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Faculty of Humanities & Social Sciences

DISSERTATION

Submitted for the Master of Research Programme

Climate action to enable quality education: Exploring the potential of Eco-Schools to reverse the triple education crises in Rwanda

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Department of Education

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Contents

Abstract

This dissertation project focusses on the intersection between climate change (SDG 13) and quality education (SDG 4) in six Rwandan schools facing severe challenges, in what the UN is terming the 'triple education crises' of inclusion, quality and relevance (UN, 2023). The project will consolidate, follow-up and present the results of a relational knowledge co-creation research project conducted between 2021 and 2023 by the Albertine Rift Conservation Society (ARCOS) with 240 partners, and teachers, learners and parents in six Rwandan schools to gain a shared understanding of the education and climate change challenges and co-create solutions using the Eco-Schools problem-based learning pedagogy. The knowledge co-creation processes revealed a negative relationship happening at the intersection between climate change and quality education which is interrupting successful implementation of both the Competence-Based Curriculum (CBC), and the School Feeding Programme policies of the Government of Rwanda, affecting national progress toward SDG 4 and SDG 13. However, by integrating climate action projects in the CBC, with practical skills and knowledge from parents and wider community members, education barriers caused by poor school conditions, and poor nutrition, health and comfort of learners are being removed, whilst the quality and relevance of teaching and learning in schools is being improved. While the transformative vision of education as a 'new social contract' (UNESCO, 2020) has been called unrealistic, this research aims to demonstrate how the Eco-Schools programme can reverse the negative relationship between climate change and quality education and support schools to simultaneously address the triple crisis of inclusion, quality, and relevance. Ultimately, by showing that it is possible to transform education in even the most challenged schools, at a relatively low cost, within a very short space of time (one school year) and without

large-scale curriculum reform or infrastructure, the findings of this research promote wider, faster, and more optimistic progression toward the UNESCO's vision and the Greening Education Partnership (GEP) targets. In particular the research proposes a new paradigm around a 'third relationship' between climate change and quality education which might be called 'climate action to enable quality education'.

Chapter One: Introduction

Recent international discourse recognises that beyond the challenge of providing universal and equitable access to schooling, education is experiencing compounded crises of quality and relevance in what, how and where children are learning (UN 2023). This means that while 'more of the world has greater access to formal educational opportunity than ever before' (Toukan, 2023), half of the children attending schools are not learning (UNESCO UIS 2017) and education is 'not yet fulfilling its promise to help us shape peaceful, just, and sustainable futures' (UNESCO, 2020, p.6). The increasing severity of climate change impacts are compounding this 'triple crises'. As recently expressed in a report published by the FCDO 'for every step we take forward on education, climate and environmental change takes us two steps back (2022, p.7). This dissertation research project responds to a call in the same report for 'more work to understand how priority issues are linked and to find integrated solutions' (FCDO, 2022).

There is by now widespread acceptance in both academic literature and international discourse that to meet the interlinked challenges of sustainable development, climate change and poverty, education systems worldwide must be transformed (UNESCO. 2020; FCDO, 2022; Tikly et al., 2020). Uniting behind a reimagined vision of education as 'a public endeavour and a common good' (UNESCO, 2020), the UN Secretary-General launched the Greening Education Partnership (GEP) with ambitious targets to use the knowledge and practice accumulated in the field of Education for Sustainable Development (ESD) to achieve the transformation needed (UN, 2023). Previous research has suggested that the international Eco-Schools programme of the Foundation for Environmental Education (FEE) can support education transformation from the bottom-

up (Copsey, 2020; Copsey, 2019). As one of the largest global ESD programmes, FEE is a lead partner for the GEP.

However, the targets are ambitious, the challenges are severe (FCDO, 2022) and previous efforts to transform education curriculums and teaching have been fraught with obstacles and failures (Schweisfurth, 2011). For example, in Rwanda where there is strong political support for change and innovation in education (Tikly and Milligan, 2017), multiple issues have interrupted the integration of the Competence-Based Curriculum (CBC) since its launch in 2015. In 2020 the Rwandan Education Board (REB) requested that the Albertine Rift Conservation Society (ARCOS) help understand how Eco-Schools can support integration of the CBC and remove barriers to quality education in Rwanda. Based on this request, a research project entitled 'Eco-Schools as a tool for integrating sustainable development and climate action within the competence-based curriculum in Rwanda' was coordinated by ARCOS between 2021 and 2023 with funding from the Transforming Education for Sustainable Futures (TESF) network plus. This qualitative research project used a relational knowledge co-creation methodology involving a broad range of partners, and teachers, learners and parents in six Rwandan Eco-Schools and myself as co-investigator on the research team.

With collaboration and funding from the Foundation from Environmental Education (FEE), this dissertation project will consolidate, follow-up and present the results of the ARCOS-TESF study aiming to build on previous understanding of how the Eco-Schools programme can help remove education barriers and achieve the vision of quality education as lead partner of the GEP. In particular this research focusses on the intersection between climate and environmental change (SDG 13) and quality education

(SDG 4) asking; *'How can Eco-Schools pedagogies and climate action projects address the triple education crises in the real-life context of Rwandan schools facing severe education and climate change challenges?'*.

Chapter Two: Literature Review

The 2023 report on the UN Transforming Education Summit held in September 2022,

describes 'a dramatic triple crisis' confronting education today;

> 'A crisis of equity and inclusion, as millions are out of school; a crisis of
> quality, as many of those who are in school are not even learning the
> basics; and a crisis of relevance, as many educational systems are not
> equipping the new generations with the values, knowledge, and skills
> they need to thrive in today's complex world' (Garnier, 2023, p.1).

This crisis has been described in literature as a persisting gap between education access

and education quality which becomes even more apparent even as the global progress is

made towards targets for universal education. For example, Milligan, Desai & Benson.

(2020) refer to Morrow's argument (1993) that inclusive education goes 'beyond mere

access to education, to include the ways that learners experience education and the

outcomes that they are able to achieve' (p.117), while Toukan warns 'The world has

greater access to formal educational opportunity than ever before, yet many of the

individual and collective benefits education promises are falling further and further out of

reach' (2023, p.2). There is by now widespread acceptance in both academic literature

and international discourse that in order to address the triple crisis of 'equity, quality, and

relevance' in education (UN, 2023) and meet combined modern challenges of sustainable

development, climate change and poverty (UNESCO, 2020; FCDO, 2022; Tikly et al., 2020)

education systems worldwide must be transformed. At the Transforming Education

Summit, 133 Member States submitted statements of 'National Commitment to

Transform Education' (UN, 2023).

However, efforts to transform education systems and curriculums have been fraught with

obstacles and failures (Schweisfurth, 2011), including those which are structural

(Stanistreet, 2022), environmental (Sims, 2023) and ideological (Van der Kuilen et al.,
2019). For example, evidence from implementation of Learner Centered Pedagogy (LCP)
across both northern and southern education systems is 'riddled with stories of failure
grand and small' (Schweisfurth, 2011, p.425). A case in point is Rwanda where there is
strong political support for change and innovation in education (Tikly and Milligan, 2017),
and good progress has been made towards enrolment (98% in primary education)
(UNICEF, 2023) with boys and girls showing gender parity in both pre-primary and
primary education (MINEDUC, 2018). Following other member states of the EAC
(Tanzania, Uganda, Kenya, Burundi, Rwanda and South Sudan) (Van de Kuilen et al., 2019)
and in line with the 2013 harmonized curriculum framework for the East African
Community (Rwanda Education Board, 2015), Rwanda's Competence-Based Curriculum
(CBC) was launched in 2015 as a 'Curriculum for Sustainable Development, Dignity and
National Identity' (REB, 2015). However, recent education research in Rwanda shows that
several implementation problems persist (Bizimana et al., 2021; Ngendahayo & Askell-
Williams, 2016; Van de Kuilen et al., 2019; Ndihokubwayo & Habiyaremye, 2018; Tusiime
& Imaniriho, 2020), and despite high enrolment, school completion and learning quality
remains low with learning adjusted years of schooling equating to only 3.9 years (World
Bank, 2020).

The situation in Rwanda is reflected across Sub-Saharan Africa where children's access to
formal education had increased from 59 to 78 percent over the past decade (GEP, 2020),
yet half of the children attending schools are not learning (UNESCO UIS, 2017). A
situational analysis of 18 African countries carried out in 2021 by Namubiru et al.
revealed that poor instructional leadership, low student motivation, language instruction
barriers, scarcity of school infrastructure, high teacher absenteeism, low teacher

competence, and competence-based curriculum constitute the main barriers to quality

education in these countries, with 32.14% of the respondents stressing that competency-

based curriculum matters constituted a priority (Namubiru et al., 2021). Meanwhile,

increasing impacts of climate change are also posing an accelerating threat to education,

particularly for girls, the poorest, and the most marginalised children (FCDO 2022; Sims,

2021). Flooding destroys schools, storms force people to flee their homes; droughts

result in children having to go further to collect water or look after animals, leaving less

time available for education (Sims, 2020). Research by Nordstrom and Cotton (2021) into

the impact of a severe drought on education outcomes in rural Zimbabwe cited

substantial evidence showing that economic hardship and hunger caused by droughts

lead to children leaving school, either due to the need to work or inability to pay school

fees. Even when children stay in school, environmental changes and subsequent

economic hardship such as temperature increases, droughts or other extreme weather

make learning difficult, as children's physical wellbeing mental health or nutrition

deteriorate and their ability to concentrate are compromised (Nordstrom and Cotton,

2021; Sims, 2021).

The literature discussing the interrelationship between education and climate change can

be broadly grouped into two themes (Sims, 2021). While research on climate change

impacts on education as detailed above is still relatively limited (Nordstrom and Cotton,

2021; Randall & Gray, 2019; Shah & Steinberg, 2017), a much larger body of research

exists to explore the role of quality education in addressing climate change (Rousell et al.,

2020; Feinstein & Mach, 2020; Monroe et al, 2019; Muttarak & Lutz, 2014; FCDO, 2022;

Sims, 2020). This literature promotes the key role of education in both climate adaptation

and mitigation, drawing links between education levels and increased adaptive capacity

to climate-related disasters (Rousell et al., 2020; Feinstein & Mach, 2020) especially for women (FCDO, 2022; Sims, 2020) as well as in increasing the knowledge, skills, and attitudes necessary to enable adaptation to current and future changes, and mitigate future climate change (Muttarak & Lutz, 2014; Monroe et al., 2019). However, this dissertation project aims to highlight a third relationship in the education and climate change intersection that is rarely mentioned, that is the role of climate change education in improving education quality. Research in this third area is relatively thin. In 2010, Bangay and Blum highlighted the connections between climate action in schools and education quality, and argued that 'education responses to climate change and quality are two parts of the same agenda' (2010, p.359). A small amount of literature is also available which identifies contributions of the wider field of Education for Sustainable Development (ESD) to quality education, for example the synthesis of studies carried out in 18 countries by Laurie et al. which showed that 'teaching and learning transforms in all contexts when the curriculum includes sustainability content and ESD pedagogies' (2016, p.205).

Meanwhile, the majority of discourse on education and climate change still views the relationship as a linear 'climate change education in – climate action out' model. This view of education 'for' sustainable development (Nikolopoulou, Taisha & Farid, 2010) reflects a latent instrumental paradigm. This is illustrated in the FCDO model (Fig.1) which was adapted from Muttarak and Lutz (2014, p.42) showing a one-way process whereby quality education is having various direct and indirect impacts towards achievement

Figure C: Relationship between quality education and improved resilience and adaptive capacity[26]
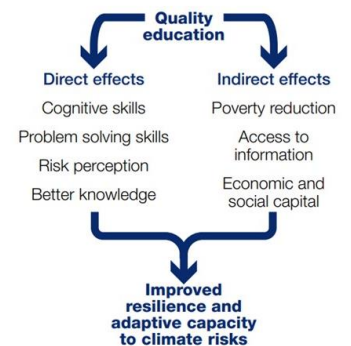
Figure 1 FCDO education and climate change model (FCDO, 2022, p.9)

of climate resilience and adaptive capacity. This dominant instrumental paradigm in

climate change education discourse has been long-contested within much emancipatory literature from the field of ESD (see for example, Huckle and Wals 2015; Jickling and Wals, 2008; Lotz-Sistika et al., 2016; Sterling 2017) which questions the suitability of a neoliberal, capitalist, patriarchal values of a modern western education paradigm which views learners as separate from the non-human world, and positions them to go on to control, dominate, and exploit the environment for their own benefit (Toukan, 2023). Instead, these academics have called for a 'radical social learning-centred transformation' of education systems (Lotz-Sisitka et al., 2016) based on emancipatory (Friere, 1996) rather than instrumental view of education and climate change, incorporating systems-thinking (Sterling, 2003), and more situated (O'Donoghue & Lotz-Sisitka, 2006), problem-based project-based and collaborative (Wals, 2007) pedagogies. This has sometimes been termed as education 'as' sustainable development and discussed in relation to a whole school approach which emphasizes integrating sustainability principles across all aspects of a school's operations, curriculum, and culture (Nikolopoulou; Abraham & Farid, 2010).

