aka. Wobva warima kambeu kaya uchingokarima mvura yanaya zvakanyanyisa kobva kaorera mumunda. Ndosaka munhu wese iyezvinozvi ava kungomhanya nechangouya, changotanga kuti, kana ndikadari zvinozoita kana ndikadari zvinoita kana ndikadari zvinoita".* [Advice from *Madhumeni* is killing us, this is what is causing food insecurity … They tell us to plant the short-seasoned variety, we do likewise; you get above normal rains that season, the crop rots. This is the reason people are experimenting with anything and everything in search of a sustainable solution] (Lemuel).	Innovations rejected, shelved, partially adopted, or altered in practice
Avoiding confrontation	e.g. Acknowledging but ignoring innovations	*Amai pane nyaya…zvinomboti netsei… unovaudza vongoti eho… Usafunge kuti vanozokuudza futi. Pomboita kanenge kagakava musati manyatsoita zvinooneka* [As for my mother (Fiona), it's a mammoth task…it's an uphill	Innovations rejected, shelved, partially adopted, or altered in practice

		task… you tell them, and they simply say okay…Don't even think she will talk to you about the subject again. We fight before we effectuate anything] (Nashley).	
Engaging in open conflict	e.g. Debating and deliberating within families	"… *ndakati inini regai ndiise chibage muna January. Baba vapano vakati chibage chemuna January hachiite but, chibage ichocho ndakatochidya mwedzi wakapera. Chakatosvika asi vaiti hachisvike mvura haizonaye manonoka. Vakazotozvidemba vakati dai wakatoisa pahombe chingadai chakatosvika and chaachisina futi makonye. Saka zvokutoti January futi unogona kutoisa chibage".* [I decided to plant maize in January. My husband said January maize won't thrive, but I ate that maize last month. It matured and yet he said it wasn't going to. He regretted and wished I had planted a bigger portion. The maize matured and wasn't attacked by the stalk borer. So, I realised, you can plant even in January] (Fiona).	Expanded knowledge base; shifting planting dates

	e.g. Critically evaluating own practices	"*Ini ndakadyara mumera umwe chete. Ndokurasika kwandakaita ikoko, zvokuti pamwe dai ndakazoita mumera wechipiri pamwe ndochaizonyatsosvika ichocho…*" [I planted once. This is how I lost it, had I planted again, the second crop might have thrived…] (Lydia).	Reconfigured planting regimes, e.g. planting in stages

Appendix 9: Shona information sheet (Student)

ZVIRI MUTSVAKURUDZO (Mudzidzi)

Kudzidza munguva dzakananganа nematambudziko okushanduka shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose: Zvakacherwa mutsvagurudzo dzobva nokuChamhembe

(UTS TENDERO YE NHAMBA 2015000301)

NDIANI MUTSVAGURUDZI?

Zita rangu ndi Raviro Chineka, ndiri mudzidzi pachikoro chefundo yapamusoro chinonzi University of Technology Sydney (UTS) iri ku Australia. Vanonditungamirira pazvidzidzo zvangu vanonzi Chiremba Keiko Yasukawa.

ITSVAGURUDZO YEI?

Ndinoshuvira kudzidza kubva mumararamiro evanhu vari munharaunda ino kuti ndinzwisise kuti mararamiro enyu ezuva nezuva ari kushanduka nemhando dzipi kana takatarisana nematambudziko ari kukonzoreswa nokushanduka shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose. Ndinoshuvira kudzidza kubva kwamuri ndochikonzero ndichida kumboita nguva nemi munharaunda ino.

KANA NDIKABVUMA, ZVII ZVINOTARISIRWA?

- Muchapinda muhurukuro nhatu dzemapoka dzinotarisirwa kutora nguva ingaita maawa maviri. Hurukoro tiri mumapoka dzinoitirwa kuchikoro kwa Marikopo uye, tichange tichizotora mifananidzo ye vidhiyo.
- Mutsvakurudzi achakushanyirai kumba, kubasa kana dzimwe nzvimbo dzokutandarira achiongorora nokukurukura nemi maererano nemashandukiro ari kuita mararamiro enyu. Muchashanyirwa katatu mukati megore rimwechete uye, mutsvakurudzi muchava naye kwemaawa angaita maviri pose paanokushanyirai.
- Pamunoshanyirwa, mungangotorwa mifananidzo uye zvamuchataura zvicharekodhwa zvigoshandurwa kuitwa zvinyorwa.

PANE HERE NJODZI KANA ZVINGANDIBURITSA MUHURONGWA?

Tsvakurudzo yakarongwa nomazvo kuitira kuti pashaye njodzi uye huti musanyanya

kuburitswa muhurongwa hwenyu hwemazuva ose. Zvisinei, munogona kunzwa kakusagadzikana, kana kunyara nokuti hurukuro dzatichaita dzakananganana nokushanduka kwemararamiro enyu kuburikidza nokushanduka shanduka kuri kungoita mamiriro ekunze pasi rose mumakore akawanda akateverana. Kana muine zvigozhero kana kurasikirwa kwamakasangana nako nemhaka iyoyi, dzimwe nguva munogona kushungurudzika nokunditaurira zvamakasangana nazvo. Tsvakurudzo yangu yakananganana chete nokuvandudza ruzivo; ndiri kuda kudzidza kubva kwamuri asi handikwanisi kukubatsirai kupedza matambudziko amakatarisana nawo. Kupinda kwenyu mutsvakurudzo iyi kuchaita kuti mumbosendeka hurongwa hwenyu muchindipa nguva yokukurukura nemi uye kuchakudyirai nguva ingaita maawa makumi maviri mukati megore rimwechete. Patichaita hurukuro mumapoka, munotarisirwa kufamba kuenda kuchikoro kwa Marikopo.

