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THE INTEGRATION OF INDIGENOUS KNOWLEDGE INTO CLIMATE CHANGE EDUCATION: A CASE STUDY OF THE ADVANCED LEVEL GEOGRAPHY CURRICULUM IN ZIMBABWE

By MACHAYA TRUST: Student Number: 201609925

Thesis submitted to the University of Fort Hare: Faculty of Education in fulfilment of the requirements for the degree of Doctor of Philosophy in Education

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DECLARATION

I declare the following:

I have read the Code of Student Conduct and Academic Responsibility as described in the *Student Handbook* of the University of Fort Hare. This thesis represents my original work, except where I have acknowledged the ideas, words, or material of other authors.

Where another author's ideas have been presented in this thesis, I have acknowledged the author's ideas by citing them in the required style, as well as where another author's works have been presented in this thesis, I have acknowledged the author's words by using appropriate quotation devices and citations in the required style.

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DEDICATION

I dedicate this thesis to:

- God the Almighty for the unfailing and unconditional love, support, and courage on the long journey through the world of formal Education.
- Jesus Christ, my Comforter and Holy Spirit.
- Mary Machaya, Prosper Chauraya, Keith Machaya, Kunashe Machaya and Hanley Machaya, the Ruwende family, the Ndou family, and Chiketa family for their unforgettable loving support.
- My parents, Mr and Mrs Machaya (May their souls rest in peace).

ACKNOWLEDGEMENTS

Many people have contributed to the success of this research study. Within that number, the following stand out, and I hereby wish to direct my special words of thanks: First, my humble gratitude goes to the Almighty God, who gave me the initiative, skills, wisdom, strength, and courage to persist in tough times during my study. He guided and led me throughout my study. He confirmed His word; "Nothing is impossible with God."

I would like to convey my sincere gratitude to my Supervisor Dr. Linake M.A. Senior lecturers at the University of Fort Hare (Faculty of Education), for her invaluable mentorship, guardianship, concern and professional guidance in the research project. Their constructive advice and support included precise attention to detail, humble and caring character, and reassuring attitudes to see me succeed. I also want to express my gratitude to Dr. Nsubuga who started the journey with me and her contribution in this study.

Thanks to The Ministry of Primary and Secondary Education (MOPSE) for allowing me to carry out this research in their province, district, and schools. A special acknowledgment goes to the District Education Inspector and the Geography teachers for the time spared participating in this study. Special thanks also go to Mkoma HT Machaya, Mr. Murekwa, Mr. Magoho, and Sis Mobie for their professional and moral assistance.

My warm gratitude goes to the entire Machaya family for understanding my absence at some family gatherings which occurred concurrently with my studies. Last but no means least, I acknowledge Shantel, Mosley, Abongwe, and Junior for their understanding and patience during my long spells of absence in their lives when they needed me around.

ABSTRACT

The purpose of this study was to establish the integration of Indigenous Knowledge (IK) into Climate Change Education (CCE) in the Advanced Level Geography curriculum at high schools in Zimbabwe. Many countries like Canada, Namibia, South Africa including Zimbabwe have enacted policies and reformed their curricula to align with the UNESCO/ UNICEF recommendation on the integration of IK into CCE. The challenge in many countries is on how to effectively integrated IK into CCE. To explore the integration of IK into CCE, the study was informed by the by Rogan and Grayson's (2003) curriculum implementation theory. The study was located in the interpretivism paradigm, adopted a qualitative approach and a case study design. Semi-structured interviews, lesson observations, and document analysis were used to generate data. Convenient and purposeful sampling were used to select the two schools investigated; the study participants consisted of one Geography district inspector and four Advanced Level geography teachers. The study revealed that teachers integrated few types of IK into CCE during their Advanced Level Geography lessons and relied mainly on the lecturing method and formal assessment as pedagogical strategies. Findings also showed insufficient financial, material, information communication technologies, and professional development support to enhance the integration of IK into CCE at the two schools. Challenges to integrating IK into CCE included the lack of a clear policy on IK integration, inadequate pre- and in-service training for teachers in IK, teachers' poor attitude towards IK, and a lack of the necessary resources to support the integration. The study concluded that at the two schools, the current integration of IK into CCE in the Geography curriculum was incomplete and ineffective. Thus, the study recommended, promulgation of clear guidelines in the policy on IK into CCE integration. Also, that the community be involved in the provision of types of IK. The initial teacher training courses include modules on IK types, and teaching and assessment approaches that enhance the acquisition of knowledge and skills on IK and CCE. The ministry provides workshops on IK, and how to integrate it in CCE in schools. Schools must have fund raising projects to allow them to visit IK resource centres. That researchers and authors need to publish materials that can enhance this effective integration of IK into CCE.

KEYWORDS: Indigenous Knowledge, Climate change Education, Sustainable development, Education for sustainable development and Curriculum integration.