More aligned with this emancipatory ESD view, the report 'Reimagining our Futures Together: A new social contract for education' of the International Commission on the Futures of Education was published by UNESCO in November 2021. In what Toukan refers to a new 'relational ontology for humanity and a living planet' (Toukan, 2023), this report aims to move education away from the traditional human-capital and transactional neoliberal paradigms in favour of a relationship-based model grounded in a shared social purpose and appreciation of interdependence and interconnectedness. In UNESCO's vision, learning is a shared societal endeavour based on an ecological understanding of humanity and 'the common good'. The report calls for pedagogy and assessment to be reorganised around the principles of cooperation, collaboration and solidarity, whereby

learning involves diverse groups of people in exploring challenges and possibilities. To facilitate this, school architectures, spaces, times, timetables, and student groupings should be redesigned to encourage and enable individuals to work together (UNESCO, 2020).

The Reimagining Education report formed a basis for discussions at the Transforming Education Summit in 2022 where the UN's new 'Greening Education Partnership' (GEP) was launched, aiming to use the **'**knowledge and practice accumulated in Education for Sustainable Development' (UN, 2022) to inform a global transformation in teaching and learning. Here the third relationship between education and climate change (climate action as an enabler of quality education) is beginning to take shape in international policy discourse. In recognising ESD as a model for improving the quality of teaching and learning practices *whilst* improving education infrastructure and removing access barriers, and therefore fostering more relevant knowledge and skills, there is potential to address all three aspects of the 'triple crises' at once. In response to the FCDO's calls for 'a paradigm shift' in how education is viewed in relation to the climate and environment crisis' (FCDO, 2022, p.6), this dissertation study will present a case for adapting their linear model presented in figure 1 into a circular model

Figure 2 Proposed adapted model based on FCDO, 2022, p.9

(proposed in Figure 2) where not only is quality education enabling climate action, but climate action is enabling quality education.

However, critics of UNESCO's Reimagining Education report say it presents an idealistic and utopian vision which is not grounded in reality (Stanistreet, 2022; Carney, 2022;

Elfert and Morris, 2022). In particular the report is criticised for ignoring the role of power relations and elite groups in shaping the neoliberal educational agenda (Stanistreet, 2022; Carney, 2022). Elfert and Morris describe a 'long shadow' between the vision and reality, arguing that the report 'presents us with a beautiful vision of how we should be living on this planet, but without any analysis of how we can overcome the structural obstacles towards that vision' (2022, p.4). It could be said that, even until recently, literature which aims to address this gap between existing education conditions and the transformed vision along emancipatory ESD lines has been largely theoretical. Several large research projects and collaborations have provided construction (or deconstruction) of education principles and frameworks to address modern challenges. For example, Lotz-Sisitka et al.'s Transfomative, Transdisciplinary and Transgressive (T-Learning) (2019); Wals' Sustainability Orientated Ecologies of Learning (2019); O'Donoghue et al.'s Handprint Care (2020) and Tikly's ESD in a Postcolonial World (2020). Meanwhile, limited analysis currently exists at the operational level which explains the practical dimensions, mechanisms and impacts of ESD and climate change education in overcoming education barriers and improving education quality in real-life school settings.

Research into how the envisioned transformation can occur has been recently accelerating however, partly driven by the £1.5 billion UK Global Challenges Research Fund (GCRF) which aimed to improve access to sustainable development through, amongst other things, 'inclusive and equitable quality education' (GCRF, 2020). Among GCRF funded projects is the Transforming Education for Sustainable Futures (TESF) network plus which was coordinated by Bristol University between November 2019 and April 2023, through applied and transformative research in India, Rwanda, Somalia/Somaliland and South Africa. TESF's aim was to coproduce new knowledge about

how education can contribute to skills and development of people's agency to achieve

sustainable livelihoods, cities and communities while addressing climate change. This

dissertation study is based on research funded by the TESF hub in Rwanda and aims

contribute new understanding of the transformative potential of the Eco-Schools

programme in addressing severe education and climate change challenges and improving

education quality in the real-life education context of six Rwandan schools.

As one of the world's largest school-based ESD programmes, Eco-Schools of the

Foundation for Environmental Education is a lead partner for the 'Greening Schools'

target of the GEP which aims to have 'at least 50% of schools, colleges, and universities

accredited to a green school accreditation scheme and operating sustainably by 2030'

(UN, 2022). Eco-Schools has received criticism in some countries for focussing on

increasing environmental knowledge without influencing on attitudes and behaviour

(Schröder et al., 2020), and a recent review of 75 climate change education projects in

Eco-Schools indicates that in the larger domain of school level 'eco-activities', adaptation

and resilience building efforts are often not prioritized as much as mitigation actions (Sing

& Shah, 2022). However, my own previous research in Western Indian Ocean and East

African Eco-Schools (Copsey, 2019; Copsey, 2020) has found practical improvements to

conditions in the schools and local communities, as well as improving learning

experiences and outcomes and reducing school dropout.

In line with the relational ontology expressed in the forms of ESD which this research

seeks to support (Toukan, 2023), and the collaborative and problem-based epistemology

of Eco-Schools, this dissertation study uses knowledge co-creation (Sprague et al 2020;

Mitchel, Wals and Brockwell 2020; Lots-Sisitika et al. 2016) to generate new knowledge

and shared understanding between teachers, learners, parents and other education stakeholders in the six schools of the contextual challenges they face in achieving quality education, and co-create new solutions and learning of how these challenges can be addressed. The results aim to fill a practical knowledge gap of how ESD and climate change education through the Eco-Schools programme can address the triple education crises in schools facing severe education and climate change challenges in Rwanda. In support of limited literature available concerning the 'third relationship' in which climate action enables quality education, this study also aims to inform ESD practitioners and policy makers in other countries of the potential benefits of Eco-Schools implementation as part of efforts towards SDG 4, and national commitments to transforming education and the Greening Education Partnership.

Chapter Three: Methodology

This dissertation study has been designed to consolidate, follow-up and present the results of research project entitled 'Eco-Schools as a tool for integrating sustainable development and climate action within the Competency-Based Curriculum in Rwanda' which was led between November 2021 and April 2023 by the the Albertine Rift Conservation Society (ARCOS) with funding from Transforming Education for Sustainable futures (TESF) network plus (project code RW40L). The aim of the project was to assess the current gaps and limiting factors preventing the achievement of SDGs 4 and 13, co-create appropriate Education for Sustainable Development (ESD) solutions to overcome these, and examine the potential impacts of these solutions on schools and their surrounding communities in improving education quality, climate action and sustainable livelihoods.

3.1 Research ontology, epistemology and ethics

The research methodology is based on the TESF methodological approach 'knowledge co-creation' which was developed by an eminent group of academics from the emancipatory school of ESD (Tikly et al., 2020; Sprague et al., 2020; Mitchell, Wals and Brockwell, 2020; Lots-Sisitika et al., 2016). Knowledge co-creation therefore reflects a relational and ethical approach to co-learning with a commitment to affecting change in understanding and practice. The approach has roots in post-humanist (Barad, 2007; Braidotti, 2013) and new-materialist (Mannion, 2020) ontologies which often draw on theories of assemblage from Deleuze and Guattari (e.g. 1987), in which reality is produced through relations and connectivity within an entangled collection of material, human and nonhuman parts which have 'expressive capacities to affect and be affected by each other, and by other assemblages' (Mannion, 2020:1354). Research in this view aims to de-centre human

beings and their anthropocentric tendency towards binary divisions, in favour of more relational, ethical, political, and ecological modes of understanding and action (Barratt-Hacking & Taylor, 2020). This includes the division between ontology, epistemology, and ethics, seen instead as an ethico-onto-epistemology (Barad, 2007) which emphasizes the entanglements and responsibilities inherent within 'intra-actions' (Haraway, 1991; Barad, 2007) such as those which occur during participatory research.

This thinking is also in line with the relational ontology which the Reimaging Education report seeks to engender in that it aims to transcend current dominant neoliberal, individualistic and contractual education paradigms and instead 'reflect humanity's inescapable and inherent interdependence and interconnectedness' (Toukan, 2023, p.3). The posthumanist/new-materialist view also challenges colonial privileging of Western knowledge, and recognizes the value of diverse ways of knowing that are situated within specific social, cultural, and historical contexts (Haraway, 1991; Barad, 2007; Taylor, 2016). While previous reports of this commission were overseen by European male politicians (Elfert and Morris, 2022) UNESCO's 2020 report was chaired by Sahle-Work Zewde, the female President of Ethiopia, and in reframing humanism from more planetary, less anthropocentric and decolonized perspectives the Reimagining Education vision is also reflective of concepts of relationality and 'co-being' associated with African philosophies such as 'Ubuntu'; "I am, because we are; and since we are, therefore I am." (Mbiti 1969:106). This research therefore embraces relationality in support of the emancipatory direction of ESD and in celebration of the local and cultural philosophies in the communities where the research takes place. During early meetings of the research team the Rwandan concept of 'Umuganda', which describes the coming together of people in common purpose, was agreed as a shared philosophy between team members.

The relational view within this research project also acknowledges entanglements of North-South research partnerships (Greive and Mitchell, 2020) as well as my own accountabilities of outsider-insider research positionality (Milligan 2016; Barratt Hacking and Taylor, 2020) as the only white British member of the research team. This was explored in more detail in another research paper with the team (Copsey et al, forthcoming), and formally through an ethics process at the University of Bath. The project received ethical clearance from both the University of Rwanda (received 15/09/2022) and the University of Bath (23-048 received 30/06/2023).

3.2 ARCOS TESF knowledge co-creation research design

The ARCOS TESF research team, consisting of 21 members from ARCOS, the Rwandan Education Board (REB), the Rwandan Environmental Management Authority (REMA), UNESCO National Commission for Rwanda (CRNU), the University of Rwanda, myself as co-investigator, and focal point teachers and head teachers from 6 schools (three from Bugesera District and three from Rulindo District), assembled in November 2021. During two workshops the methodology was co-designed in collaboration with all research team members as an essential part of the knowledge co-creation process. This was guided by the TESF methodological guides (Sprague et al., 2020; Mitchell, Wals & Brockwell., 2020) and literature on social, transdisciplinary, transformative and transgressive research processes which challenge the status quo and enable alternative praxis and change (Wals, 2019; Lotz-Sisitka, 2019; Kulundu-Bolus, 2020; Tikly et al., 2020; Swilling, 2020; Lotz-Sisitka et al., 2016).

It was decided that the ARCOS TESF methodology should mirror and reinforce the Eco-Schools problem-based learning (PBL) approach which had already been established for one year in four out of the six schools (two in each district). In Eco-Schools PBL learners

establish an Eco-Schools Committee including teachers, parents and other community members with whom they evaluate, research and co-create solutions to priority challenges. Our knowledge co-creation methodology was developed to advance the Eco-Schools PBL according to Hirsch Hadorn et al.'s critical transdisciplinary research challenge (2008);

> *'To grasp the complexity of the problems, to take into account the diversity of scientific and societal views of the problems, to link abstract and case specific knowledge, and to constitute knowledge with a focus on problem-solving for what is perceived to be the common good' (in Lotz-Sisitka et al., 2016, p.52).*

Three original research questions were co-developed:

1. What are the main challenges being identified to quality education and climate change adaptation in Rwanda and how are these articulated by learners, teachers and parents in six Rwandan Eco-Schools?

2. How can these challenges be addressed using the Eco-Schools methodology?

3. What is the potential impact of these Eco-Schools solutions on the integration of the CBC and the quality of education in Rwanda?

3.2.1 The ARCOS – TESF research process (September 2022 – April 2023)

After several administrative delays, the ARCOS – TESF knowledge co-creation process was launched in six schools in September 2022. Three of the schools were in Bugesera district in the Eastern province and three in Rulindo in the Northern province. Four of these schools had previously been recruited and trained in the Eco-Schools programme pedagogy and had already established an Eco-Committee. One school in each district was newly recruited in order to establish causation and attribution of results.

In total 240 people participated in research in the six schools during interviews and focus group sessions. They included 6 head teachers, 72 teachers, 18 parents, and 144 students, as well as 27 representatives from different District Education Partners in Bugesera and 24 from Rulindo including CSOs, District Directors of Education (DDE) and Sector Education Inspectors (SEI). Table one shows the methodological steps taken by the ARCOS TESF knowledge co-creation partners.

Phase One – Survey
A questionnaire with multiple-choice questions with open qualitative questions was crafted together by the research team and translated into Kinyarwanda by the teachers. The survey was carried out with 24 students grouped into 4 focus group discussions of 6 students each, staff members (head teacher and 12 teachers) and 3 parents in each of the six schools.

Phase Two – Co-engaged enquiry
A workshop was organized in each district, bringing together district education duty bearers (District Director of Education, District Education Officers, Sector Education inspectors) and partners (Civil Society Organization and other NGOs working in education sector). Open and honest discussion leading to the identification of one outstanding challenge per school was facilitated by the ARCOS team. Challenges identified were recorded through stories, diary notes, audio recordings, written-work, drawings, photographs, and digital artefacts.