SEI NDASARUDZWA?

Nokuda kwokuti uri nhengo ye kirabhu inodzidzisa vana kuchengetedzwa kwezvakatikomberedza nemararamiro akanaka iyo inonzi Marikopo High School Eco- Schools Club (ESC). Nokudaro unogona kupa humbovo hwakakwana maererano nedzidziso dziri kupiwa ne kukirabhu iyi nemabatsiriro airi kuita vanhu munharaunda yamunogara kugadzirisa matambudziko ari kusanganikwa nawo kuburikidza nekungoshanduka shanduka kwoita zvemamiriro okunze pasi rose mukati menguva refu.

NDINOSUNGIRWA KUBVUMA HERE?

Kwete, hamusungirwi kubvuma.

NDINOITWA SEI KANA NDIKATI KWETE?

Hapana; ndinongokutendai nenguva yamandipa kusvika parizvino uye handizodzoki kwamuri zvakare.

NDIKAMBOBVUMA PAKUTANGA, NDINOGONA HERE KUZOSHANDURA PFUNGWA?

Munogona kushandura pfungwa dzenyu uye hamutarisirwi kupa tsanagudzo ipi zvayo.

KO KANA NDINE ZVICHEMO KANA NYUNYUTO?

Kana mune zvamusiri kugutsikana nazvo pamusoro petsvakurudzo yangu, sunungukai kundibata ini kana mukuru wangu panhamba dzinotevera:

Muzvare Raviro Chineka +61 [redacted] (Australia) KANA +263 [redacted] (Zimbabwe) KANA Chiremba Yasukawa +612 9514 3478

Kana muchida kukurukura nemunhu asinei netsvakurudzo munogona kubata Muoongorori wekuita Tsvakuridzo zvine Hunhu pa Research.Ethics@uts.edu.au, movapa nhamba dzinotevera **2015000301**.

Munogonawo kubata Mai Munyanyi, mudzidzisi anobata nevana vari muboka re Marikopo High School EE Club pa nhamba dzinoti +263 771 259 809 KANA Va Chimanikire Mukuru wechirongwa che Mukuvisi Woodlands Environmental Education Centre pa +263 773 840 320. Vaviri ava vakapa rutsigiro rwavo kuti ndigone kubata nemi.

Appendix 10: Shona consent form (Student)

FOMU ROKUBVUMA(Mudzidzi)

"*Kudzidza munguva dzokushanduka-shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose: Muenzaniso wetsvagurudzo dzinobva nechokuChamhembe*"

Ini_____ ndinobvuma kupinda mutsvakurudzo "***Kudzidza munguva dzokushanduka-shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose: Muenzaniso wetsvagurudzo dzinobva nechokuChamhembe"***

Muonera pamwe mukugadzirisa matambudziko akanangana nokushanduka shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose" UTS HREC tendero inoratidzwa ne nhamba dzinoti **2015000301** iri kuitwa na Raviro Chineka, tsamba yemagetsi Raviro.Chineka@student.uts.edu.au foni +61 [redacted] kana +263 [redacted] weku University of Technology, Sydney pazvidzidzo zvake zve Chiremba wezve Fundo. Hapana ari kupa mari ku tsvagurudzo iyi.

CHINANGWA CHETSVAKURUDZO

Ndinonzwisisa kuti chinangwa chetsvakurudzo kunzvera kubva kune vari kurarama mazviri shanduko iri kuitika mumaramiro evanhu munharaunda ino zvichiburikidza neshanduko dzezvemamiriro okunze pasi rose mumakore akawanda apfuura. Tsvakuridzo yakananganazve nokunzvera zviri kudzidzwa uye madzidziro ari kuita vanhu kurarama hupenyu hutsva

ZVINOTARISIRWA

Ndinonzwisisa kuti ndasarudzwa kuva mutsvakurudzo nokuti ndiri mutungamiriri we kirabhu inodzidzisa vana kuchengetedzwa kwezvakatikomberedza nemararamiro akanaka iyo inonzi Marikopo High Eco-Schools Club (ESC). Ndinobvuma kuti:

- Raviro achakurukura neni nokundiongorora apo ndichange ndichiita zvatinoita mazuva ose kukurabhu yedu. Ndichashanyirwa katatu mugore rimwe chate uye, mutsvakurudzi ndichava naye kwemaminitsi angaita makumi mana namashanu pose paachandishanyira.

- Pandinoshanyirwa, ndingangotorwa mifananidzo uye zvandichataura zvicharekodhwa zvigoshandurwa kuitwa zvinyorwa.
- Ndichapinda muhurukuro nhatu dzemapoka dzinotarisirwa kutora nguva ingaita maawa maviri. Hurukoro tiri mumapoka dzinoitirwa kuchikoro kwa Marikopo uye, tichange tichizotorwa mifananidzo ye vidhiyo.
- Zvichabuda mutsvakurudzo iyi hazvina umwe ari kunze ungaziva. Raviro haazoudza ani zvake zvandinenge ndamutaurira. Neniwo ndicharemekdza pfungwa dzevamwe vangu vandichakurukura navo mumapoka uye zvatinenge takurukura muboka redu handingazvifumurwe kune vari kunze.