LIST OF ABBREVIATIONS

CALA: Continuous Assessment Learning Area

CC: Climate Change

CCE: Climate Change Education

CtL: Capacity to Innovate

DoBE: Department of Basic Education

ESD: Education for Sustainable Development

GoZ: Government of Zimbabwe

IK: Indigenous Knowledge

IKS: Indigenous Knowledge System

IPCCC: Intergovernmental Panel on Climate Change

MoPSE: Ministry of Primary and Secondary Education

OI: Outside Influence

PoL: Profile of Implementation

SD: Sustainable Development

SSA: Sub-Saharan Africa

UNESCO: United Nations Educational, Scientific And

Cultural Organisations

UNICEF: United Nations International Children's Emergency Fund

ZIMSEC: Zimbabwe School Examination Council

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

TABLE OF CONTENTS

CHAPTER ONE

BACKGROUND OF THE STUDY

1.1 Introduction

This chapter introduces the study and the structure of the thesis on the integration of indigenous knowledge (IK) into climate change education (CCE) in the Advanced Level Geography Curriculum at selected high schools in Gwanda North District of Zimbabwe. It further gives the background to the study, the problem statement, research questions and objectives, the purpose of the study, the significance of the study, study delimitations, study limitations, and definitions of key concepts. The chapter ends with the thesis outline.

1.2 Study Background

There is a global recognition of the role of IK in CCE. However, in the face of modernity, IK is regarded as regressive, static, and an interruption to modernization (Mofongoya & Ajayi, 2017). Despite this misconception, UNESCO has recommended integrating IK into CCE (UNESCO, 2015). The integration of IK into CCE has several benefits. For example, when integrated into CCE, IK nurtures and expands learners' identities, preparing them for living in both the indigenous and the scientific worlds (Ford, 2016). Adding IK into CCE gives the Indigenous people a sense of stewardship to the environment, they become encouraged to actively participate in addressing CC issues (Hiwasaki, Luna, Syamsidik & Shaw, 2014). With the inclusion of IK into CCE and the curriculum, students develop greater interest and positive attitudes toward learning (Naude, 2019). As a result of this community involvement, a vital foundation for community-based CC adaptation strategies is ushered in (Theodory, 2014; Hiwasaki, Luna, Syamsidik & Shaw, 2014). The integration of IK into CCE links the outside community with the school (Kagodo, 2009).

Zimbabwe identified specific legislation to include IK in the education system in 2004 (Mpofu, 2004). Before 2004, many government policy issues and ideologies were consistent with the intent of inclusive Education. Examples are the Zimbabwe Education

Acts (Education Act, 1996 and 2006), both of which call for the inclusion of local knowledge in environmental issues. As a result, there has been increased literature on the inclusion of IK in agriculture, biology, and mathematics (Meyiwa, Letsekha, & Wiebesiek, 2013). The move towards the inclusion of IK intensified in 2008, with the integration of CCE into the Zimbabwean primary and secondary school curricula (Government of Zimbabwe, 2014). A report from the Government of Zimbabwe (2014) shows that between 2009 and 2012, several workshops were organized to raise CC awareness and provide training in CCE. Consequently, in Zimbabwe secondary schools, CCE is taught mainly in geography (Manjengwa et al., 2014). In the Advanced Level Geography curriculum, CCE content is covered in topics such as Climatology, Hazardous Environment, and Arid and Semi-Arid Geography (ZIMSEC Advanced Level Syllabus, 2013-2017; Government of Zimbabwe, 2014:59). However, several challenges have been identified in the way CCE is currently being implemented in Zimbabwean schools, notably the lack of locally relevant educational materials to support the teaching of CCE (Manjengwa et al., 2014), and failure to integrate indigenous knowledge (IK) into the CCE curricula (Government of Zimbabwe, 2014). The failure to integrate IK into CCE persists despite the UNESCO recommendation that IK should be integrated into formal education systems to improve their quality and relevance. This approach to CCE is based on the suggestion by UNESCO (2012) that CCE should be rooted in the communities where it is implemented.

Furthermore, as a teacher of Advanced Level Geography, the researcher noticed that year-in and year-out examinations set by ZIMSEC at this level are silent on issues about IK in CCE. In addition, the researcher also witnessed little interaction between schools and their communities concerning the integration of IK into school curricula. With these concerns in mind, this study aimed to investigate the integration of IK into CCE in the advanced-level geography curriculum to design a framework for its effective implementation in Zimbabwe's schools.

1. 3 Statement of the Research Problem

Regardless of the inclusion of IK into CCE globally, there is still a lack of integration of Indigenous knowledge (IK) into climate change education (CCE) in the Advanced Level Geography Curriculum at schools in other countries, just like in Zimbabwe. Although IK is widely used in many communities worldwide, numerous countries face challenges regarding effectively integrating IK into CCE (UNICEF, 2015). In Zimbabwe, research focusing on integrating IK into Science and Mathematics is increasing (Mapara, 2022; Nziramasanga, 1999). However, little research has been done to explore the integration of IK into CCE in schools. Although in Zimbabwe, the Advanced Level Geography curriculum contains CC-related topics such as Climatology, Hazardous Environment, and Arid and Semi-Arid Geography (ZIMSEC, A-Level Syllabus, 2013-2017; Government of Zimbabwe, 2014:59), research showed that Zimbabwe School Examinations Council (ZIMSEC) is silent on issues about IK. There is also little interaction between schools and their communities. With these concerns in mind, this study aimed to investigate the integration of IK into CCE in the advanced-level geography curriculum to design a framework for its effective implementation in Zimbabwe's schools.