Phase Three – Depth-deliberation and micro project testing
Workshops were organized at each school to present and discuss key limiting factors impeding the achievement of SDG4 and 13 and deliberate on key ESD solutions proposed and rank them per priority given the resources available as well as feasibility in terms of time and responsibility of each among the team. Under the guiding research principle of 'Umuganda' students, staff members, family, friends, and neighbours were involved in the co-development of an action plan for the implementation of identified priority micro projects at each school.

Phase Four- data cleaning and analysis
Prior to data collection, questions were treated and uploaded using the Kobo-collect App. Analysis was performed by teachers and learners with regular support from ARCOS' team. The key challenges were ranked based on level of severity in both areas of quality education (SDG 4), and climate actions (SDG 13). One challenge was participatory chosen for action. The choices were determined by their importance and perceived capacity for action. Presentations of findings are prepared by the school-based research team (in form of photos, videos, or any other materials). Some statistical analyses were computed in excel.

Table 1: ARCOS TESF project knowledge co-creation steps

Both quantitative and qualitative data were collected during this process. Whilst the quantitative data has been presented in the form of graphs in the ARCOS TESF final project report (Kubwimana et al., 2023) and is shown as percentage figures in Chapter 4, some qualitative data was not analysed. Therefore, chapter four of this dissertation presents the analysis of qualitative findings from knowledge co-creation discussions during one-to-one interviews and focus group sessions. The questions asked during these discussions were informal and unstructured, but centred around research question one

'What are the main challenges being identified to quality education and climate action in Rwanda and how are these articulated by learners, teachers and parents in six Rwandan Eco-Schools?'. This analysis was carried out individually by myself using open coding (Kennedy-Lewis, 2014), and verified during in depth discussion with some members of the research team.

3.2.2 Follow up research carried out in the six participating schools (June 2023)

The TESF project timeline ended in April 2023, which, due to administrative hold-ups, meant that the final project report was compiled before the project results in the schools were visible. A separate research paper has been co-produced (Copsey et al., forthcoming) to discuss the challenges of 'extra-time' required for knowledge co-creation. The second part of this dissertation research was funded through a research collaboration with the Foundation for Environmental Education (FEE) who kindly covered travel and expenses for follow-up research visits to the six schools in Rwanda.

The knowledge co-creation methodological approach was continued during the follow-up visits, with interviews with head teachers designed as a relational process whereby the data would be co-constructed through dialogue (Roulston et al., 2003) and therefore at the 'far end of the spectrum' of informal interviewing (Burgess, 1986). While only the headteacher and/or the environmental coordinator was requested to join the meetings, some chose to invite other members of the school staff or Eco-Schools committees including parents and students. A total of 26 people were involved in the co-creative interviews including six headteachers, fourteen teachers, four students, and two parents. Each co-creative interview was followed by a tour of the school projects. Each visit took approximately two hours.

In order to allow for open and free discussion between the headteachers and teachers, as well as the few parents and learners who joined, with the ARCOS staff and myself, the co-creators were free to speak in any language of their choice (French, English or Kinyarwanda). Where Kinyarwanda was spoken, it was directly translated by the ARCOS staff present into English ensuring immediate confirmation of the group. Therefore, in Chapter Five, which presents an analysis of these discussions, the data can sometimes be seen written in the third person.

3.3 Analysis

Due to ethical issues concerning confidentiality and often constricted time, knowledge co-creation often falls short at the point of data analysis (Sprague et al., 2020). In order to try to overcome this, the data, findings and possible themes were discussed in depth with the ARCOS team members during car journeys, team meetings and one-to-one meetings during the one-week period that the follow-up research was taking place. During the meetings in the schools, a brief introduction was given with some explanation of the reason for the follow-up and particular aspects of interest including the outcomes in terms of quality education. In addition, the prior involvement of the headteachers and other individuals present in the ARCOS-TESF knowledge co-creation project and their engagement with the aims of the follow up visits meant that some degree of simultaneous analysis (Sheridan et al., 2020) was possible during the follow-up co-creative dialogues, with themes arising being reflected back and discussed further. After the meetings were finished, the data was transcribed individually, and analysed individually using inductive close reading and open coding to identify themes (Kennedy-Lewis, 2014). An anonymised analysis chapter was shared with members of the co-creation team at ARCOS for inputs and further co-creative discussion.

The data in Chapter Five is presented as much as possible in the words (or direct translations) of the teachers, head teachers and parents involved, with narrative explanation to link the text and explain the points being made. Inspired by the 'Material Moments' methodology used in some post-humanist/new-materialist research (Barratt-Hacking and Taylor, 2020; Taylor, 2018), the analysis also contains material examples, also written in the words of the knowledge co-creation partners. These examples have been chosen as significant material-discursive data hotspots (Barratt-Hacking & Taylor, 2020, p.138; MacLure, 2010) which provide a richer contextual view of the change occurring in the schools. Again, whilst the examples present unique stories or encounters found during the research, they have been chosen because they represent common themes identified in more than one school. For example, GS Yanze was among three schools which have introduced pigs for organic manure.

Chapter 4. Identifying the main challenges to quality education (SDG4) and climate action (SDG13) in six Rwandan Eco-Schools

In order to answer research question one 'What are the main challenges being identified to quality education and climate action in Rwanda and how are these articulated by learners, teachers and parents? this chapter presents an analysis and findings from the co-creative conversations, interviews and focus group sessions which were held in October 2022 at the start of the ARCOS TESF research project. A total of 240 teachers, learners, parents and district officials participated in these knowledge co-creation sessions in the six schools to explore current challenges being faced within the two areas of quality education and climate change. Recent literature is discussed alongside the findings from this phase of the research to gain a deeper understanding of key challenges within the broader Rwandan context.

The knowledge co-creation discussions held in the schools revealed several interlinked education and climate change challenges which are affecting quality education in the schools. The relational view of this research emphasises the unique entanglements and assemblages created between the humans, non-humans and material elements in each school, and the processes described cannot in any way be seen as linear. However, several distinct themes arose during the interviews and focus groups which are discussed under the headings below. Other themes arose among the findings of the co-creative discussions, for example a strong relationship between English as the language of instruction and both the quality of teaching and learning in class and ability of parents to support study at home. However, because of the space and time available it was decided to omit daiscussion which fell outside of the climate change and quality education intersection, and therefore beyond the scope of Eco-Schools intervention.

4.1 Education challenges

This research project was born from a request by the Rwandan Education Board (REB) for support to integrate the competence-based curriculum (CBC) through the Eco-Schools framework. In two workshops held for research team members (including REB) a broad range of issues and challenges were raised. These discussions formed the basis for co-design of a research questionnaire which aimed to guide the co-creation of more in-depth contextual knowledge about the barriers to CBC implementation in the six schools.

Being designed as a 'Curriculum for Sustainable Development, Dignity and National Identity' (REB, 2015), the Rwandan CBC framework is potentially congruent with both the emancipatory education view and the problem-based Eco-Schools approach. The CBC asks teachers to shift from traditional methods of instruction and adopt participatory and interactive learning methods using a learner-centred approach (LCP), with learning content becoming more relevant and adaptive to the changing needs of pupils, teachers, and society (Ngendahayo & Askell-Williams, 2016; van de Kuilen et al., 2019). Recommended approaches include individual, paired and group work; oral questioning, discussions and debates, role play, presentations, projects, practical work, investigations, research, prediction, problem-solving, assignments, field visits, tests and quizzes (REB, 2015). A statistical analysis carried out by Ndihokubwayo and Habiyaremye in 2018 found that a significant number of teachers prefer the CBC to the previous Knowledge Based Curriculum (KBC) in terms of practicability to teachers' needs and interests, well organization and timing, appropriateness of activities, competences of curriculum developers, carrier guidance as well as market orientation.

However early discussions with education stakeholders, including teachers, and growing evidence in Rwandan education literature suggests that the approach is not being easily

understood, accepted, and implemented at classroom level (van de Kuilen et al., 2019; Ndihokubwayo & Habiyaremye, 2018). A recent study with Teacher Training College Tutors in Rwanda found that teachers still rely too heavily on traditional, teacher-centred instruction, and no evidence that the CBC is appropriate or produces the expected results in the Rwandan context (Bizimana et al., 2021).

4.1.1 Insufficient teacher training

The success of the CBC transition relies on qualified teachers and there are calls for more resource to be allocated to teacher training rather than updating pedagogical documents (Ndihokubwayo & Habiyaremye, 2018). During the knowledge co-creation sessions in the schools, concerns over lack of training were raised by teachers in all schools except two. In particular during focus group discussions, and in all discussions involving district partners in both Bugesera and Rulindo a lack of training for teachers on the 'modern methods' of LCP and CBC was raised. Teachers who do not have required competencies in teaching or no formal teacher training, were seen to pose a serious risk to the achievement of quality education in these schools.

4.1.2 Lack of materials for teaching and learning

During the knowledge co-creation workshops in the schools, several teachers and learners mentioned an impediment in teaching and learning caused by low availability of teaching materials. Thirteen discussions concerned insufficient teaching aids, for example 'No flipchart, flash cards, map, charts', not enough books (14 counts), few or no computers (7 counts) and no science laboratories (3 counts). While a study carried out jointly by the University of Rwanda and REB in 2018 recommended that CBC delivery could be improved by the widespread use of teacher-made teaching aids rather than expensive equipment (Ndihokubwayo & Habiyaremye, 2018), the emphasis on

classroom-based teaching aids and materials indicates that this aspect of the CBC has not generally been taken up in the six schools.

In addition, the inability of parents to provide adequate school materials and equipment was a major concern in all the schools (confirmed above 60%) and very severe in two schools (confirmed by 100% of respondents). During the knowledge co-creation focus groups this issue was the most frequently raised (21 counts). This finding supports research by Nizeyimana et al. (2021) which found that the cost of uniforms, books, notebooks, pens, school bags, study tables at home etc, as a barrier to quality education for poor families especially in rural areas.

4.1.3 Low morale and poor performance among teachers

Nzabalirwa and Nkiliye (2012) underlined that the difficult conditions in which Rwandan teachers work significantly de-motivate them and decrease their efforts to achieve better results for their learners. During the knowledge co-creation workshops, teacher absenteeism and late arrival to classes was raised twice. There was also some suggestion of poor behaviour among teachers for example one student said, 'the male teachers disturb the students and the teachers speak badly', while a parent further suggested 'teachers do not care about children, children's education'. Poor job satisfaction and low motivation among teachers in Rwanda has often been attributed to poor monetary rewards and deteriorating standards of living compared to other professionals with the same level of education (Rwigema & Andala, 2022). Ntahomvukiye (2012) noted that extrinsic factors such as lack of resources and teaching facilities, increased workload, low esteem of teaching as a profession, and low salary all decrease teacher job satisfaction in Rwanda. In the same vein, a recent study by Rwigema and Andala also identifies working conditions and fringe benefits alongside salary as key determinants of teacher

performance suggesting that opportunities exist to improve teacher morale and performance aside from raising salaries (2022).

4.1.4 Overcrowding

In Rwanda overcrowded classrooms have previously been identified as a barrier to students' involvement in learning, effecting motivation and achievement (Nizeyimana, 2013; Sheahan, 2014). The introduction of nine-year basic education programme (9YBE) in 2008 and high levels of repetition due to flexibility in students' progression between grades (Dufitumukiza et al., 2020) puts further pressure on school infrastructure and classrooms. Despite targets for building of more classrooms and reduction of the pupil: teacher ratio from 70:1 to 45:1 by 2015 (Nizeyimana, 2021) the density of students per class is still high.

Due to double shifting, some of the schools involved in our study have managed to reduce the student-teacher ratio which at the lower end was 35-55 learners to each classroom. However, at the upper end teachers are still struggling with 60-70 learners per class. During the interviews, and knowledge co-creation discussions with the district and in schools, insufficient classrooms was identified as causing high student-teacher ratio in some classes. In the focus group discussions, overcrowding was the second most frequently discussed factor affecting the quality of teaching and learning in the schools (16 counts) with too few teachers for the number of children (3 counts) affecting the ability of teachers to pay attention to all students. Several discussions concerned lack of classrooms (7 counts) and too few chairs. As one pupil explained 'There are some schools where there are very few seats for the students to sit and study, so writing is not possible for them'. Some teachers linked poor behaviour among learners to overcrowding of

classes with too few teachers to control the pupils (3 counts), as one teacher stressed 'Do you think they pay attention to me??'.

4.1.5 Lack of parent support

A study carried out by Nizeyimana et al. (2021) found that the majority of key education stakeholders do not appreciate the quality of education offered in basic education schools. A negative attitude towards school and learning was found among learners, parents and community members who question its value and relevance in preparing children for the future. Nizeyimana et al. found that this attitude causes poor attendance and drop out, with parents only sending their children to school to avoid penalties. The poor opinion of education held by parents appears to cause a poor relationship between schools and parents, with communication limited to meetings held in the event of problems or bad behaviour of students. The ARCOS-TESF knowledge co-creation processes confirmed these findings, revealing concerns in all six schools over a lack of interest, involvement and monitoring being shown by parents for their children's education (15 counts), as one teacher stated, 'Parents themselves discourage students and don't support them in learning' and 'insufficient parent involvement' was given as a frequent cause of drop-out.