NJODZI NEKUBURITSWA MUHURONGWA

Tsvakurudzo yakarongwa nomazvo kuitira kuti pashaye njodzi uye huti ndisasanyanya kuburitswa muhurongwa hwangu hwamazuva ose. Zvisinei:

- ndinogona kunzwa kakusagadzikana, kana kunyara nokuti ndinenge ndichizviziva kuti ndiri kuongororwa uye kuti zvandiri kuita zviri kurekodhwa.
- Kupinda kwangu mutsvagurudzo iyi kuchaita kuti ndimbosendeka hurongwa hwangu ndichindipa muhurukuro uye kuchandidyira nguva ingaita maawa makumi maviri mukati megore rimwechete.

KUDEREDZA NJODZI UYE KUBURITSWA MUHURONGWA

Kuitira kuderedza njodzi nokuburitswa muhurongwa hwamazuva ose, Raviro anovimbisa:

- Kundizivisa hurongwa hwehurukuro nokushanya kwake pachine nguva
- Kuitira hurukuro dzose muvazhe dzechikoro mukati menguva dzechikoro
- Kusaudza ani zvake zvandinenge ndamutaurira

KANA NDINE ZVICHEMO KANA NYUNYUTO

Ndinoziva kuti kana ndine zvandisiri kugutsikana nazvo pamusoro petsvakurudzo iyi ndakasununguka kubata Raviro kana mukuru wake panhamba dzinotevera:

Muzvare Raviro Chineka +61 [redacted] (Australia) KANA +263 [redacted] (Zimbabwe) KANA Chiremba Yasukawa +612 9514 3478

Ndinogonawo kubata Mai Munyanyi, mudzidzisi anobata nevana vari muboka re Marikopo High School Eco -Schools Club pa nhamba dzinoti +263 771 259 809 avo vakapa rutsigiro rwavo kuti mutsvakurudzi agone kubata nesu.

Ndinozwisisawo kuti ndakasununguka kubuda mutsvaKurudzo ino pandadira ndisina tsanangudzo yandinopa uye pasina mhosva yandingapiwa.

Ndinobvuma kuti Raviro wapindura mibvunzo yangu yose zvakajeka uye zvakazara.

Ndinobvuma kuti zvichabuda mutsvakuridzo ino zvishandiswe kugadzirwa zvinyorwa

zvingaparidzirwa asi zvisingaburitse kuti ndini ani.

_____ ____/____/____

Runyoro (Mutambi)

Runyoro (Mubereki/Muriritiri / /

_____ ____/____/____

Runyoro (Mutsvagurudzi)

ONGORORA:

Tsvakurudzo iyi yakabvumidza ne bazi rinoongorora ne Zvokuitwa kwe Tsvakurudzo zvine Hunhu mu University ye Technology Sydney. Kana uine zvichemo kana nyunyuto maererano nokuva kwako mutsvkurudzo iyi zvisingagone kuti ugadzirisane nemutsvakurudzi, unogona kubata ve Komiti yekuita Tsvagurudzo zvine Hunhu pa foni: +61 2 9514 9772 kana pa tsamba yemagetsi Research.Ethics@uts.edu.au) uchitaura nhamba dzetendero inoti **2015000301**. Zvichemo zvose zvaunopa hazvifumurwe uye zvinoongororwa zvakazara ugoudzwa zvinobuda muuongororo.

Appendix 11 Shona consent form (Teacher)

ZVIRI MUTSVAKURUDZO (Mudzidzisi)

Kudzidza munguva dzokushanduka-shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose: Muenzaniso wemutsvagurudzo dzinehudzamu kubva kuChamhembe

(UTS NHAMBA YETENDERO 2015000301)

NDIANI MUTSVAGIRUDZI?

Zita rangu ndinonzi Raviro Chineka, ndiri mudzidzi pachikoro chefundo yapamusoro cheUniversity of Technology Sydney (UTS) iri kuAustralia. Vanonditungamirira pazvidzidzo zvangu vanonzi Chiremba Keiko Yasukawa.

ITSVAGURUDZO YEI?

Ndinoshuvira kudzidza kubva mumararamiro evanhu vari munharaunda ino kuti ndinzwisise kuti mararamiro enyu ezuva nezuva ari kushanduka nemhando dzipi, kana takatarisana nematambudziko ari kukonzoreswa nokushanduka shanduka kwoita mamiriro ekunze, mukati menguva refu pasi rose. Ndinoshuvira kudzidza kubva kwamuri ndicho chikonzero ndichida kumboita nguva nemi munharaunda ino.

KANA NDIKABVUMA, ZVII ZVINOTARISIRWA?

- Muchapinda muhurukuro nhatu dzemapoka dzinotarisirwa kutora nguva ingaita maawa maviri. Hurukuro tiri mumapoka dzinoitirwa kuchikoro kwaMarikopo uye, tichange tichizotora mifananidzo yemapikicha nevhidhiyo.
- Mutsvakurudzi achakushanyirai kumba, kubasa kana dzimwe nzvimbo dzokutandarira achiongorora nokukurukura nemi maererano nemashandukiro ari kuita mararamiro enyu. Muchashanyirwa katatu mukati megore rimwechete uye, mutsvakurudzi muchava naye kwemaawa angaita maviri pose paanokushanyirai.
- Pamunoshanyirwa, mungangotorwa mifananidzo uye zvamuchataura zvicharekodhwa zvigoshandurwa kuitwa zvinyorwa.