UNESCO recommends that CCE be integrated with IK and incorporated into the school curriculum. Many countries have since put CCE high on the national agenda as a means of addressing CC issues (UNESCO, 2012), as well as being an integral part of Education for sustainable development (ESD) (UNESCO, 2019). Including IK in CCE improves the quality and relevance of curriculum content and pedagogical practice in developing countries (IPCC, 2019). Since IK encompasses all forms of knowledge, technologies, know-how skills, practices, and beliefs (Mapara, 2022), it should be integrated into school curricula, especially into all forms of EE, including CCE (O'Donoghue et al., 2016),

1.4 PURPOSE OF THE STUDY

The purpose of this study was to explore the integration of IK into Climate Change Education (CCE) in the Advanced Level Geography Curriculum at selected high schools

in Gwanda North District of Zimbabwe. The investigation was done to develop an implementation framework that could be used to improve the integration of IK into CCE in the Advanced Level Geography curriculum.

1.5 RESEARCH QUESTIONS

1.5.1 Main Research Question

The key research question to this study is:

How is IK integrated into CCE in the Advanced Level Geography Curriculum in selected high schools in Gwanda North District of Zimbabwe?

1.5.2 Sub-research questions

The following sub-research questions were set to help answer the main research question:

1. What types of IK are integrated into CCE in the Advanced Level Geography Curriculum at the selected high schools?
2. Which pedagogical strategies are used by teachers in the integration of IK into CCE in the Advanced Level Geography Curriculum at selected high schools?
3. What challenges are teachers facing in integrating IK into CCE in the Advanced Level Geography curriculum at the selected high schools?
4. How is the integration of IK into CCE in the Advanced Level Geography Curriculum supported?
5. Which framework could be used to improve IK integration into CCE in the Advanced Level Geography Curriculum?

1.6 RESEARCH OBJECTIVES

The objectives of the study were to:

1. Identify the types of IK integrated into CCE in the Advanced Level Geography Curriculum at the selected high schools.

2. Examine pedagogical strategies used by teachers to integrate IK into CCE in the Advanced Level Geography curriculum at the selected high schools.
3. Describe how the integration of IK into CCE in the Advanced Level Geography curriculum is being supported.
4. Analyse the challenges teachers face in integrating IK into CCE in the Advanced Level Geography curriculum at the selected high schools.
5. Develop a framework that could be used to improve the integration of IK into CCE in the Advanced Level Geography curriculum.

1.7 SIGNIFICANCE OF THE STUDY

The study's findings might benefit in the following ways: Firstly, MOPSE and Curriculum Development Unit (CDU) in Zimbabwe may use the insight generated from this study to design policies, strategies, and educational materials that enhance the integration of IK into CCE in schools. The Zimbabwe School Examinations Council (ZIMSEC) might also use the study results to assess learners in IK and the CCE in the geography curriculum. Moreover, the study would probably benefit teacher training colleges regarding appropriate teacher training practices to ensure the effective integration of IK into CCE at schools. The study might also empower district officials with more effective supporting strategies for integrating IK into CCE and school curricula in general. Local communities may benefit from incorporating their knowledge into school curricula, thus helping bridge the gap between schools and their communities. Lastly, the research findings might contribute to the body of knowledge regarding integrating IK into the school curriculum and stimulate further research in IK and CCE in Zimbabwe and beyond.

1.8 STUDY DELIMITATION

The research examined the integration of IK into CCE in only one subject, Advanced-level Geography. The study involved five and six classes in Gwanda North District of Matabeleland, South Province, in Zimbabwe. This involved two high schools. In addition, one district Geography inspector and four Advanced Level Geography teachers from these schools participated in the study.

1.9 STUDY LIMITATIONS

The main limitation of the study was the small sample size. The study involved form five and form six classes at only two high schools in Gwanda North District of Matabeleland, South Province. As a result, the smaller sample size could have led to the researcher overestimating the actual dynamics of integrating IK into CCE. More studies with larger sample sizes should be conducted to confirm the findings. Another limitation of this study was that it used a qualitative approach and interpreted subjective data. This could have led to subjectivity in the data gathered. The researcher used thick descriptions to reduce subjectivity and was immersed in the study to deeply understand everything in the context. Furthermore, the researcher used critical friends and the supervisor to code the data separately and then came together to construct the results. Using qualitative research that relies heavily on context-specific research could have led to difficulties re-entering the same setting with the same variables and repeating them, hence the need for quantitative study in the future. The researcher used various data collection instruments like document analysis, in-depth interviews, and class observations (for triangulation) to reduce this limitation. Lastly, there were time constraints, where the researcher had limited time. This could have affected the quality of the results. The researcher had to have a case study with a smaller study group.