4.1.6 Poor behaviour of students

For several reasons which relate to the issues identified above, indiscipline of students was highlighted as a major concern in half the schools (confirmation at 65%; 58% and 41%). Several people mentioned poor or declining behaviour of students and noise in the classroom (10 counts) which disturbs the learning of the other students and as one student noted, drop-out caused by violence between students. Some believe this is down to upbringing (2 counts), and one person mentioned the removal of punishments for

poor behaviour 'The misbehaviour of some students is caused by the removal of the teachers face from the student (penalties)'. Students also noted that theft also occurs when poor students do not have sufficient materials in class (2 counts).

However, most of the individuals involved in the knowledge co-creation did not relate failure to deliver the LCP and CBC with lack of student's participation. It was generally accepted by teachers, parents and students during the discussions that students are committed and 'want to meet their vision' through learning and reading books.

4.2 Climate change challenges

The effects of climate change in Rwanda include increasing temperature, heavy rains, droughts and climate-related hazards such as floods, landslides and storms which have increased in recent years with devastating effects on the population (REMA, 2023). Bugesera in the Eastern province and Rulindo in the Northern province, where the Eco-Schools are located, are already experiencing climate change impacts on agriculture, infrastructure, and services. The learners, teachers and parents are therefore experiencing day-to-day challenges which were discussed during the early stages of the knowledge co-creation project. These discussions forming part of the baseline and action planning stages, as well as the widening of the knowledge co-creation to members of the community (e.g. Box One: School-Community cooperation on climate action in Budehere).

A recently published FCDO report characterises the effects of climate change on education as direct and indirect (2022). Direct impacts of climate change identified and explored during the co-creation processes in the schools include water scarcity, flooding, soil erosion, extreme weather (heavy rainfall, high winds and drought) and food

insecurity. Indirect impacts of these climate challenges can last much longer (Sims, 2021; Kousky, 2016; Anderson, 2019) and were perhaps even more obvious and discussed in depth during the knowledge co-creation processes in the schools. These are primarily seen when children's physical wellbeing and ability to concentrate are compromised (FCDO, 2022).

4.2.1 Drought

While all six schools experience water shortages during the dry season, in the drier eastern province of Bugesera, dry spells are increasing in length, leading to water scarcity and food insecurity (USAID, 2019) and availability of water is a major concern. In the three Eco-Schools in Bugesera, severe problems are experienced to do with availability and access to the water needed for drinking, cleaning, cooking, sanitation and watering of crops. In one Bugesera school for example, no water was available on site and learners were each required to fetch a jerry can of water each morning which they would carry to school on their heads. Not only was this tiring and stressful for the learners, but the lack of knowledge or control over the different water sources being brought to school would often lead to outbreaks of stomach illness and disease. The increased severity and regularity of drought in the area causes decreases in income and food access putting pressure on families as one parent described; 'Last season in 2022 there was a drastic sun time [drought], they didn't harvest anything, they couldn't feed their kids'.

4.2.2 Soil erosion and landslides

In the Northern province of Rulindo, schools are experiencing frequent floods, landslides, and soil erosion on the steep slopes during the rainy season (USAID, 2019). For example, one school is situated close to the mining areas near the Burundi border, notorious for landslides, flooding, high winds, and lightening storms. Consequently, eroded, degraded

and compacted soil mean that communities struggle to stabilise the soil and maintain crops during the rainy season, and with water carried downhill, these schools also experience water scarcity and difficulty to water their crops during the dry season. This has led to poor harvesting and lack of food in general among families, and contributed to local poverty.

4.2.3 Poverty

As highlighted by Nordstrom and Cotton (2020), climate change impacts can affect household resource allocation and schooling decisions, while exposing individuals to ill health, stress and uncertainty. The findings of this research support literature on education in Rwanda which suggest that poor socioeconomic conditions of students and families is negatively influencing the quality of learning (Nizeyimana et al, 2021; Van der Kuilen). In the focus group discussions seven people mentioned poverty among families specifically as a factor affecting children's success at school. Family conflict and abuse was equally mentioned. The necessity for children and young people to supplement family incomes through casual labour, or support households through chores or caregiving responsibilities at home is also increased in poor households (Nordstrom and Cotton, 2021; Sims, 2020) and was raised in four co-creative focus group discussions as a cause of tiredness and low motivation in class.

4.2.4 Malnutrition and ill-health

Several examples were given during the co-creative discussions to explain how lack of access to clean water in schools ultimately impacts the children's ability to learn. For example as explained by one teacher; 'Knowing that kid is not starving she will succeed. But also when someone is not sick, they can perform well'. This issue compounds education barriers for those who do not receive adequate food at home, as noted by one

student, 'These students often fall asleep during class because of the fatigue they have'.

For those who do not drop out, the pressure and inequalities experienced as a result of

the school feeding challenges have affected students' attainment. According to one

parent 'Some children are not allowed to eat at school. That makes some people not

learn, or learn badly'.

4.2.5 Challenges with School Feeding Programme implementation

In 2019, the Government of Rwanda updated and approved the draft comprehensive

School Feeding Policy and Strategic Plan (CNSFP) to pursue four specific outcomes:

'Support education through enhanced learning ability: combined with quality education, the

school feeding programme shall increase enrolment, attendance, cognition and contribute to

learning, improve the nutrition status of school children by addressing nutritional needs and

micronutrient deficiencies, provide a safety net for food insecure households; and enhance

agricultural productivity by providing local farmers with a reliable and predictable market'

(Ministry of Education, 2021).

However several factors are impinging on its success. Ten focus group discussions

concerned lack of food as a problem in the schools and 'too few ingredients' to

adequately provide meals for all learners. In particular the inability of parents to pay their

required contribution was a regularly discussed leading to a decrease in the overall

budget for school feeding and consequent difficulty to afford sufficient quality

ingredients. For example, in the six schools participating in our study 1,301 out of 7,912

students were not paying school feeding fees. According to staff in one school almost

50% of the learners were not eating at school due to the problem of affordability of fees.

In several schools, non-payment eventually leads to exclusion of learners and lack of

parental contribution to the school feeding programme was mentioned in all schools as a

cause of low attainment and drop-out. As one headteacher explained 'Some students were dropping out because of some challenges related to the local lack of food. The students were not able to pay the school feeding'. Therefore, while the school feeding policy aims to increase enrolment, in some cases it is having the opposite effect.

4.3 Challenges at the intersection between climate change/school feeding/SDG 13 and quality education/CBC/SDG 4.

Analysis from the co-creation discussions to explore the challenges in schools reveal an interrelationship between climate change and quality education which consists of direct and indirect causal effects and interactions. The challenges posed by climate change to learners, schools and families, particularly in the areas of water, food and poverty, are directly affecting the ability of schools to provide a quality education due to poor conditions, hunger and ill health. Ultimately, the negative relationship happening at the intersection between climate change and quality education is affecting progress toward SDG 4 and SDG 13. The intersection remains the same when seen through the policy lens when the challenges facing families and schools interrupt the delivery of the school feeding programme and therefore continue to stall the successful integration of the Competence-Based Curriculum. Therefore, crucial to the success of this knowledge co-creation process is the ability to introduce measures which can overcome climate change barriers, which as we have seen, are becoming severe enough to eclipse local concerns beyond daily survival, including education.
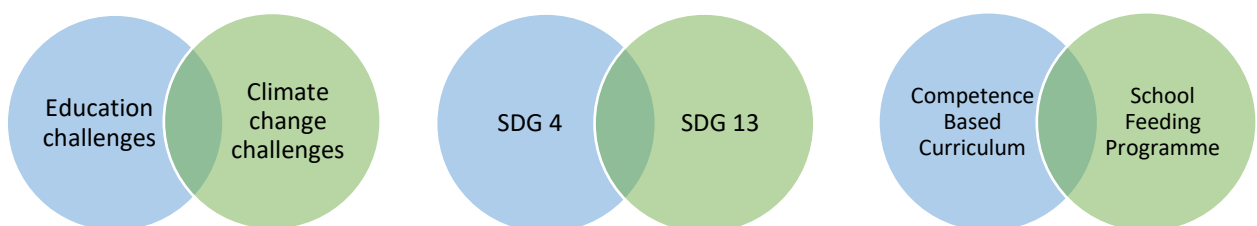
Figure 3 Showing the intersections between climate change and quality education, SDG 4 and 13, and the CBC and School Feeding programme

Chapter Five: Eco-Schools at the intersection between climate action and quality education

5.1 Co-created climate actions

The TESF knowledge co-creation action-research design replicated the Eco-Schools project-based approach in which challenges are identified during an evaluation process involving parents, teachers and students through the Eco-Schools Committee. This grounds the learning process, providing a baseline understanding of the school's key challenges and their causes and a driving purpose for the introduction of climate action projects.

In every country where Eco-Schools operate, the programme is influenced and shaped by the organisational objectives and working practices of the national operating organisation. Therefore, the programme in Rwanda reflects the integrated conservation and community development approach which ARCOS takes in all its programmes. In particular, ARCOS' strength and expertise is in agroforestry programmes and integrated forest management, and this can be seen in the Green Learning Zones which form the focal point for Eco-Schools projects in each school. The ARCOS-TESF interventions were designed within these zones according to identified challenges during co-creative sessions with learners, staff and parents guided by ARCOS staff. Example components of the green learning zones include water harvesting, agriculture (kitchen gardens), irrigation, biodiversity (which is mostly observed in tree-planting), waste management, and sanitation projects. Given the common climate change challenges experienced in Rulindo and Bugesera districts there are several similarities and common projects visible in each of the six participating schools. However, as the solutions have been co-created using local knowledge and expertise, there are variations and innovations within these

projects which have been developed based on specific issues such as soil erosion, high winds, or prevalence of pests such as termites.

Box 1: Material example - School-Community cooperation on climate action in G.S Budehere

'They have seen that it is not only concerning to the school, the school is for the community so the parents they should come to the school with the local leaders. And he confirmed that they come. With the local leaders together with the students they analyse the challenges and the problems faced by the environment, regarding to the soil and other environmental problems, they saw them together and they teach them and even the community teach the school to the practice that will help to handle those problems inside there. They sit together and they also have the meetings twice a semester, at the start and the end of the school term. Through those meetings they can interchange the knowledge. So they don't bother on the problems regarding students discipline or whatever, they just discuss the environmental issues, they saw them together and they even interchange the knowledge'.

Headteacher, G.S. Budehere

5.2 In what ways is the Eco-Schools programme currently addressing identified challenges towards climate action/school feeding/SDG 13 and quality education/CBC/SDG 4

The following sections present an analysis of the discussions held in the schools in July 2023 after one year of ARCOS TESF Eco-Schools implementation. To honour the participants in knowledge co-creation, as much as possible in the words (or direct translations) of the teachers, head teachers and parents involved, with narrative explanation to link the text and explain the points being made. Although the conversations were conducted in six separate schools, the common experience of all involved in the TESF project and the relational paradigm in which the research was carried out, allows them to be presented together as an assemblage of interrelated parts (Mannion, 2020). All quotes chosen are representative of perspectives shared among all schools, unless specifically stated otherwise.

Material examples, also written in the words of the knowledge co-creation partners involved have been shared in boxes in order to add context and illustration of specific mechanisms identified. Again, whilst the examples present unique stories or encounters found during the research, they have been chosen because they represent common themes identified in more than one school.

5.2.1 Role of the Eco-Schools programme in supporting the School Feeding Programme

Interviews with headteachers and Eco-Schools committee members in the six schools supported the findings from the literature and the data analysis in Chapter 4. regarding the primary problem linking food insecurity, household poverty, and lack of contribution to the school feeding programme. However, the introduction of the kitchen gardens led to a large increase in the availability of fresh vegetables to supplement the 135RF (GBP) daily allowance for each child. Three headteachers provided cost savings in figures, for example; 'we have saved about RF 600,000 … we have not paid any francs for vegetables this term'; 'For two months we didn't buy any vegetables maybe it might be like RF 500,000 saved'; and

The whole year they didn't pay anything for vegetables, three terms! He was

saying that per day we used 40 bags of vegetables and 1 bag can be 100 francs

so per day they could need 4000 francs per vegetables, and they saved the cost,

the whole money from there was kept and was reused in buying other

supplementaries like rice, pocho, potatoes, better quality food that can go hand

in hand with the vegetables. So they appreciate it. They wont stop. They wont

stop now they have got experience from this.

The last example further explains the value of the variety of fresh vegetables in improving the nutritional value of the meals provided at school as well as the ability of the school to buy an improved quality and variety of starch to accompany the vegetables produced. The quantity of food now available in the schools because of the climate smart agricultural projects has also meant that schools are able to provide enough food for all learners. This has relieved the pressure on families who were unable to afford their school feeding contributions. The direct result being that those children who were previously not coming in, or sent home, are now able to return to school.