PANE HERE NJODZI KANA ZVINGANDIBURITSA MUHURONGWA?

Tsvakurudzo yakarongwa namazvo kuitira kuti pashaye njodzi uye kuti musanyanya

kuburitswa muhurongwa hwenyu hwemazuva ose. Zvisinei, munogona kunzwa kakusagadzikana, kana kunyara nokuti hurukuro dzatichaita dzakananganga nokushanduka kwemararamiro enyu kuburikidza nokushanduka shanduka kuri kungoita mamiriro ekunze pasi rose mumakore akawanda akateverana. Kana muine zvigozhero kana kurasikirwa kwamakasangana nako nemhaka iyoyi, dzimwe nguva munogona kushungurudzika nokunditaurira zvamakasangana nazvo. Tsvakurudzo yangu yakananganga chete nokuvandudza ruzivo; ndiri kuda kudzidza kubva kwamuri asi handikwanisi kukubatsirai kupedza matambudziko amakatarisana nawo. Kupinda kwenyu mutsvakurudzo iyi kuchaita kuti mumbosendeka hurongwa hwenyu muchindipa nguva yokukurukura nemi uye kuchakudyirai nguva ingaita maawa makumi maviri mukati megore rimwechete. Patichaita hurukuro mumapoka, munotarisirwa kufamba kuenda kuchikoro kwa Marikopo.

SEI NDASARUDZWA?

Nokuda kwokuti muri mudzidzisi anotungamirira kirabhu inodzidzisa vana kuchengetedzwa kwezvakatikomberedza nemararamiro akanaka iyo inonzi Marikopo High School Eco-Schools Club (ESC). Nokudaro munogona kupa umbowo hwakakwana maererano nedzidziso dziri kupiwa kukirabhu iyi, nemabatsiriro airi kuita vanhu munharaunda yamunogara kugadzirisa matambudziko ari kusanganikwa nawo, kuburikidza nekushanduka shanduka kwoita zvemamiriro ekunze pasi rose mukati menguva refu.

NDINOSUNGIRWA KUBVUMA HERE?

Kwete, hamusungirwi kubvuma.

NDINOITWA SEI KANA NDIKATI KWETE?

Hapana; ndinongokutendai nenguva yamandipa kusvika parizvino uye handizodzoki kwamuri zvakare.

NDIKAMBOBVUMA PAKUTANGA, NDINOGONA HERE KUZOSHANDURA PFUNGWA?

Munogona kushandura pfungwa dzenyu uye hamutarisirwi kupa tsanagudzo ipi zvayo.

KO KANA NDINE ZVICHEMO KANA NYUNYUTO?

Kana mune zvamusiri kugutsikana nazvo pamusoro petsvakurudzo yangu, sunungukai kundibata ini kana mukuru wangu panhare dzinotevera:

Muzvare Raviro Chineka +61 [redacted] (Australia) KANA +263 [redacted] (Zimbabwe) KANA Chiremba Yasukawa +612 9514 3478

Kana muchida kukurukura nemunhu asinei netsvakurudzo munogona kubata Muoongorori wekuita Tsvakuridzo zvine hunhu patsamba yemagetsi inoti Research.Ethics@uts.edu.au, movapa nhamba dzinotevera **2015000301**

Munogonawo kubata Mai Munyanyi, mudzidzisi anobata nevana vari muboka re Marikopo High School EE Club panhare dzinoti +263 771 259 809 KANA Va Chimanikire, Mukuru wechirongwa che Mukuvisi Woodlands Environmental Education Centre pa +263 773 840 320. Vaviri ava vakapa rutsigiro rwavo kuti ndigone kubata nemi.

Appendix 12 Shona information sheet (Teacher)

ZVIRI MUTSVAKURUDZO (Mudzidzisi)

Kudzidza munguva dzokushanduka-shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose: Muenzaniso we mutsvagurudzo dzinehudzamu kubva ku Chamhembe

(UTS TENDERO YE NHAMBA 2015000301)

NDIANI MUTSVAGURUDZI?

Zita rangu ndi Raviro Chineka, ndiri mudzidzi pachikoro chefundo yapamusoro chinonzi University of Technology Sydney (UTS) iri ku Australia. Vanonditungamirira pazvidzidzo zvangu vanonzi Chiremba Keiko Yasukawa.

ITSVAGURUDZO YEI?

Ndinoshuvira kudzidza kubva mumararamiro evanhu vari munharaunda ino kuti ndinzwisise kuti mararamiro enyu ezuva nezuva ari kushanduka nemhando dzipi kana takatarisana nematambudziko ari kukonzoreswa nokushanduka shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose. Ndinoshuvira kudzidza kubva kwamuri ndochikonzero ndichida kumboita nguva nemi munharaunda ino.

KANA NDIKABVUMA, ZVII ZVINOTARISIRWA?