1.10 DEFINITION OF TERMS

This section defines the main concepts used in this research.

- **Indigenous Knowledge**: This is the "knowledge of a society in a particular area based on their interfaces and experiences within that area, including their customs (Nyota & Mapara, 2008; Mapara, 2009: 140). In this study, IK refers to the skills and observations, practices, values, and attitudes which are passed from one generation to the other within a group of people.

- **Climate change:** It is the alteration in the statistical circulation of weather over periods of time that span from decades to millions of years (Kumar, 2014). It can be a change in the average weather or a change in the distribution of weather events around an average (for example, greater or fewer extreme weather events).

In this study, CC refers to variations in the average weather conditions of a given place observed over a period of at least 5 years. This change could either be permanent or temporary.

- **Climate change Education (CCE):** This is the educational strategy that is considered for the purpose of creating public awareness of CC, empowering people to address CC, live sustainably, and improve their adaptation capacity to CC risks at individual and community levels (UNESCO, 2019). In this study, CCE refers to the educational process of preparing learners with the knowledge, understanding, skills, and traits regarding CC issues.

- **Sustainable development (SD)**: This is growth that meets the needs of the present-day without compromising the ability of future generations to attain their own needs (Brudntland, 1987:8). For this study, SD refers to the prudent use of natural assets to prevent them from degradation.

- **Education for sustainable development (ESD)**: This is the practice of equipping learners with the knowledge and understanding, skills and attributes needed to work and live in a way that protects environmental, social, and economic wellbeing, both in the contemporary and future generations (United Nations World Summit, 2005). In this study, ESD refers to the imparting and acquiring competencies that bring about behaviours and actions leading to an environmentally responsive citizenry.

- **Curriculum Integration:** This is the process of merging different disciplinary knowledge or subject, such as IK and Western knowledge, into the school curriculum (Hammersmith, 2007). In this study, curriculum integration denotes the deliberate and conscious addition of IK to the mainstream in the school curriculum.

- **Curriculum implementation**: It is the act of putting into practice the plans and suggestions that have been made by curriculum specialists and subject experts in a classroom (Makewa & Ngussa, 2015). In this study, curriculum implementation means putting an idea or programme for IK and CCE integration into practice.

- **Strategy:** This refers to the method or plan chosen to bring about a desired future, such as achieving a goal or solution to a problem (Business Dictionary, 2016). In this study, strategy means a plan or tactic used to integrate IK into CCE in Advanced Level Geography Curriculum in high schools in Zimbabwe.

1.11 Thesis Outline

- Chapter 1 includes the study's background, statement of the problem, purpose, scope, research questions, significance of the study, delimitations, and definition of key terms.

- Chapter 2 outlines the theoretical framework which guided this study.

- Chapter 3 provided an overview of the literature on integrating IK in CCE in the Advanced Level Geography curriculum. It highlights existing literature about the trends in research on the IK integration into CCE to highlight the gaps in the literature that this study sought to bridge.

- Chapter 4 presents the research methodology that was followed in conducting the study. This includes the research paradigm, approach, design, selection of participants, methods for data collection, data analysis, and ethical and trustworthiness considerations.

- Chapter 5 presents the results of the study.

- Chapter 6 presents a discussion of the results. The discussions in this section include comparisons of the findings with similar studies from the literature.

- Chapter 7 summarises the study and presents conclusions based on the research findings. It also provides recommendations and highlights opportunities for further research.

1.12 Chapter Summary

This chapter introduced the study and the structure of the thesis. This included descriptions of the background to the study, problem statement, research questions, and objectives, purpose of the study, the significance of the study, delimitations, limitations, and definitions of key concepts. The next chapter concentrates on the examination of literature related to the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The previous chapter discussed the study's background, the problem statement, purpose, scope, research questions, the significance of the study, delimitations and limitations, and the definition of key terms. This chapter presents an overview of the literature on integrating Indigenous Knowledge (IK) into Climate Change Education (CCE) into the school curricula. The chapter presented and discussed relevant literature on integrating IK into CCE globally, regionally, and in Zimbabwe. The chapter begins with a detailed analysis of climate change (CC) and its effects, focusing on the context of Zimbabwe. All these are followed by an overview of the link between CC and Sustainable Development (SD), culminating in educational responses to CC. Additionally, the chapter looked at CCE globally and in Zimbabwe. It further defined IK and explained its nature. Subsequently, it compares IK and Western knowledge and discusses the benefits of integrating IK into CCE. The chapter also presented a synopsis of research on integrating IK into CCE in high schools globally and Zimbabwe. The chapter also summarized numerous research findings on various issues related to integrating IK into CCE in different countries. The chapter ended with a chapter summary.