Due to the fact that they have the money to make their own field of vegetables they can tolerate those children that doesn't have the money. The students are not sent out because they do income compensation and they can recover the absence of money, and the drop out had reduced because of that fact.

Parents who are unable to pay but still wish to contribute are now even able to make in-kind contributions in the form of casual labour in the school vegetable plots.

They are using it in school feeding because for example if the government was offering 135 RF per day in primary school, so that is not much for the kids to be fed, and when the total amount of the kids was over [payments outstanding] *the students should go out of the school feeding programme, that's how it was. But the parents are celebrating that the school is tolerating for that because they are getting the support from the kitchen garden. If the parent can come and give a day of casual work, of watering…but otherwise the whole year without having to buy vegetables is like a saviour to them because of the Eco-Schools programme.*

Several parents attended the co-creative meetings at the schools and were able to provide their perspectives of the school feeding contribution of the Eco-Schools programme. Among the experiences shared, there was a dominant theme concerning the reassurance among parents who may previously have struggled to provide a daily meal or school feeding contributions, and now were able to attend their own daily activities and work with improved peace of mind. The improvements in the school feeding programme made by the Eco-Schools projects and subsequent improved nutrition of learners and reduced pressure and responsibility of parents for their children's diets, were also directly linked by some teachers and parents to a change in the attitudes and general supportiveness of parents toward their children's education.

Due to the fact that the school has the school feeding programme they work safely. They know that their kids will be eating at school, they won't be coming home starving, so they work safely. And when the school needs their support they do it with good heart, with commitment because they know that their kids will be safe there, they will be happy to stay there, and they can work their daily activities without worrying about disturbance.

The schools highlighted the contribution of the Eco-Schools programme over and above the government school feeding scheme in supplementing, upgrading, and improving equity in the availability and provision of food for all children within Eco-Schools, regardless of their family circumstances. One teacher suggested that the improved nutrition of the children because of the measures introduced for the Eco-Schools programme may lead to measurable impacts in terms of the children's growth and reduced stunting which is both a testament to her perception of the impact among her

students and her own children, and a novel but potentially transformative suggestion for future Eco-Schools programme monitoring.

> I was asking if they had diseases of malnutrition, and she said, 'we didn't experience that, but they are stagnant kids due to the fact that they didn't get that nutritious food' and they are hoping that will be reduced because that is something that can be measured for a long time. But they are thinking that it will be reduced as time comes.

Box 2: Material example - Lunch at G.S. Ntarama

The stew, it is cabbage, it is carrot, it is egg plant, small egg plant, and with beans, so these kids are having a nutritious lunch. They are having it with rice or we make pocho from maize, it is very nice. This one it contains all nutrients, it contains like protein, then cabbage contains like vitamin A, which helps the learners for seeing, for eyesight… it contains all the nutrients, for moving, for growing, It's very very different from before. Before we had just the starch, now we have the full package of nutrients. Its very different when you compare with before we cultivated those vegetables.

So now you don't need that afternoon nap.

Now when they participate the learners, they get the nutrients that you are seeing, and even they practice for learning, even cabbage we were not finding it by the previous ways. But now we see the food we have grown it complements the full package of nutrients needed. When we compare before we cultivated those vegetables. But there is more, the students have been educated for how they can do that, how to practice it at their home, so it's very important for our students, we think how can we spread that for fighting malnutrition, in order to educate them, to educate our parents, how we can do, and what the benefit is for that, it is very important for us to help them in order to fight that malnutrition at home.

Learner, Senior Six, G.S. Ntarama

5.2.2 Role of Eco-Schools in integrating the Competence-Based Curriculum

Because Eco-Schools is foremost an education programme, there is a strong emphasis of the importance of integrating the climate action projects within curriculum learning. When the schools first signed up to join the programme, training was carried out with both teachers and Eco-Schools committee members. The teacher training includes familiarisation with the Eco-Schools seven step framework and practical explanation of how project-based learning can help to fulfil curriculum areas. In several East African Eco-Schools programmes funded by the Danish Outdoor Council the IVAC approach (Investigation, Vision, Action, Change) has been adopted as an additional framework to simplify and drive through the problem-based learning in the schools.

Before we used the knowledge, it was not competence, now ARCOS it helped us how to apply [the CBC]. We saw some trainings about the CBC, basically the programme, but now we have the experience from ARCOS we apply because now the students are involved in the activity, you give them the activities they can do, they are making some discussions in the groups, then the can form some... For instance, when we are teaching the sciences, geography, physics and biology and social studies in primary then they go there in nature. You can give them an activity related to nature and then they find the solutions. Then you help them to make a conclusion. It's very easy now, it's not like before. Before you take a book and you read to them… now today they can teach themselves and you are there as a facilitator, and you make a conclusion with them and they understood well what you are teaching.

Several teachers like the one quoted above explained that while previously the CBC guidance requested that teachers adopt a learner centred approach (LCP), without

purposeful and substantial projects the teachers struggled to understand how to do this successfully. With the introduction of the climate action projects in the schools however, along with the teacher training provided by ARCOS, they have managed to bring their teaching practices more in line with the LCP approaches of the CBC.

Before we had nature but we didn't practice because we didn't know how to do that. Now we know that you can sit in the classroom and the teacher will talk, but today if you want to teach in the world you cannot stay in the classroom.

An important barrier the quality education previously identified during the knowledge co-creation workshops for the TESF research programme included the lack of teaching aids available in classrooms. However, when this issue was raised with head teachers and other teachers during the discussions, the issue was dismissed. Their explanations stressed the new way of viewing nature and climate action projects as the teaching aids, and a new role for teachers in facilitating group work and enquiry;

The problem was of saying that we don't have materials that could help us to touch… everyone was saying that if I want to count I need many balls to count, but now they know that they can even count trees, leaves... I count 1,2,3. So what Eco-Schools has helped in using the outdoor learning space as a tool as like a material. So what they were saying they don't have sufficient teaching aids, so now the eco-system is becoming the teaching aids as they don't have other supportive teaching aids.

The accounts given by teachers above also demonstrate some of the perceived benefits in terms of the improved comprehension and retention of the concepts being taught.

Several expressed that this new teaching approach has removed the pressure on teachers due to classroom overcrowding and in-discipline, and therefore made their role easier.

When they are coming out they bring curiosity and they become attentive, they say 'oh they are going to conclude the session, they are going to add on what we have been talking there outside', so they come inside to follow up and with rested mind with a fresh mind, eager to be attentive to what has been said outside the classroom.

Perhaps most striking in terms of the follow-up discussions held in the schools were some of the descriptions given in terms of improved academic performance among the learners since the Eco-Schools programme had been introduced. For example; 'past years they could have like 15 students who failed, but this year they are only having five'; 'On average we are having 22 marks different, when even last year some failed'; and

The quality of education has been improved, they are saying they had 52 students do the exams, and 51 went to boarding school, and last year they didn't have any.

In trying to understand how the practical skills learned during through the project-based learning and climate action transferred to exam success, teachers highlighted the difference between knowledge that has been learned through rote learning or cramming style revision using textbooks, and knowledge that has been gained through practical involvement and experience.

When you are a teacher who is involved in the practicals of the Eco-Schools programme you recognise that kid. Because his answers are not theoretical, they

are practical, he's saying something and then you see that he is recalling what he

has done, it is something different from what is written in the notes. He's not

answering the notes, he's saying 'this one plus this' because of what he's seen,

but you see the notes are written in another way. This kid is different from the

one who has memorised the notes.

However, beyond academic performance and test results of learners, the greatest achievement of the Eco-Schools programme in terms of delivery of the CBC was described by several teachers in terms of a three-way connection between improved quality of life, gaining the skills to achieve it, and forming a deep contextual knowledge of what it means. For example, as explained by the staff members below, clean water does not just appear, it comes with new skills to access it and understanding of how to use (and reuse) it. Food at school does not just appear, it is grown by the learners during lessons teaching nutrition and health.

The headmaster has emphasised the importance of water, and having to bring

water to school. Before there was a challenge, the challenge was some people

don't have a heart of love, they can bring water fetched anywhere, they can

bring water in many forms, use it in their home without considering where is that

water going to be used. So after getting those tanks to catch water from the rain

this had a good impact educationally in their success, even in the wellbeing of

their students, we know where the water that we use is coming from instead of

knowing that, this one bring water, this one bring water that is black water, this

one bring water with some materials we don't know, then when we put them

together it is chemistry which was causing some disease for the students.

Box 3: Material example - Trees at GS Nyagahunica

'Let me talk about it by linking the activity of eco-school with teaching. As we I have said before, in the beginning we understood that trees were for cooking and construction not for using them to teach students. But nowadays we know what is the importance of trees, not only to find firewood but you can use it for students to sit under the trees, and this dry season for discussing the activity to change our environment at our school, for motivation, not only that but we also use those environment. Let's take for example geography, we teach students types of trees, we know that we have a whole part of the trees, we know that trees have roots, stems, leaves, branches, and flowers and we show students, with environmental learning students learn by touching, hearing, seeing; tactile learners. So if you remain those students inside the classroom they don't have that opportunity - we are teaching a part of the student, not the whole. So we use the trees to bring the student there, they know the bark, we show the students the part of leaves in the fresh air. We show the picture then the real-life situation, then they draw the picture after seeing the real one. So this Eco-School is important, we use the teaching to conceptualise, or to dramatise what we are teaching in the classroom'.

Teacher, G.S. Nyagahunica

5.2.3 Other impacts contributing to quality education (SDG 4) and climate action (SDG 13)

Aside from direct impacts happening within the schools in terms of support and integration of the school feeding programme and CBC, indirect impacts are being seen which are affecting learners and their families, ultimately contributing to the duel aims of SDGs 4 and 13. In a similar way to the indirect negative impacts of climate change (Sims, 2021), these changes could potentially have longer lasting positive effects than those direct impacts being experienced in school.

5.4.1 Improved confidence and self-esteem

Also difficult to assess during an exam, but nevertheless an important impact expressed by several of the teachers, is an improvement being seen in the confidence of learners due to the new enquiry-based forms of learning taking place.

The students are the ones who present what they learned in the field, they see what's going around, they see the changes, they see the degradable and biodegradable, if it is that assessment they have, they make a small report, after making that report they are the ones to present, and the teacher is there to compliment. And you see it makes self-esteem, self-confidence, to be confident that they are capable to express what they have found in front of others. The concept that every kid can be able to express his ideas, it's just an achievement for them to use their knowledges. That is good motivation for the learners, wherever they are they can express themselves.

Here there were some interesting discussions based on how learners of both genders are differently responding to the Eco-Schools programme. While it was expected that, in common with Rwandan culture, the boys would take the lead on project implementation and reporting, several schools mentioned that it was in fact the girls who are flourishing through involvement of climate action projects. One teacher identified a need for more research to understand the different effects of the Eco-Schools programme between girls and boys.

About this issue of gender, from my point of view even in our club or our eco-school parliament we have mixed, we have a voice in each group. When we get an activity, an Eco-schools Activity because on Friday we do an activity, we see

that the performing students are girls, we need the research, we have pairs, boys

and girls in each class, but only the girls do the activity in our club, in the

creativity of the songs, the competitions, the girls comes first.

The confidence seen in the learners, combined with their improved academic

performance and better nutrition and health, along with the amenity improvements

clearly visible in the school grounds overall create a new sense of pride which was clearly

expressed in all the schools. The schools articulated this pride together as mission or

vision for the school, behind which the leadership, staff and students can unite, and

towards which the projects can be developed which both deliver climate action,

improved health, and provide a vehicle for the CBC.

We see it in the presence of the students, last year some dropped out, there are

early pregnancy for females, but nowadays the bad attitude has changed, they

like this school, they see that school excel in all, in the sports results, at the

national results. Even our teachers they are regularly at school. Even me when I

hold a meeting with the teachers I say 'its me who arrives early at school, its me

who goes back late, so you have to be like me'. So we have a vision as the eco-

school has taught us, IVAC investigate, vision, action, change, that vision helped

us to lead and to have a vision of the school.

Box 4 Material example - Sorghum planting in G.S. Kibongo

Those sorghum are the result of a single, a single, item of sorghum, and when the learners were cultivating here under the trees, to keep green our trees, they get such item, a single branch of sorghum, and then they say 'let us conserve this sorghum', and they replanted it. The Sorghum in Rwanda is the symbol of unity. Because we cultivate Sorghum, we harvest it, we make a beer, and we call the community, then we dance. The Sorghum is featured in the national emblem of Rwanda and on the bank notes. So we plant it here as a symbol of unity in our school.

Teacher, G.S. Kibongo, demonstrating the Sorghum as national symbol depicted on a Rwandan bank note.

5.2.4 Replication of agricultural projects at home

The replication of agricultural projects in the communities around the schools demonstrates that the learning in schools is relevant and effective, and therefore provides an important marker of the success and progress of the Eco-Schools programme. Replication is initially expected via learners who are able to transfer learning directly from school to home, and in doing so improving their health and nutrition at home as well as school.