- Muchapinda muhurukuro nhatu dzemapoka dzinotarisirwa kutora nguva ingaita maawa maviri. Hurukoro tiri mumapoka dzinoitirwa kuchikoro kwa Marikopo uye, tichange tichizotora mifananidzo ye vidhiyo.
- Mutsvakurudzi achakushanyirai kumba, kubasa kana dzimwe nzvimbo dzokutandarira achiongorora nokukurukura nemi maererano nemashandukiro ari kuita mararamiro enyu. Muchashanyirwa katatu mukati megore rimwechete uye, mutsvakurudzi muchava naye kwemaawa angaita maviri pose paanokushanyirai.
- Pamunoshanyirwa, mungangotorwa mifananidzo uye zvamuchataura zvicharekodhwa zvigoshandurwa kuitwa zvinyorwa.

PANE HERE NJODZI KANA ZVINGANDIBURITSA MUHURONGWA?

Tsvakurudzo yakarongwa nomazvo kuitira kuti pashaye njodzi uye huti musanyanya

kuburitswa muhurongwa hwenyu hwemazuva ose. Zvisinei, munogona kunzwa kakusagadzikana, kana kunyara nokuti hurukuro dzatichaita dzakananganana nokushanduka kwemararamiro enyu kuburikidza nokushanduka shanduka kuri kungoita mamiriro ekunze pasi rose mumakore akawanda akateverana. Kana muine zvigozhero kana kurasikirwa kwamakasangana nako nemhaka iyoyi, dzimwe nguva munogona kushungurudzika nokunditaurira zvamakasangana nazvo. Tsvakurudzo yangu yakananganana chete nokuvandudza ruzivo; ndiri kuda kudzidza kubva kwamuri asi handikwanisi kukubatsirai kupedza matambudziko amakatarisana nawo. Kupinda kwenyu mutsvakurudzo iyi kuchaita kuti mumbosendeka hurongwa hwenyu muchindipa nguva yokukurukura nemi uye kuchakudyirai nguva ingaita maawa makumi maviri mukati megore rimwechete. Patichaita hurukuro mumapoka, munotarisirwa kufamba kuenda kuchikoro kwa Marikopo.

SEI NDASARUDZWA?

Nokuda kwokuti muri mudzidzisi anotungamirira kirabhu inodzidzisa vana kuchengetedzwa kwezvakatikomberedza nemararamiro akanaka iyo inonzi Marikopo High School Eco-Schools Club (ESC). Nokudaro munogona kupa humbovo hwakakwana maererano nedzidziso dziri kupiwa ne kukirabhu iyi nemabatsiriro airi kuita vanhu munharaunda yamunogara kugadzirisa matambudziko ari kusanganikwa nawo kuburikidza nekungoshanduka shanduka kwoita zvemamiriro okunze pasi rose mukati menguva refu.

NDINOSUNGIRWA KUBVUMA HERE?

Kwete, hamusungirwi kubvuma.

NDINOITWA SEI KANA NDIKATI KWETE?

Hapana; ndinongokutendai nenguva yamandipa kusvika parizvino uye handizodzoki kwamuri zvakare.

NDIKAMBOBVUMA PAKUTANGA, NDINOGONA HERE KUZOSHANDURA PFUNGWA?

Munogona kushandura pfungwa dzenyu uye hamutarisirwi kupa tsanagudzo ipi zvayo.

KO KANA NDINE ZVICHEMO KANA NYUNYUTO?

Kana mune zvamusiri kugutsikana nazvo pamusoro petsvakurudzo yangu, sunungukai kundibata ini kana mukuru wangu panhamba dzinotevera:

Muzvare Raviro Chineka +61 (Australia) KANA +263 (Zimbabwe) KANA Chiremba Yasukawa +612 9514 3478

Kana muchida kukurukura nemunhu asinei netsvakurudzo munogona kubata Muoongorori wekuita Tsvakuridzo zvine Hunhu pa Research.Ethics@uts.edu.au, movapa nhamba dzinotevera **2015000301**

Munogonawo kubata Mai Munyanyi, mudzidzisi anobata nevana vari muboka re Marikopo High School EE Club pa nhamba dzinoti +263 771 259 809 KANA Va Chimanikire, Mukuru wechirongwa che Mukuvisi Woodlands Environmental Education Centre pa +263 773 840 320. Vaviri ava vakapa rutsigiro rwavo kuti ndigone kubata nemi.

Appendix 13: Shona consent form (Parent/Guardian)

FOMU ROKUBVUMA(Mubereki/Muriritiri)

Kudzidza munguva dzakananganа nematambudziko okushanduka shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose: Zvakacherwa mutsvagurudzo dzobva nokuChamhembe

Ini_____ ndinobvuma kupinda mutsvakurudzo "Muonera pamwe mukugadzirisa matambudziko akanangana nokushanduka shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose" UTS HREC tendero inoratidzwa nenhamba dzinoti **2015000301** iri kuitwa naRaviro Chineka, tsamba yemagetsi Raviro.Chineka@student.uts.edu.au Runhare +61 [redacted] kana +263 [redacted] weku University of Technology, Sydney pazvidzidzo zvake zvehuChiremba wemuzvinafundo. Hapana ari kupa mari kutsvakurudzo iyi.