2.2 Climate Change and Its Effects

This study aimed to explore the integration of IK into CCE in high schools, specifically the Advanced Level Geography curriculum. Across the globe, Indigenous people have lived in close connection with their environments for many years. This long-term presence has allowed them to accumulate detailed observations about local climates, weather patterns, and ecosystems over generations. This knowledge provides valuable baseline data for understanding CC, especially in regions with limited or non-existent scientific records. To explore the dynamics of integrating IK into CCE in the geography curriculum, the researcher had to define the concept of CC and its effects clearly. The concept of CC e denotes a long-term swing in weather statistics, such as expected average values for temperature, precipitation, humidity, and wind for a given place and period of the year from one decade to the next (National et al., 2016). These climatic variations result from anthropogenic activities that change the configuration of the Earth's atmosphere (IPCC,

2018). This notion about the causes of CC waters down the belief that it mainly results from natural causes (IPCC, 2007) by overemphasizing the role of anthropogenic activities. The knowledge about the causes of CC and their effects has a bearing on what IK is and how it is being integrated into CCE. These questions help answer the major objective of this study, which is to integrate IK into CCE in the Advanced Level Geography curriculum. This exploration helps develop a possible IK integration framework into CCE in schools.

2.2.1 Natural Causes of Climate Change

IK typically takes a holistic approach, viewing natural systems as interconnected webs rather than isolated components. Thus, knowledge about the causes of CC has been the basis for adapting to the challenges and effects of the changing climate. The average state of the climate system is controlled by a combination of forcing factors external to the system (solar variability, astronomical effects, tectonic processes, and volcanic eruptions) and internal radiative forcings (atmospheric composition, cloud cover) (IPCC, 2018). There are also anthropogenically induced changes (in atmospheric composition and surface land cover) and feedback effects (such as changes in atmospheric water vapour content or cloudiness caused by global temperature changes) (Etchart, 2017).

Looking at the natural factors that cause CC (Etchart, 2017) posits that observations by Astronomers have sensed slow changes in Earth's orbit that affect the distance between the sun and Earth and the deviation of Earth's axis on the ecliptic plane. This produces regular changes in the amount of solar energy that reaches Earth, leading to climate change. Climate change is also naturally attributed to atmospheric dust level variations (Dhal, 2019). In this regard, volcanic activities pump enormous ash into the stratosphere and reduce the insolation reaching Earth's surface for 1–3 years.

As an example, the massive eruption of Tambora (in Indonesia) in 1815 and the eruption of Krakatoa (also in Indonesia) in 1883 led to a decrease in temperature years (UNEP, 2019). Atmospheric Gases like carbon dioxide (CO_2) and methane act as "greenhouse gas. Other greenhouse gases include CFCs (chlorofluorocarbons) and N_2O (nitrous

oxide) (Dhal, 2019). In addition, the changes in the Ocean cause Climate change. Hence, oceans cover over 70% of Earth's and act as buffers against Earth's climate changes climate. Whenever changes occur in oceanic temperatures, chemistry, or circulation, significant changes in global climate are certain to follow (UNEP, 2019). Lastly, changes in landmasses also cause CC. For example, the uplift of the Himalayas is altering atmospheric flows and monsoonal effects in Asia, resulting in Climate Change.

2.2.1 Anthropogenic Causes of Climate Change

The human-induced causes of CC are a major worry to environmentalists. As an example the total effect of human activities since 1750 has been one of warming (Brazier, 2015). Since the 1900s, the average global annual surface temperature has increased by 0.4 degrees Celsius, as illustrated in Figure 2.1. Anthropogenic processes such as fossil fuels burning and land use changes emit vast amounts of greenhouse gases such as carbon dioxide, methane, and nitrogen dioxide into the Earth's atmosphere. This causes an upsurge in the heat trapped in the Earth's atmosphere, which would normally be discharged back into space. Such a scenario results in a global warming climate change (IPCC, 2018). Thus, CC and global warming are often used instead of the other, although they have dissimilar meanings (Allison, 2010). Scientists have acquired overwhelming evidence to prove that global climatic conditions are changing. Evidence acquired by the IPCC Report (2014) shows that rising amounts of carbon dioxide in the atmosphere have mirrored the increased temperatures in the atmosphere and oceans.

Fig 2.1 shows the global temperature change from pre-industrial times to 2015. In this view, one can infer how our climate has changed over time.