Parents are informed because we have formed the eco-school committee to balance the students, teachers and parents near the school. The parents use the kitchen gardens in their homes, they plant some vegetables in their gardens. They grow some vegetables and some fruit trees in their home.

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The students have been educated for how they can do that, how to practice it at

their home, so it's very important for our students, we think how can we spread

that for fighting malnutrition, in order to educate them, to educate our parents,

how we can do, and what the benefit is for that, it is very important for us to help

them in order to fight that malnutrition at home.

Alongside the new partnerships forming between schools and parents regarding the role of Eco-Schools in school feeding, the involvement and training of parents within the Eco-Schools committees in each school further ensures the transference of new agricultural and climate action techniques between homes and communities. Parent and general meetings held regularly provide further opportunities to see the projects and learn the skills and one school discussed the use of the Green Learning Zone school as a demonstration model for wider community members. This role of in helping schools to become local hubs for life-long learning is an important factor in achieving local transformation through the Eco-Schools programme.

So the eco-committee is the committee that combines parents students and

school leadership. So they meet, they make some eco-committee meeting, they

assess the things that have been given by the school parliaments, and they look

about the solutions together, and if they decide to do something they do it

together. So you see it is like a committee which brings the stakeholders together

if I can say that. So this eco-committee it has three parents, they are the ones to

teach the other committees of the school, with 17 parents, there are twenty

altogether who will disseminate the knowledge to the other parents. So it is like a

channel, they start with few.

However, the Eco-Schools learning taking place between schools and parents is not a one-way process, as parents are also bringing their own skills and knowledge of local and traditional farming methods into the schools. One notable example was the new establishment of a medicinal garden at the school intended to reinvigorate the traditional knowledge of beneficial herbs and natural remedies.

A parent was the one who taught the school to make the kitchen garden. And the

parents who didn't know that skills came here to learn from the students.

During the conversations several teachers and parents emphasised a change that has occurred in the attitude and improved follow-up of parents to their children's education. The reasons given varied from value of the school feeding programme, and increased presence at school due to involvement in the Eco-Schools Committee or General Assemblies as we have seen. There was also a link made to the parent's involvement in the TESF project and trainings received after lack of parental support and involvement was identified as a barrier to quality education at school. Both parents and teachers gave examples of how the increased parental support for children has resulted not only in better support to schools (for example Box 3. Pigs at Yanze), but also in particular the academic performance of the learners.

Due to the fact of the eco-committee I do a follow up on my kids. Because

whenever they call me that my kid is not performing, I come to school and see

what is going on, The other time I was not involved I was thinking that it is not

that important to go to school and make a personal follow up of my kids, so I had

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a student who could be like 20th, another one was 28th, now one is 10th, another

one is 12th, 10 students in front!

Box 5: Material example - Pigs at G.S Yanze.

They couldn't get organic manure, so the parents organised themselves to buy two piglets, two piglets are there, because they made the assessment by themselves with the school they bought the piglets to support the farm. The whole school's parents contributed. A parent contributed between 3500 and 3750 RF from each parent to have the piglets.

We discussed with them about this price, they agreed with us, and then they committed.

So they had a meeting and made the commitment because they were thinking of something that can sustainably help them to get the feeding vegetables without buying them, so they said that lets for once give this money, maybe we'll last a whole year without buying vegetables.

The students participate in bringing the grasses for the piglets in the weekend. Because in the normal days they feed on the residues of the school feeding programme, but in the weekend the students feed them. Economically the piglets are observed as the contribution of the school feeding programme, because they will sell the younger piglets and they bring the profits in the school feeding programme it is an economic value. And they were saying that even the manure of two piglets is not enough, each kid will bring 5kg of organic manure from home per term. So he may bring 2kg today, another in another few weeks, another in another month, to support the farm of the school. So you see the parents bought the pigs, the children are feeding them and even the kids are bringing the manure to support the farm.

There is a training that took place here in Rulindo where they were training the eco-committee so they were refunded their transportation, their meals and whatever, so the kids took some amount, they bought their piglets at home, three kids bought their piglets of 15k. They copied from the school, then they took that knowledge at home, they said 'if I get that money I'll buy a piglet', and they each bought a piglet of 15k. So he was saying they are complying with the practice.

Eco-Schools Committee members, G.S Yanze

Chapter Six: Discussion

The relational and knowledge co-creation approaches engendered during the course of the ARCOS-TESF research project and follow-up visits to the schools, have succeeded in building close relationships between research team members, education stakeholders and teachers, learners and parents in the six schools. Through many meetings, interviews and focus groups, as well as practical training and project implementation, we have developed a shared understanding of the specific assemblages and entanglements between humans and non-humans, spaces, environments and challenges which each school is individually formed of and operating within. However, during the project implementation and research some interlinkages, shared themes and interrelationships became apparent which linked all six schools, and these were also linked to broader policies and issues which concern all schools in Rwanda, and likely further afield.

The UN has identified 'a dramatic triple crises' of inclusion, quality and relevance, which our findings support. This research project particularly addressed the intersection between climate change (SDG 13) and quality education (SDG 4), exploring how climate change impacts and poor conditions in schools are contributing to this triple crisis, and conversely how the integration of climate action projects through project-based learning in the six schools can reverse the cycle, producing better quality education. In this chapter the findings will be discussed alongside the UN's triple crisis, and within each crisis the mechanisms at work through the Eco-Schools implementation and their impacts will be elaborated.

6.1 A crisis of equity and inclusion

The findings of this research have confirmed challenges of low attendance and drop-out in six schools linked to negative attitudes towards teaching and learning among teachers,

learners and parents as described in literature (Nizeyimana et al. 2021). However, despite this our research has also found that children want to learn, are committed to their education and 'want to meet their vision' with the aspirations and hopes for future careers and lives which one would expect from any young person. During the research we also met many passionate and dedicated teachers who showed high levels of professional interest and ambition, as well as a commitment to achieving the best outcomes for all their learners. Finally, we encountered parents who are doing their best for their children in the circumstances given to them. Taking the time out of daily work to attend knowledge co-creation meetings and training sessions, forfeiting their own time to work of the farms, and sparing much needed financial resources when given the opportunity to improve the quality of their children's education.

Instead, the knowledge co-creation processes in the schools have revealed deeper causal factors underlying negative experiences of teaching and learning in schools. While this study encountered a variety of education and environmental challenges contributing to low attendance and drop-out, including overcrowding; insufficient school materials; lack of parent support; poor behaviour, poverty; malnutrition and ill-health, it also found that these challenges are all exacerbated both directly and indirectly by climate change. For example, overcrowding in schools is made worse by teacher absenteeism caused by stress, ill health and poor working conditions (all of which are made worse during drought or extreme weather). Parents whose incomes are suffering due to poor harvest caused by drought or heavy rainfall, are less likely to afford the materials needed for their children's schooling. Lack of food and water scarcity is affecting the health, energy and concentration of learners in classrooms, and natural disasters damage school infrastructure and interrupt schooling.

In particular this research revealed a paradox within education policy implementation happening in the schools. This is the introduction of the school feeding programme which aims to ensure every child receives a meal at least once a day, improve nutrition, concentration and enrolment. However, all the schools in our study experienced problems with non-payment of parent contributions to the school feeding programme with subsequent non-attendance, exclusion or drop-out.

The introduction of measures designed to address climate change impacts in the schools therefore has had a significant impact on education inclusion. Anecdotal evidence provided by schools has shown that the establishment of climate-smart agriculture in kitchen gardens, improved sanitation through rainwater handwashing stations for example, or tree-planting for shade, has directly impacted the comfort and health of learners, reducing absences caused by illness and improving concentration in class, and also increased their willingness to come to school through improving the variety and taste of meals, and improving the general conditions and amenity value of the school. Of particular importance is the focus of these climate action projects on supplementing the school feeding programme, meaning that schools are able to reduce or remove the burden on families who are not able to afford their contributions, and these learners can return to school.

6.2 A crisis of quality

This research set out gain an in-depth understanding of the challenges facing the six schools in delivering quality education. In common with other studies, the research found that despite curriculum reform and support for innovation at national level, a combination of large class sizes, lack of teaching aids, insufficient teacher training and language barriers means that teachers are struggling to adopt the learner centred

teaching methods of the CBC, and instead relying on traditional didactic forms of classroom-based learning. Inside classrooms, overcrowding, lack of engaging approaches and materials and language issues are also contributing to noise, disruptive behaviour, bullying and theft in classrooms which prevents concentration and learning. In traditional forms of learning, school materials such as books and writing equipment are vital. Pressure to provide these for children is adding stress to low-income households and increasing absence and drop-out. Compounding this situation as previously discussed, the increasing severity of climate change impacts are causing worsening conditions, ill health and hunger which also disrupt learning.

However, the knowledge co-creation processes revealed a strong will in schools to overcome education challenges and the teachers who'd received training on the CBC tended to support the premise of learner centred pedagogy. With bare spaces and few natural features in school compounds, what the teachers lacked was the substantial and purposeful projects, engaging outdoor spaces, ideas and specific technical knowledge to successfully implement the CBC approach with their own classes. The supported introduction of climate action projects and training provided by ARCOS on their use as project-based learning within the curriculum is therefore providing a vehicle for the LCP approaches required in order for teachers to transition to the CBC. Teachers repeatedly spoke in transformative terms of the changes in their teaching approach since the introduction of Eco-Schools, and the subsequent impact on the learning, knowledge retention, confidence and attainment of their learners. Striking also were the accounts from parents who, through involvement and training in the Eco-Schools committee and climate action projects, are reevaluating and supporting their children's education. Parents are coming to school more regularly to contribute practical help and technical

knowledge, and increasing follow-up with teachers regarding their children's progress in class.

The level of transformation being seen in teaching, and the increased role and responsibility being taken by parents mean it is possible here to draw a comparison between the impacts being seen through ARCOS' implementation of Eco-Schools, and the emancipatory vision expressed in UNESCO's reimagining education report whereby 'pedagogy and assessment to be reorganised around the principles of cooperation, collaboration and solidarity, whereby learning involves diverse groups of people in exploring challenges and possibilities'.

6.3 A crisis of relevance

The findings of this research project support other literature from Rwanda which identify that schools and their surrounding communities are facing severe day-to-day challenges to meet the basic needs of their children, and these challenges are being exacerbated by climate change. Over the next 30 years it is predicted that longer dry periods in the east (including Bugesera) and increased heavy rainfall damage around the country are likely to exacerbate local food shortages and malnutrition rates (USAID, 2019). Given the difficulties of providing sustained quality education in these circumstances, it is hard to see that education targets (or indeed any other SDGs) can be met without addressing climate threats. On the other hand, as identified in ESD literature and international policy, a quality education is essential to equip communities with the relevant values, knowledge, and skills they need to adapt and thrive (FCDO, 2022; Sims, 2020). Given resource and financial constrains on education systems, particularly in countries such as Rwanda which are most vulnerable to climate shocks, the problem is how to move

schooling from the present crisis situation, towards the transformed vision of quality education which is known to be needed for climate resilience and adaptation.

This knowledge co-creation project has found that, operating at the intersection where climate change challenges are interrupting delivery of quality education, the Eco-Schools programme is managing to reverse some of the cycles to address the crisis of relevance in education. In a problem-based process whereby priority local challenges are identified and addressed through research, collaboration, and innovation, schools are also teaching skills, knowledge and values which are needed to improve their quality of life and livelihoods beyond school. Even after just one year of implementation, it was clear during the research that learners and parents are finding a new value and relevance in education, this is manifesting in the replication of projects leading to better health and nutrition at home, increased presence of parents at school, and improvements in the learner's classroom and examination performance.

6.4.1 Implications for the Rwandan Education Board
The project was initially born out of a request from REB to ARCOS for help to understand how Eco-Schools can support integration of the CBC. Training in problem-based approaches and climate action strategies, and the co-creation of Green Learning Zones through the Eco-Schools programme has introduced substantial opportunities for teachers to adapt their schemes of work around outdoor learning, skills development and group enquiry which is consistent with the aims of the CBC. The immediate impacts of this have been expressed anecdotally through improved knowledge retention, concentration, and academic performance of learners in the qualitative data collected for this study.

While not an original intention of this research, looking closely at the intersection between quality education and climate change in the schools, has revealed an interdependence between the CBC and the school feeding programme which is either disenabling or enabling the achievement of quality education, and this is exacerbated by climate change shocks. By integrating climate smart agriculture and water management projects in schools not only is CBC integration being enabled, but the knowledge and skills are used in the establishment of farms which supplemented the school feeding programme with better quality fresh ingredients.

However, the micro-projects implemented within Eco-Schools are not cost-free (some are cost-ly), for example, teachers and Eco-Schools committee members require training and follow-up by ARCOS staff. Furthermore, while parents have shown willingness to support projects in schools (e.g. Box 3 Pigs at Yanze) in learning from challenges experienced in the School Feeding Programme implementation, there is an important need to ensure that further demands are not made on schools, or parents to provide resource they cannot afford. Some programme costs are beyond the capacity of schools (for example rainwater harvesting tanks are approx €2000 each). Therefore, the mainstreaming of Eco-Schools has budget implications for the Ministry of Education. Further details on process, budget and recommendations will be provided in a policy brief for the Rwandan Education Board (REB).