CHINANGWA CHETSVAKURUDZO

Ndinonzwisisa kuti chinangwa chetsvakurudzo iyi, kunzvera kubva kune vari kurarama mairi shanduko iri kuitika mumaramiro evanhu munharaunda ino, zvichiburikidza neshanduko dzezvemamiriro okunze pasi rose mumakore akawanda apfuura. Tsvakurudzo yakananganazve nokunzvera zviri kudzidzwa uye madzidziro ari kuita vanhu kurarama hupenyu hutsva

ZVINOTARISIRWA

Ndinonzwisisa kuti ndasarudzwa kuva mutsvakurudzo nokuti ndagara munharaunda ino kwemakore akati wandei. Nokudaro ndinokwanisa kupa humbowo hwakakwana maererano nokushanduka kuri kuita mararamiro evanhu ezuva nezuva kuburikidza neshanduko dzinounzwa nokuda kwekushanduka shanduka kuri kuita zvemamiriro ekunze munguva refu yapfuura pasi rose. Chimwe chandasarudzirwa ndechokuti ndine mwana wekubereka, kana wandinochengeta ari mukirabhu inodzidzisa vana kuchengetedzwa kwezvakatikomberedza nemararamiro akanaka iyo yavanoti Marikopo High School Environmental Education (EE) Club. Ndinobvuma kuti:

- Ndichapinda muhurukuro nhatu dzemapoka dzinotarisirwa kutora nguva ingaita maawa maviri. Hurukuro tiri mumapoka dzinoitirwa kuchikoro kwa Marikopo uye, tichange tichizotorwa mifananidzo yevhidhiyo.

- Raviro achandishanyira kumba, kubasa kana dzimwe nzvimbo dzokutandarira achiongorora nokukurukura neni maererano nemashandukiro ari kuita mararamiro angu. Ndichashanyirwa katatu mukati megore rimwechete uye mutsvakurudzi ndichava naye kwemaawa angaita maviri pose paachandishanyira.
- Pandinoshanyirwa, ndingangotorwa mifananidzo uye zvandichataura zvicharekodhwa zvigoshandurwa kuitwa zvinyorwa.
- Zvichabuda mutsvakurudzo iyi hazvina umwe ari kunze angaziva. Raviro haazoudzi ani zvake zvandinenge ndamutaurira. Neniwo ndicharemekedza pfungwa dzichapiwa navamwe vangu vandichakurukura navo mumapoka uye zvatinenge takurukura muboka redu handingazvifumure kune vari kunze.

NJODZI NEKUBURITSWA MUHURONGWA

Tsvagurudzo yakarongwa nomazvo kuitira kuti pashaye njodzi uye kuti ndisasanyanya kuburitswa muhurongwa hwangu hwemazuva ose. Zvisinei:

- ndinogona kunzwa kakusagadzikana, kana kunyara nokuti hurukuro dzatichaita dzakananganana nezvakavanzika zvangu zvine chokuita nokushanduka kwemararamiro angu kuburikidza nokushanduka shanduka kuri kungoita mamiriro ekunze pasi rose mumakore akawanda akateverana.
- Kana ndine zvigozhero kana kurasikirwa kwandakasangana nako nemhaka iyoyi, dzimwe nguva ndingagona kushungurudzika nokuda kwokutaura zvandakasangana nazvo.
- Tsvakurudzo iyi yakanangana chete nokuvandudza ruzivo; Raviro ari kuda kudzidza kubva kwandiri asi haakwanisi kundibatsira kupedza matambudziko andakatarisana nawo.
- Kupinda kwangu mutsvakurudzo iyi kuchaita kuti ndimbosendeka humwe hurongwa hwangu ndichindipa muhurukuro, uye kuchandidyira nguva ingaita maawa makumi maviri mukati megore rimwechete. Patichaita hurukuro mumapoka, ndinotarisirwa kufamba kuenda kuchikoro kwaMarikopo.

KUDEREDZA NJODZI UYE KUBURITSWA MUHURONGWA

Kuitira kuderedza njodzi yokuburitswa muhurongwa hwemazuva ose, Raviro

anovimbisa:

- Kundizivisa hurongwa hwehurukuro nokushanya kwake pachine nguva
- Kusaudza ani zvake zvandinenge ndamutaurira

Kusashandisa zita rangu chairo, uye humwe humbowo hwandinenge ndamupa nenzira dzingaite kuti ndizivikanwe

KANA NDINE ZVICHEMO KANA NYUNYUTO

Ndinoziva kuti kana ndine zvandisiri kugutsikana nazvo pamusoro petsvakurudzo iyi ndakasununguka kubata Raviro, kana mukuru wake panhare dzinotevera:

Muzvare Raviro Chineka +61 [redacted] (Australia) **KANA** +263 [redacted] (Zimbabwe) **KANA** Chiremba Yasukawa +612 9514 3478 (Australia)

Ndinogonawo kubata Mai Munyanyi, mudzidzisi anobata nevana vari muboka re Marikopo High School EE Club panhare dzinoti +263 771 259 809 KANA vaChimanikire, Mukuru wechirongwa cheMukuvisi Woodlands Environmental Education Centre panhare idzi +263 773 840 320. Vaviri ava vakapa rutsigiro rwavo kuti mutsvagurudzi agone kubata nesu munharaunda ino.

Ndinozwisisawo kuti ndakasununguka kubuda mutsvakurudzo ino pandadira ndisina tsanangudzo yandinopa uye pasina mhosva yandingapiwa.

Ndinobvuma kuti Raviro wapindura mibvunzo yangu yose zvakajeka uye zvakazara.

Ndinobvuma kuti zvichabuda mutsvakuridzo ino zvishandiswe kugadzira zvinyorwa zvingaparidzirwa asi zvisingaburitse kuti ndini ani.