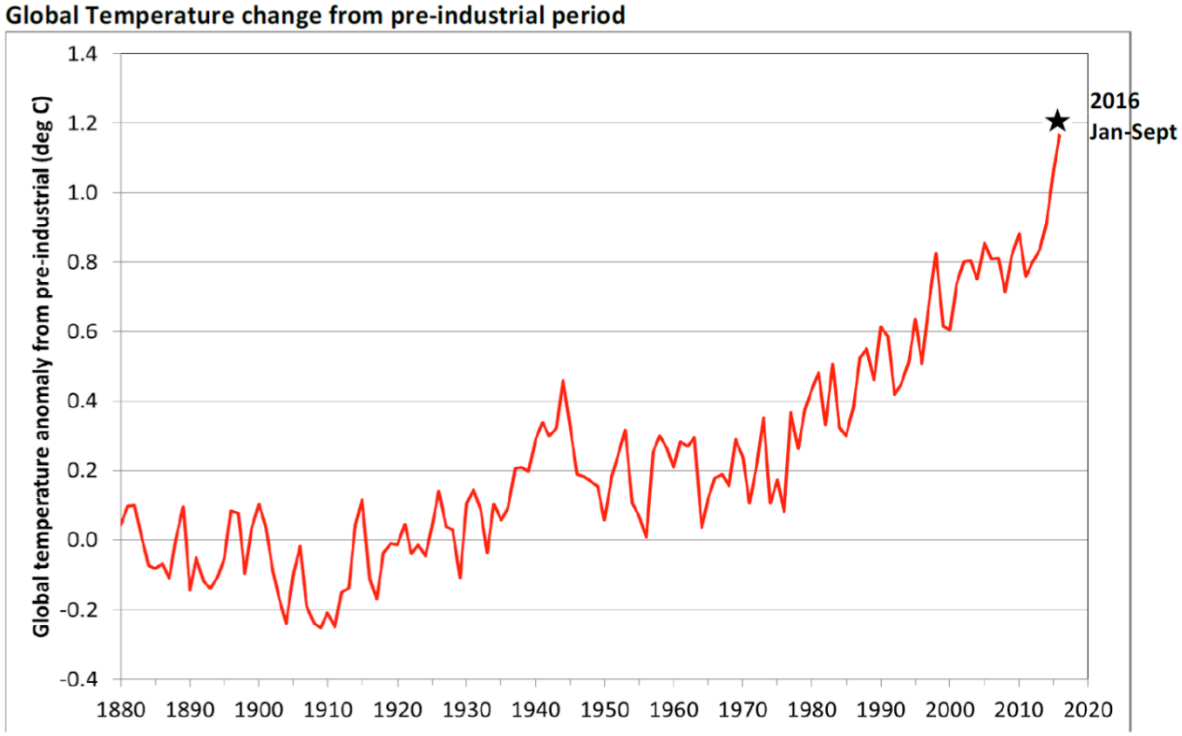


Fig 2.1 Global temperature change from pre-industrial times to 2015. (Adapted from Brazier, 2015:33).

The Intergovernmental Panel on Climate Change (IPCC) Report (2014) posits that snow and ice in the mountains, such as the Himalayas, have been progressively melting due to warmer winters. The report further argues that this global warming trend has been associated with melting glaciers and snow at the poles, leading to rising sea levels. Brazier (2015) adds that it indicates atmospheric and Ocean temperatures have risen since the 1970s. She further argues that the warmest temperatures have been measured in the past ten years, and 2014 was the hottest year, with 2015 proving to become even hotter. Moreover, Brazier (2015) says that the melting ice and glaciers have caused sea levels to rise by 17cm in the past decade.

2.2.3 Effects of Climate Change

The Intergovernmental Panel on Climate Change (IPCC) 2013 Summary Report for Policy Makers traces changes in climate over a long period. It argues that observations in the climate system have been done through measurements, remote sensing, and other platforms. According to Brazier (2015), in recent years, fluctuations in climate have instigated impacts on natural and human systems across the globe.

These CC effects are experienced in all regions of the world and manifest in the following three major categories (IPCC, 2018). Firstly, CC gradually leads to the Earth's weather systems being thrown off balance (Brazier, 2015). These changes in atmospheric dynamics have led to fluctuating precipitation, melting of snow and ice, shifting the hydrological systems, and degrading the water resources in terms of amount and worth (Nagaraja, 2019). Moreover, heat waves have progressively fanned wildfires on almost every landmass, predominantly in North America and Australasia, extinguishing vast areas of vegetation and human habitats (Brazier (2015). Furthermore, recent storms and floods have triggered the obliteration of crops and settlements, mainly in Asia, Europe, Africa, and Latin America (Environment Bureau, 2010).

Secondly, numerous floras and faunas struggle to handle the effects of CC, which increases the risk of species extinction and biodiversity loss (IPCC, 2018). Brazier (2015) notes that since 1970, a drop of 52% has occurred in archetypal populations of mammals, birds, reptiles, amphibians, and fish, which is blamed on human activities, including CC. Many terrestrial and aquatic species' relocation patterns, geographic series, and seasonal movements have shifted in response to CC (EDF, 2016). The richness and interaction among species have also changed (IPCC, 2018). Many land-dwelling, freshwater, and oceanic species have shifted their geographic ranges, seasonal actions, migration patterns, abundances, and species interactions, some becoming extinct in response to ongoing CC (EDF, 2016).

Lastly, CC is causing social and economic stress to humanity due to food insecurity, disease epidemics, and the destruction of infrastructure (Brazier, 2015).

Sea altitudes could rise by as much as 25 to 50 cm by 2100 (IPCC, 2007), threatening the 60% of humanity that lives in coastal areas and productive river delta’s worldwide

(EDF, 2016). In 2012, worldwide economic losses due to CC were estimated to be US $ 1.2 trillion annually (Hertsgard, 2012).