6.4.2 Implications for Eco-Schools and the Greening Education Partnership

The findings from this research also support the key role of the Eco-Schools programme of the Foundation for Environmental Education in supporting the targets of the Greening Education Partnership. While literature has highlighted a 'gap' between the reimagined vision of quality education promoted by UNESCO (2020) and the current situation facing

real schools today (Elfert and Morris, 2022) which can be describes as a 'triple crises of inclusion, quality and relevance' (UN, 2023). This study has shown that the Eco-Schools programme, operating at the intersection of climate change and quality education, can help to bridge this gap. However, as seen in literature evaluating Eco-Schools in other countries (Schröder et al., 2020; Sing & Shah, 2022), the programme success is variable and relies on the vision, skills and contextual working practices of the national organisation operating it. Further implications and recommendations of this research will be provided to the Foundation for Environmental Education and their network partners in a technical report which explains the practical implications of using 'climate action to enable quality education' alongside the opposite instrumental view.

Conclusion

The ARCOS-TESF knowledge co-creation project aimed to gain a shared understanding of the challenges which are currently preventing the successful implementation of the Competence-Based-Curriculum in Rwandan schools and co-create solutions using the Eco-Schools problem-based learning methodology. In line with emancipatory ESD approaches, the research used a relational knowledge co-creation methodology which engendered open and deliberative discussions during interviews and focus group sessions.

The findings provide real-life Rwandan context for what has been described as a triple education crises (UN, 2023). The challenges identified were broadly consistent with literature from Rwanda and across the East African region and beyond (Nizeyimana et al., 2021; Nzabalirwa and Nkiliye, 2012; Ndihokubwayo & Habiyaremye, 2018; Namubiru et al., 2021), which identify deficiencies in teacher resourcing, training and morale, linked to classroom overcrowding, poor concentration, attendance and attainment among learners, and lack of parent support. This research also found that these problems are all closely related to, and exacerbated by, the increasing severity of climate change in multiple direct and indirect ways. Ultimately, the challenges posed by climate change to learners, schools and families, particularly in the areas of water, food and poverty, are directly affecting the ability of schools to provide a quality education due to poor conditions, hunger and ill health. The negative relationship happening at the intersection between climate change and quality education is interrupting successful implementation of both the Competence-Based Curriculum, and the School Feeding Programme policies of the Government of Rwanda, and affecting national progress toward SDG 4 and SDG 13.

However, by integrating problem-based learning into the CBC teaching and learning practices, and involving parents and wider community members in the co-creation of climate action solutions to address priority education barriers, the Eco-Schools programme can support schools to simultaneously addressing the triple crisis of inclusion, quality, and relevance in the schools. In the six Rwandan Eco-Schools this also succeeded in expediating implementation of both the CBC and the Schools Feeding programme, with immediate and highly visible impacts on education quality and climate resilience in the schools. The project findings suggest that the knowledge, values and skills being learned through this education transformation is consistent with UNESCO's relational vision of education as a 'new social-contract' (UNESCO, 2020).

Furthermore, through increased engagement of learners, parents and community members in climate resilience projects in the six schools, and the integration of these in the CBC, the Eco-Schools programme is proposing a logical means by which schools can reorganise pedagogy and assessment 'around the principles of cooperation, collaboration and solidarity', and 'involve diverse groups of people in exploring challenges and possibilities based on an ecological understanding of humanity and 'the common good'' (UNESCO, 2020). The conclusions of this research therefore oppose views that the Reimagining Education report is idealistic, utopian and not grounded in reality (Stanistreet, 2022; Carney, 2022; Elfert and Morris, 2022). On the contrary, the changes happening in the six schools through Eco-Schools implementation are showing that it is possible to transform education in even the most challenged schools, at a relatively low cost, within a very short space of time (one school year) and without large-scale curriculum reform or infrastructure. Ultimately the findings of this research promote wider, more positive and optimistic progression toward education transformation

through the emancipatory and relational vision of ESD, and related GEP targets. In particular the research proposes a new paradigm around the 'third relationship' between climate change and quality education which might be called 'climate action to enable quality education' or, as Bangay and Blum put it, 'two parts of the same agenda' (2010).

7.3 Limitations and suggested future research

The relational co-creative approach of this research project enabled the building of close relationships and mutual support between the research team and individuals within the schools. Whilst this was highly instrumental in the successes of the project interventions, from a research perspective it may have introduced some bias. Returning to Mannion's description of the 'expressive capacities to affect and be affected by each other' (Mannion, 2020:1354), within the assemblages and entanglements which were entered or created as part of this research it is possible than the inherent funder-fundee and North-South research relationship (Ishengoma, 2016) affected the co-creative conversations between the research team and the schools. While to some extent the practical and visible results in schools speak for themselves, it may be helpful to involve some individuals from outside of the original research team (for example other parents) in qualitative discussion to ascertain further reliability of the results and positive attribution to the Eco-Schools programme.

In addition, the anecdotal evidence given of cost savings, attendance improvements, reduced drop-out and improved academic performance was surprising given the short timescale of this research project. Further mixed-methods research which includes some quantitative data collection and analysis of these categories is recommended. As advised in the schools this should also include analysis of variation between boys and girls, and also some metrics around growth and health.

Some anomalies arose in the co-creative data between the first phase of the research and the follow up visits. For example, while language barriers were identified as a major barrier to quality education during the first phase, the topic was not entertained when raised during the follow up visits. Conversely while gender was not a major theme during the first phase, different project engagement and impact for boys and girls was highlighted in several schools during the follow up discussions. Future research might be beneficial to understand how these two important areas are intersecting with the climate action and quality education relationship identified during this research project.

References

Anderson, A., 2012. Climate change education for mitigation and adaptation. *Journal of Education for Sustainable Development*, 6(2), pp.191-206.

Akresh, R., 2016. Climate change, conflict, and children. *Future Child* 26, 51–71.

Bangay, C. and Blum, N., 2010. Education responses to climate change and quality: Two parts of the same agenda?, International Journal of Educational Development, Volume 30, Issue 4, Pages 359-368, ISSN 0738-0593, https://doi.org/10.1016/j.ijedudev.2009.11.011.

Barad, K., 2007. Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning. Duke University Press.

Barratt Hacking, E. and Taylor, C.A., 2020. Reconceptualizing international mindedness in and for a posthuman world. International Journal of Development Education and Global Learning, 12 (2), 133–51. https://doi.org/10.14324/IJDEGL.12.2.05

Basabose, J. de D., 2019. *Anti-corruption Education and Peacebuilding : The Ubupfura Project in Rwanda* 1st ed. 2019., Cham: Springer International Publishing : Imprint: Springer.

Braidotti, R., 2013. The Posthuman. Cambridge: Polity Press.

Bizimana, B., Njoroge, G K., Tusiime, M., Nzahabwanayo, S., Salmon, T., 2021. The Experience of Learners' Thinking Autonomy In Rwanda. A Phenomenological Study of Tutors' Implementation of Competence Based Monroe et al, 2019 Monroe, M.C., Plate, R.R., Oxarart, A., Bowers, A. and Chaves, W.A., 2019. Identifying effective climate change education strategies: A systematic review of the research. *Environmental Education Research*, *25*(6), pp.791-812. Multicultural Education Volume 7, Issue 12, 2021 140.

Burgess, R., 1986. In: Burgess, R. G. (Ed.). 1986. *Field research: A sourcebook and field manual*. Taylor & Francis Group, pp. 164–169.

Carney, S., 2022. Reimagining our futures together: A new social contract for education. Comparative Education, 58(4), 568–569. https://doi.org/10.1080/03050068.2022.2102326

Copsey, O., 2019. Eco-Schools in Africa, Case Study Evaluation with Social Return for Investment Analysis in Uganda and Tanzania. Research report for the Danish Outdoor Council, Copenhagen.

Copsey, O., 2020. A Regional Approach to Eco-Schools in the Western Indian Ocean, in Green Schools Globally. Cham: Springer International Publishing (International Explorations in Outdoor and Environmental Education), pp. 403–418.

Copsey, O., Kanyamibwa, S., Kubwimana, J P., Ishimwe, M. E., Bwiza, Q. N., and, Nshimiyimana, B., Forthcoming. Going into extra time: Reflections from one team's experience of knowledge co-creation in Rwanda. Abstract submitted for publishing to the *South African Journal of Environmental Education.* Expected January 2024.

Deleuze, G. and Guattari, F., 1987. A thousand plateaus : capitalism and schizophrenia. Minneapolis ; London: University of Minnesota Press.

Dufitumukiza, A., Ntakirutimana, E., Niyibizi, E. and Mukanziza, J., 2020. The nine year basic education policy and secondary school internal efficiency: A case study in Rwanda. *International Journal of Research in Business and Social Science (2147-4478)*, *9*(6), pp.202-212

Elfert, M., & Morris, P., 2022. The long shadow between the vision and the reality: A review of the UNESCO report 'Reimagining our futures together: a new social contract for education'. *Quaderni di Pedagogia Della Scuola*, 1(2), 37–44.

FCDO, 2022. Addressing the climate, environment, and biodiversity crises in and through girls' education, Policy paper, available online: https://www.gov.uk/government/publications/addressing-the-climate-environment-and-biodiversity-crises-in-and-through-girls-education Accessed 30/05/2023

Feinstein, N.W. and Mach, K.J., 2020. Three roles for education in climate change adaptation. *Climate policy*, 20(3), pp.317-322.

Frankenberg, E., Sikoki, B., Sumantri, C., Suriastini, W., Thomas, D., 2013. Education, vulnerability, and resilience after a natural disaster. *Ecol Soc* 18, 16.

Freire, P., 1996. Pedagogy of the oppressed (20th anniversary ed.). London: Penguin.

Garnier, L., *in* UN, 2023. Report on the 2022 Transforming Education Summit Convened by the UN Secretary-General. Available online: https://transformingeducationsummit.sdg4education2030.org/system/files/2023-01/Report%20on%20the%202022%20Transforming%20Education%20Summit.pdf Accessed 01/07/2023

GPE., 2023. KIX Africa 19 Hub, Webpage: https://www.gpekix.org/regional-hub/kix-africa-19. Accessed on 01/06/2023

Grieve, T. and Mitchell, R., 2020. Promoting Meaningful and Equitable Relationships? Exploring the UK's Global Challenges Research Fund (GCRF) Funding Criteria from the Perspectives of African Partners, *European journal of development research*, 32(3), pp. 514–528.

Haraway, D., 1991. Simians, cyborgs, and women: The reinvention of nature. Routledge.

Hirsch Hadorn, G., Hoffmann-Riem, H., Biber-Klemm, S., Grossenbacher-Mansuy, W., Joye, D., Phol, C., Wiesmann, U., Zemp, E. 2008. Handbook of Transdisciplinary Research. Springer; 2008

Huckle, J., and Wals, A., 2015. The UN Decade of Education for Sustainable Development: Business as usual in the end. *Environmental Education Research*, 21(3), 491-505.

Ishengoma, J., 2016. Strengthening Higher Education Space in Africa through North-South Partnerships and Links: Myths and Realities from Tanzania Public Universities,

Comparative and International Education / Éducation Comparée et Internationale: Vol.45: Iss. 1, Article 3.

Jickling, B. and Wals, A.E.J., 2008. Globalization and Environmental Education: Looking beyond Sustainable Development, *Journal of curriculum studies*, 40(1), pp. 1–21.

Kennedy-Lewis, B.L., 2014. Using diagrams to make meaning in grounded theory data collection and analysis. *SAGE research methods*. Cases London: SAGE Publications.

Kulundu-Bolus, I., 2020. Not Yet Uhuru! Attuning to, re-imagining and regenerating transgressive decolonial pedagogical praxis across times Khapa(ring) the rising cultures of change drivers in contemporary South Africa (Ph.D.). Rhodes University, South Africa.

Laurie, R., Nonoyama-Tarumi, Y., Mckeown, R., & Hopkins, C., 2016. Contributions of Education for Sustainable Development (ESD) to Quality Education: A Synthesis of Research. *Journal of Education for Sustainable Development*, 10(2), 226–242. https://doi.org/10.1177/0973408216661442GCRF

Lotz-Sisitka, H., Wals, A., Kronlid, D., & McGarry, D., 2015. Transformative, transgressive social learning: Rethinking higher education pedagogy in times of systemic global dysfunction. *Current Opinion in Environmental Sustainability, 16*, 73-80.