_____ ____/____/____

Runyoro (Mutambi)

_____ ____/____/____

Runyoro (Mutsvakurudzi)

ONGORORA:

Tsvakurudzo iyi yakabvumidzwa nebazi rinoongorora neZvokuitwa kweTsvakurudzo zvine hunhu neUniversity ye Technology Sydney. Kana uine zvichemo kana nyunyuto maererano nokuva kwako mutsvagurudzo iyi zvisingagone kuti ugadzirisane nemutsvakurudzi, unogona kubata veKomiti yekuita Tsvakurudzo zvine Hunhu panhare dzinoti +61 2 9514 9772 kana patsamba yemagetsi Research.Ethics@uts.edu.au) uchitaura nhamba dzebvumidzo iyi. Zvichemo zvose zvaunopa hazvifumurwe uye zvinoongororwa zvakazara ugoudzwa zvinobuda muuongororo.

Appendix 14: Shona information sheet (Parent/Guardian)

ZVIRI MUTSVAKURUDZO (Mubereki/Muriritiri)

Kudzidza munguva dzokushanduka-shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose: Muenzaniso we tsvagurudzo dzinehudzamu kubva ku Chamhembe **(UTS tendero ye nhamba 2015000301)**

NDIANI MUTSVAGURUDZI?

Zita rangu ndi Raviro Chineka, ndiri mudzidzi pachikoro chefundo yapamusoro chinonzi University of Technology Sydney (UTS) iri ku Australia. Vanonditungamirira pazvidzidzo zvangu vanonzi Chiremba Keiko Yasukawa.

ITSVAGURUDZO YEI?

Ndinoshuvira kudzidza kubva mumararamiro evanhu vari munharaunda ino kuti ndinzwisise kuti mararamiro enyu ezuva nezuva ari kushanduka nemhando dzipi kana takatarisana nematambudziko ari kukonzoreswa nokushanduka shanduka kwoita mamiriro ekunze mukati menguva refu pasi rose. Ndinoshuvira kudzidza kubva kwamuri ndochikonzero ndichida kumboita nguva nemi munharaunda ino.

KANA NDIKABVUMA, ZVII ZVINOTARISIRWA?

- Muchapinda muhurukuro nhatu dzemapoka dzinotarisirwa kutora nguva ingaita maawa maviri. Hurukoro tiri mumapoka dzinoitirwa kuchikoro kwa Marikopo uye, tichange tichizotora mifananidzo ye vidhiyo.
- Mutsvakurudzi achakushanyirai kumba, kubasa kana dzimwe nzvimbo dzokutandarira achiongorora nokukurukura nemi maererano nemashandukiro ari kuita mararamiro enyu. Muchashanyirwa katatu mukati megore rimwechete uye, mutsvakurudzi muchava naye kwemaawa angaita maviri pose paanokushanyirai.
- Pamunoshanyirwa, mungangotorwa mifananidzo uye zvamuchataura zvicharekodhwa zvigoshandurwa kuitwa zvinyorwa.

PANE HERE NJODZI KANA ZVINGANDIBURITSA MUHURONGWA?

Tsvakurudzo yakarongwa nomazvo kuitira kuti pashaye njodzi uye huti musanyanya kuburitswa muhurongwa hwenyu hwemazuva ose. Zvisinei, munogona kunzwa kakusagadzikana, kana kunyara nokuti hurukuro dzatichaita dzakanangana

nokushanduka kwemararamiro enyu kuburikidza nokushanduka shanduka kuri kungoita mamiriro ekunze pasi rose mumakore akawanda akateverana. Kana muine zvigozhero kana kurasikirwa kwamakasangana nako nemhaka iyoyi, dzimwe nguva munogona kushungurudzika nokunditaurira zvamakasangana nazvo. Tsvakurudzo yangu yakanangana chete nokuvandudza ruzivo; ndiri kuda kudzidza kubva kwamuri asi handikwanisi kukubatsirai kupedza matambudziko amakatarisana nawo. Kupinda kwenyu mutsvakurudzo iyi kuchaita kuti mumbosendeka hurongwa hwenyu muchindipa nguva yokukurukura nemi uye kuchakudyirai nguva ingaita maawa makumi maviri mukati megore rimwechete. Patichaita hurukuro mumapoka, munotarisirwa kufamba kuenda kuchikoro kwa Marikopo.

SEI NDASARUDZWA?

Nokuda kwokuti magara munharaunda ino kwemakore akati wandei munokwanisa kundipa humbovo hwakakwana maererano nokushanduka kuri kuita mararamiro evanhu munharaunda ino zvichiburikidza nokushanduka shanduka kuri kungoita zvemamiririo ekunze pasi rose mumakore akawanda apfuura. Chimwe chikonzero ndechokuti mune mwana wekubereka kana wamunochengeta ari mukirabhu inodzidzisa vana kuchengetedzwa kwezvakatikomberedza nemararamiro akanaka iyo yavanoti Marikopo High School Eco -Schools Club (ESC).

NDINOSUNGIRWA KUBVUMA HERE?

Kwete, hamusungirwi kubvuma.

NDINOITWA SEI KANA NDIKATI KWETE?

Hapana; ndinongokutendai nenguva yamandipa kusvika parizvino uye handizodzoki kwamuri zvakare.

NDIKAMBOBVUMA PAKUTANGA, NDINOGONA HERE KUZOSHANDURA PFUNGWA?

Munogona kushandura pfungwa dzenyu uye hamutarisirwi kupa tsanagudzo ipi zvayo.