The United States of America faces up to $180 billion in economic fatalities by the end of the century, which result from drought and water shortages due to CC (Milman, 2017). A report produced by the IPCC (2012) pointed out that due to widespread poverty in Africa and limited human capacity, the continent is one of the most vulnerable regions to reduced yields from rain-fed agriculture, increased food insecurity, and undernourishment due to CC.

Like other countries, Zimbabwe is already experiencing the effects of CC, notably increased temperature and rainfall variability (Mapara, 2022). A study by Unganai (1996) and Brawn et al. (2012) on the effects of CC in Zimbabwe exposed that now, there are more dry days during the rainy season between January and March than in the 1900s, leading to drought and desertification. The bearings of CC for Zimbabwe, principally the increase in rainfall changeability, make it problematic for people who depend on rainwater, including those engaged in agriculture, tourism, and industry, to strategize and implement their activities (Brazier, 2015).

Moreover, the increased incidences of drought in Zimbabwe have disrupted the subsistence agricultural economy on which most rural households depend and have increased their vulnerability to heightened risks of food insecurity and poverty (Brown & Lall, 2006). Chanza (2015) further argues that rivers, streams, ponds, and wetlands are drying up and increasing pest populations. He further asserts that changes have also been noted using indigenous knowledge systems, such as observing and studying the migratory patterns of birds (mashuramurove), as well as flowering patterns of certain trees that they use to predict droughts and floods. Chanza (2015) identified some strategies used, such as cropping practices based on indigenous knowledge systems; wild fruit gathering; dry planting (before the rains have started); stream bank cultivation; planting drought-tolerant small grains, and traditional food storage processing techniques.

Chirasha (2016) points out that in the 2015/2016 agricultural season, rural communities in Zimbabwe, especially those in the Southern and Northern districts, experienced low crop yields due to erratic rainfall patterns and suffered from food shortages. The rains have become so unpredictable in many parts of the country that the UNDP (2017) forecasts that agricultural productivity, the main livelihood source for about three-quarters of Zimbabwe's population, could shrink by up to 30%. In Zimbabwe, CC has also shifted the boundaries of natural agricultural regions. Brown et al. (2012) cite examples by arguing that Chinhoyi, Chibero, and their surroundings have shifted from natural region three to natural region four. In addition, natural region one has reduced in size, natural region two has shifted further east, and natural region three has shifted to the north. Thus, almost all places in Zimbabwe have experienced CC in one way or another.

Another major effect of CC in Zimbabwe is the declining water levels in the Kariba Dam, Zimbabwe's largest hydro-electrical power station, which has adversely affected the electricity production in the country (Brazier, 2015). According to the Zimbabwe Power Company (2017), the water heights in Zimbabwe's chief lake, Lake Kariba, have plummeted to below 30%, which is extremely disturbing power generation in the country, further reducing the productivity of the few remaining industries in the country (Chirasha, 2016).

Zimbabwe has also experienced increased frequencies of flooding due to Climate Change. According to the survey made by Red Cross and Red Crescent Zimbabwe, in 2015, more than 160 homes were destroyed across the country. This resulted in the loss of 200 lives and the displacement of 3000 families due to flooding (Brazier, 2015). The same study reported increased incidences of waterborne ailments such as cholera, typhoid, and dysentery among the affected communities. Moreover, there is a potential threat of malaria to a broader geographical space of the country. Malaria is prevalent in low-lying areas like Zambezi Valley all year round. With increased temperatures due to CC, the vector mosquito migrates into higher areas (Civil Protection Organisation of Zimbabwe, 2013).

Based on the discussion above, Climate change has had a negative impact on the tourism industry, which is one of Zimbabwe's most significant foreign currency earners. The anticipated drop in water flow within the Zambezi River that feeds Victoria Falls is likely to have a detrimental effect on the aesthetic value of the waterfall (Chirasha, 2016). Studies also reveal that increased incidences of drought and wildfires are leading to losses of flora and fauna, ultimately resulting in reduced attractiveness and a consequent loss in tourist arrivals (Dube, 2016). Local communities across the globe have been the most affected by the effects of CC and have tried to adapt to these climate dynamics. These adaptation strategies can be of importance if integrated into CC. Hence, the aim of this study is to explore the integration of IK into CCE.

2.3 Climate Change and Sustainable Development (SD).

Although the exact meaning of Sustainable Development (SD) is contested, there is a consensus that environmental, social, and economic deliberations must be well-adjusted to pursue a better quality of life (Dhal, 2019). Accordingly, sustainability is an exemplar for thinking about a future in which environmental, social, and economic considerations constantly pursue development and an improved quality of life (UNESCO, 2012).