Lotz-Sisitka, H., Ali, M.B., Mphepo, G., Chaves, M., Macintyre, T., Pesanayi, T. and Wals, A., 2016. Co-designing research on transgressive learning in times of climate change. *Current Opinion in Environmental Sustainability* 20:50-5. doi: https://doi.org/10.1016/j.cosust.2016.04.004

MacLure, M., 2010. The offence of theory. *Journal of Education Policy*, 25 (2), 277–86. Online. https://doi.org/10.1080/02680930903462316

Mannion, G., 2020. Re-assembling environmental and sustainability education: orientations from New Materialism, *Environmental Education Research*, 26:9-10, 1353-1372, DOI: 10.1080/13504622.2018.1536926

Mbiti J. S., 1969. African Religions and Philosophy. London: Heinemann Educational.

Milligan, L., 2016. Insider-outsider-inbetweener? Researcher positioning, participative methods and cross-cultural educational research, *Compare* , vol. 46 , no. 2 , pp. 235-250 . https://doi.org/10.1080/03057925.2014.928510 ISSN:0305-7925.

Milligan, L.O., Desai, Z. and Benson, C., 2020. A critical exploration of how language-of-instruction choices affect educational equity. In *Grading goal four* (pp. 116-134). Brill.

Ministry of Education., 2021. School Feeding Policy and Strategic Plan (CNSFP). Government of Rwanda. Policy paper. Available online: https://www.mineduc.gov.rw/index.php?eID=dumpFile&t=f&f=23437&token=cb243d309da920d47fec8fdd0ad3011928149779. Accessed on 15/07/2023.

Mitchell, R., Wals, A., Brockwell, A. J., 2020. Mobilising capacities for Transforming Education for Sustainable Futures: Opening spaces for collaborative action and learning.

TESF Background Paper Series. Bristol, TESF. DOI
https://doi.org/10.5281/zenodo.4134931

Monroe, M.C., Plate, R.R., Oxarart, A., Bowers, A. and Chaves, W.A., 2019. Identifying effective climate change education strategies: A systematic review of the research. *Environmental Education Research*, *25*(6), pp.791-812.

Morrow, W., 1993. Epistemological access in the university. *AD Issues*, 1(1), 3–5. Academic Development Centre, University of the Western Cape: Bellville, South Africa.

Muttarak, R. and W. Lutz. 2014. Is education a key to reducing vulnerability to natural disasters and hence unavoidable climate change? *Ecology and Society* 19(1): 42. http://dx.doi.org/10.5751/ES-06476-190142

Ndihokubwayo, K., and Habiyaremye, H., 2018. Why Did Rwanda Shift from Knowledge to Competence Based Curriculum? Syllabuses and Textbooks Point of View. *African Research Review*. AFRREV Vol. 12 (3), Serial No 51, July, 2018: 38-48. Dar, Ethiopia. SSN 1994-9057 (Print) ISSN 2070-0083 (Online) DOI: http://dx.doi.org/10.4314/afrrev.v12i3.4

Ngendahayo, E. and Askell-Williams, H., 2016. Rwanda's new competence-based school curriculum: New approaches to assessing student learning needed. In *Publishing Higher Degree Research* (pp. 155-165). Brill Sense.

Nikolopoulou, Anastasia & Abraham, Taisha & Mirbagheri, Farid. (2010). Education for Sustainable Development: Challenges, Strategies, and Practices in a Globalizing World. 10.4135/9788132108023.

Nizeyimana, G., Nzabalirwa, W., Mukingambeho, D. and Nkiliye, I., 2020. Hindrances to quality of basic education in Rwanda. *Rwandan Journal of Education*, 5(1).

Nizeyimana, G., 2013. Student engagement in teacher education at the Kigali Institute of Education in Rwanda (Doctoral dissertation, University of the Witwatersrand, Faculty of Humanities, School of Education).

Nordstrom, A., & Cotton, C. (2020). Impact of a severe drought on education: More schooling but less learning. Queen's Economics Department Working Paper No. 1430. Queen's University, Department of Economics. Retrieved from: http://hdl.handle.net/10419/230583

Ntabajyana, S., Nizeyimana, G. and Nzabalirwa, W., 2021. Teachers' experiences of implementing value education in Rwandan schools. *Rwandan Journal of Education*, *5*(2), pp.228-238.

Ntahomvukiye, C., 2012. The Impact of Principals' Leadership Behaviours on Teachers' Job Satisfaction in Rwanda: A Case Study of Secondary Schools in the Gakenke District. Doctoral dissertation, University of the Witwatersrand, Faculty of Humanities, School of Education.

Nuwategeka, E, Monge, C, Shields, R, and Singh, A., 2021. Exploring environmental justice in educational research. JustEd: Education as and for Epistemic, Environmental and Transitional Justice to enable Sustainable Development. DOI: 10.5281/zenodo.5517300

Nyatanyi, T. et al., 2017. Implementing one health as an integrated approach to health in Rwanda. *BMJ global health*, 2(1), p.e000121.

Nzabalirwa, W. and Nkiliye, I., 2012. A study on the socioeconomic conditions of teachers in Primary and Secondary Public schools in Rwanda: Case study of Bugesera, Nyarugenge and Ruhango Districts. *Rwandan Journal of Education*, 1(1), pp.72-83.World Bank 2011

O'Donoghue, R. and Lotz-Sisitka, H., 2006. Situated environmental learning in Southern Africa at the start of the UN decade of education for sustainable development. *Australian Journal of Environmental Education*, *22*(1), pp.105-113.

O'Donoghue, R., Henze, C., Shimray, C., Sarabhai, K.V. and Rivera, J.C.A.S., 2020. Hand-Print CARE: Towards ethics-led action learning for ESD in school subject disciplines. *Journal of Education for Sustainable Development*, *14*(1), pp.41-60.

Randell, H., and Gray, C., 2016. Climate variability and educational attainment: Evidence from rural Ethiopia. *Glob Environ Change* 41, 111–123.

REB, 2015. Competence-Based Curriculum Framework – Pre-Primary to Upper Secondary. Policy Paper. Government of Rwanda. REB/MINEDUC.

Reid, A., 2019. Climate change education and research: possibilities and potentials versus problems and perils?. *Environmental Education Research*, *25*(6), pp.767-790.

REMA., 2023. Climate Change. Webpage: https://www.rema.gov.rw/our-work/climate-change. Accessed on 06/06/2023.

Roulston, K., de Marrais, K. and Lewis, J.B., 2003. Learning to Interview in the Social Sciences, *Qualitative inquiry*, 9(4), pp. 643–668.

Rousell, D. and Cutter-Mackenzie-Knowles, A., 2020. A systematic review of climate change education: Giving children and young people a 'voice'and a 'hand'in redressing climate change. *Children's Geographies*, *18*(2), pp.191-208.

Rwigema, P.C. and Andala, H., 2022. The influence of teacher-related factors on the implementation of the competency-based curriculum in Rwanda. A case study of public primary schools in Kicukiro District. *The Strategic Journal of Business & Change Management*, *9*(1), pp.16-30.

Schweisfurth, M., 2011. Learner-centred education in developing country contexts: From solution to problem?. International journal of educational development, 31(5), pp.425-432. Report on the 2022 Transforming Education Summit Convened by the UN Secretary-General
https://transformingeducationsummit.sdg4education2030.org/system/files/2023-01/Report%20on%20the%202022%20Transforming%20Education%20Summit.pdf.

Schweisfurth, M., 2011. Learner-centred education in developing country contexts: From solution to problem?. *International journal of educational development*, *31*(5), pp.425-432.2018 WB, HCI.

Shah, M., and Steinberg, B. M., 2017. Drought of opportunities: Contemporaneous and long-term impacts of rainfall shocks on human capital. *J Polit Econ* 125, 527–561.

Sheahan, K., 2014. The Effects of Class Size on Achievement. Available online: http://www.ehow.com/info_8474419_effects-class-size-achievement.html.

Sims, K., 2021. Education, Girls' Education and Climate Change. K4D Emerging Issues Report 29. Institute of Development Studies. DOI: 10.19088/K4D.2021.044 Sims, K. (2021). Education, Girls' Education and Climate Change: Executive Summary. *K4D Emerging Issues Report 29*. Institute of Development Studies. DOI: 10.19088/K4D.2021.045

Sprague, T., Nwako, Z., Kulundu-Bolus, I., Tikly, L., Wals, A., Facer, K., Elmi, M., and Imaniriho, D. (2021). Co-Creating Education for Sustainable Futures: TESF Methodology Background Paper. Bristol, TESF. DOI https://doi.org/10.5281/zenodo.4462433

Stanistreet, P., 2022. Education in an age of inequality. *International Review of Education*, *68*(6), pp.803-810. https://doi.org/10.1007/s11159-023-09989-7

Sterling, S., 2003. *Whole Systems Thinking as a Basis for Paradigm Change in Education: Explorations in the Context of Sustainability*. University of Bath. Available at: http://www.bath.ac.uk/cree/sterling/sterlingtitle.pdf.

Swilling, M., 2020. The Age of Sustainability. Abingdon: Routledge.

Taremwa, N K., Gasingirwa, M. and Nsabimana, D., 2022. Unleashing traditional ecological knowledge for biodiversity conservation and resilience to climate change in Rwanda, *African Journal of Science, Technology, Innovation and Development*, 14:1, 204-215, DOI: 10.1080/20421338.2020.1821948

Taylor, C., 2018. What can bodies do? En/gendering body-space choreographies of stillness, movement and flow in post-16 pedagogic encounters. *International Journal of Educational Research*, 88 (March), 156–65. Online. https://doi.org/10.1016/j.ijer.2018.02.001

Taylor, C. 2016., Chapter 1. Edu-crafting a Cacophonous Ecology: Posthumanist Research Practices for Education. In: Taylor, C (Eds) *Posthuman Research Practices in Education*, Palgrave Macmillan UK, 2016.

Tickly, L., 2020. Education for Sustainable Development in the postcolonial world – Towards a transformative agenda for Africa. Oxford: Routledge.

Tikly, L., Batra, P., Duporge, V., Facer, K., Herring, E., Lotz-Sisitka, H., McGrath, S., Mitchell, R., Sprague, T., Wals, A. 2020. Transforming Education for Sustainable Futures Foundations Paper. Bristol, TESF. https://doi.org/10.5281/zenodo.4279935

Tikly, L. and Milligan, L., 2017. Learning from Innovation for Education in Rwanda, Bristol working papers in education series, Graduate School of Education, Bristol.

Toukan, E., 2023. Future of Learning and Innovation, UNESCO A NEW SOCIAL CONTRACT FOR EDUCATION: Advancing a paradigm of relational interconnectedness

Tusiime, M. and Imaniriho, D., 2020. TESF Rwanda Background Paper. Bristol, TESF. https://doi.org/10.5281/zenodo.4331474

UN., 2022. Greening Education Partnership - Transforming education to transform the world. Webpage: https://www.un.org/en/transforming-education-summit/transform-the-world. Accessed on 10/08/2023.

UN, 2023. Report on the 2022 Transforming Education Summit Convened by the UN Secretary-General. Available online: https://transformingeducationsummit.sdg4education2030.org/system/files/2023-01/Report%20on%20the%202022%20Transforming%20Education%20Summit.pdf Accessed 01/07/2023

UNESCO, 2020. Reimagining our futures together: a new social contract for education. *International Commission on the Futures of Education [24], ISBN : 978-92-3-100478-0. Paris.*

UNESCO UIS, 2017. More Than One-Half of Children and Adolescents Are Not Learning Worldwide. Fact Sheet No. 46 September 2017 UIS/FS/2017/ED/46. Available online: http://uis.unesco.org/sites/default/files/documents/fs46-more-than-half-children-not-learning-en-2017.pdf. Accessed on 08/08/2023

USAID, 2019. Climate Change Risk Profile – Rwanda. Available online: https://pdf.usaid.gov/pdf_docs/PA00TNRB.pdf. Accessed on 08/07/2023.

Van de Kuilen, H.S., Altinyelken, H.K., Voogt, J.M. and Nzabalirwa, W., 2019. Policy adoption of learner-centred pedagogy in Rwanda: A case study of its rationale and transfer mechanisms. *International Journal of Educational Development*, 67, pp.64-72.;

Wals, A.E. ed., 2007. *Social learning towards a sustainable world: Principles, perspectives, and praxis*. Wageningen Academic Publishers.

Wals, A.E., 2019. Sustainability-oriented ecologies of learning: A response to systemic global dysfunction. In Ecologies for Learning and Practice (pp. 61-78). Routledge.

Wals, A. E., and Jickling, B., 2002. "Sustainability" in higher education from doublethink and newspeak to critical thinking and meaningful learning. International Journal of Sustainability in Higher Education, 3(3), 221-232.

Westin, M., Hellquist, A., and Kronlid, D., 2012. Towards Urban Sustainability Learning from the Design of a Programme for Multi-stakeholder Collaboration. Southern African Journal of Environmental Education, Vol. 29, 2012/2013.

Wals, A.E.J., 2007. Social learning towards a sustainable world: principles, perspectives, and praxis. Wageningen: Wageningen Academic Publishers.

World Bank., 2020. Rwanda Human Capital Index 2020, Human Capital Project - October 2020. Available at:
https://databank.worldbank.org/data/download/hci/HCI_2pager_RWA.pdf