KO KANA NDINE ZVICHEMO KANA NYUNYUTO?

Kana mune zvamusiri kugutsikana nazvo pamusoro petsvakurudzo yangu, sunungukai kundibata ini kana mukuru wangu panhamba dzinotevera:

Muzvare Raviro Chineka +61 [redacted] (Australia) KANA +263 [redacted] (Zimbabwe) KANA Chiremba Yasukawa +612 9514 3478

Kana muchida kukurukura nemunhu asinei netsvakurudzo munogona kubata Muoongorori wekuita Tsvakuridzo zvine Hunhu pa Research.Ethics@uts.edu.au, movapa nhamba dzinotevera **2015000301**

Munogonawo kubata Mai Munyanyi, mudzidzisi anobata nevana vari muboka re Marikopo High School Eco -Schools E Club pa nhamba dzinoti +263 771 259 809 KANA Va Chimanikire, Mukuru wechirongwa che Mukuvisi Woodlands Environmental Education Centre pa +263 773 840 320. Vaviri ava vakapa rutsigiro rwavo kuti ndigone kubata nemi.

Appendix 15: Shona interview/observation guide

` Hwaro hwehurukuro/zviongororwa

Dzidziso nevana

- Ndeipi dzidziso yamunowana kuvana, uye munoitambira sei?
- Pane here zvinoonekwa kana kubatika nokuda kwokuti ari muboka rinodzidzisa vana nezwekuchengetedzwa kwemamiriro ekunze?
- Semaonero enyu, vabereki vanekodzero here yekuziva zvinodzidzwa nevana?

Tsika

- Chii chinonzi tsika, dzakabvepi, uye ndiani anoita kuti dzichengetedzwe?
- Tsika yekurima chibage mumapindu emuriwo yakambotanga sei?
- Chibage munharaunda ino chirikutsva gore negore, pane chikonzero here chinoita kuti musachinja kurima dzimwe mbeu?
- Ndedzipi dzimwe tsika munharaunda menyu dzinobatsira kukunda dambudziko reKKE?
- Ndedzipi tsika dzatiri kuchengetedzanedzatiri kurasa mukuedza kukunda dambudziko KKE?
- Panewo here vamuri kudzidzisa, uye munovadzidzisa kutii?
- Ndedzipi tsika dzedu dzatiri kuchengetedza dzatiri kufanira kurasa?

Zvinobatsira nezvinovhiringa

Mavenenguva yakareba zvakadii muchigara munharaunda ino? Ndedzipi shanduko dzamuri kuona dzakanangana nemamiriro ekunze?

- Semaonero enyu, shanduko idzi dziri kukonzereswa nei?
- Kushanduka kuri kuitika kwemamiriro ekunze kuri kushandura mamiriro eupenyu hwenyu nenzira dzipi?
- Ndeapi matambudziko amuri kusangana nawo, uye murikuakunda sei?
- Imi ndezvipiwo sedungamunhu kana semhuri zvamunofungawo, kuti

zvirikukonzeresa kushanduka kwemamiriri e kunze (KKE)?

- Zvii zvamuri kudzidza neKKE?
- Dzidziso dzamunowana dzinobva nekupi?
- Kune here dzidziso disingatambiriki, uye dzinenge dzakaita sei?
- Dzinotambirika dzinenge dzakaita sei, uye dzinobva nekumativi api?
- Zvakakutorerai nguva yakareba sei kuti dzidziso yamakambowana muishandise?
- Zvii zvinokutadzisai kuita zvinhu zvamunenge madzidziswa kana kuti zvii zvinoita kuti murambe muchiita zvinhu zvamunoziva kuti zvinokonzeresa KKE?

Rutsigiro kubva kuhurumende.

- Nderupi rutsigiro rwamuri kuwana kubva kuhurumende nemamwe mapoka anobatsira akazvimirira, uye ndeapi mapoka acho?
- Padzidziso dzamunowana kubva kumapoka akasiyana siyana, pane here padzinopesana?
- Nyaya dzemamiriro ehupfumi munyika, dzinokubatai papi, takatarisana nedambudziko remamiriro ekunze?

Kugarisana

- Ndeapi matambudziko amunosangana nawo mukugarisana kwenyu mumba kana munharaunda menyu nokuda kweKKE?
- Semaonero enyu, dambudziko reKKE, rinobata vanhurume kana vakadzi zvakasiyana here?

Vana mazvikokota

- Nditsanangurireiwo hwaro, muono nechimiro chechirongwa chenyu che ECHO School Programme (ESP)?
- Ndeapi mashoko amuri kupa muzvikoro, uye ndedzipi nzira dzamunoshandisa kuti mashoko aya aparidzirwe?

- Dzidziso dzamunopa dzakananganga nei? Pane kupikisana here kana kupokana kunoitika?
- Vana vanofanira kudzidzei, kuti vagone kuva vaiti vekudzivirira kushanduka kwemamiriro ekunze (KKE)?
- Nderupi ruzivo rwemamiriro ekunze anodiwa nevana kuti vagone kukunda matambudziko anokonzerwa neKKE?
- Kana tichida kuti dzidziso igone kubatsira vanhu kuti vakunde reKKE, dzidziso yacho inofanira kunge yakamira sei?
- Ndezvipi zvikwaniso zviripo, uye zvingasimbiswe sei kuti chirongwa chenyu chivandudzwe?
- Muono wenyu wedzidziso yeKKE, wenyu munyika yenyu?

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