There exists a dual relationship between CC and global efforts to achieve SD. On the one hand, CC negatively affects the critical natural resources that form the basis for social and economic expansion. Notwithstanding that, society's pursuit of social and economic development is the main driver of CC. The World Bank (2014) warns that CC threatens to drag millions into grinding poverty, the most significant challenge to achieving SD. It is feared that the adverse impacts of CC will be most striking in emerging nations such as Zimbabwe because they rely on natural resources and have a narrow capacity to acclimate to a changing climate. Across these countries, the underprivileged, with the least resources and the minimum ability to adapt, are the most susceptible (UNICEF, 2020). Climate Change will affect the capability of countries to attain Sustainable Development. Contrariwise, the quest for SD will disturb the prospects for and triumph of CC guidelines. There is, hence, a link between CC effects and SD. Education is a key strategy for sustainable development.

2.4 Educational Responses to Climate Change.

Education has long been recognized as a key strategy for addressing the world's environmental crunch. The 1992 Earth Summit: Chapter 36 of Agenda 21's blueprint for SD highlighted the need to reorient the world's education systems to foster SD (UNESCO, 2015). Since the Earth Summit, Education for Sustainable Development (ESD) has gradually replaced Environmental Education (EE) as the world's leading educational response to the environmental crisis. Communities around need to be educated about CC to improve awareness, bolster action, and promoting sustainable practices (McKenzie, 2021). These sustainable practices lead to social change that produces more ecological societies. ESD aims to provide an intelligible interaction between Education, public awareness, and training to create a more sustainable future (UNESCO, 2012). Respectively, Education for Sustainable Development is far more than teaching knowledge and principles related to SD. It touches every aspect of Education, including planning, policy development, programme implementation, finance, curricula, teaching, learning, assessment, and administration. UNESCO (2015) maintains that the essential characteristic of ESD is to be applied in various ways so that the exceptional environmental, social, and economic conditions of a respective locality are reflected in local teaching and learning practices in local schools.

Since CC is a compound problem with different transverse dimensions such as social, environmental, cultural, ecological, ethical, economic, and political matters, it should be taught as a cross-curricular, and ESD provides the best framework for addressing this complicated issue (Dhal, 2019). When humanity dialogs about ESD, invariably are referring to CCE as the two have the same goal. Both ESD and CCE aim to create public awareness about CC, empower people to address CC, live sustainably, and improve their adaptation capacity to CC risks at individual and community levels (Nhamo & Shava, 2015)

One major milestone in responding to CC was the agenda 2030. In 2015, the 2030 Agenda was adopted as a global action plan to spearhead the world toward achieving 17 different SD goals. Of the 17 goals, goal number 13 calls for climate change action. This

goal is a cog as it urges communities to take urgent action to combat CC and its impacts. Goal 13 emphasizes limiting and adapting to CC. Based on goal number 13, member states are urged to take imperative action to combat CC and its impacts (UNESCO, 2015). More importantly, the associated targets of Goal 13 focus on the need for world governments to *inter alia* improve their education systems as a strategy towards CC mitigation (UNESCO, 2014). As an educational response to CC, the United States of America, specifically in New York City, has set climate action days for every school to engage in climate action to build a better future. CC is now affecting every country on every continent. It disturbs national economies and affects lives, costing people, communities, and countries. Thus, every single effort matters in finding solutions to reduce the impacts of CC. Strategies need to be developed and implemented in this cause.

Moving from the 1992 Earth Summit, especially the Article 6 on CC, it was noted that education is a key vector to prepare societies for global changes. CCE efforts were subsequently brought into the spotlight through the COP meetings. COP28 for instance, presented the growing recognition of the importance of education in combating CC and preparing future generations to address environmental challenges. Despite these intergovernmental commitments to advancing CCE internationally, there remains a lack of global data to enable tracking on country progress (McKenzie, 2021). The major achievement of the COP28 was the signing by 39 countries, ratifying the Declaration for CC and education, committing to integrate CC and sustainability into their educational curricula. Furthermore, 127 countries pledged to enhance their educational frameworks to include CCE). Through COP28, countries were called for to iincrease educational strategies in CC. These strategies included the need for teacher preparedness, research, innovative funding, the involvement of youth and the engagement of IK (UN DESA, 2023) However, how IK is being integrated into CCE in schools needs to be explored. This becomes the niche for this exploration aimed at developing a workable framework for integrating IK into CCE.

2.5 Climate Change Education (CCE).

Defining CCE

Climate change education (CCE) is an education initiative that strives to safeguard individuals and communities who appreciate the essential principles of Earth's climate system and the impacts of Climate Change to make conversant and responsible decisions concerning activities that may affect the Earth's climate and adaptation to CC (UNESCO, 2018). In this light, CCE seeks to improve the understanding of the basic science of climate and CC, and support informed decision-making by individuals, organizations, and organizations, and positive behavioural shifts toward sustainability and stewardship of the environment (UNICEF, 2020). It further represents an educational tool for developing responses and assisting people to address CC. Moreover, CCE is important for the younger generations as it aims to prepare them to live with the impacts of CC to enable them to take appropriate actions and embrace more sustainable lifestyles (Dhal, 2019).

Its major objectives are to reinforce the capacity of countries to deliver quality CCE, inspire ground-breaking teaching approaches to CCE in schools, nurture awareness about CC, and augment on-formal education programmes through media, networks, and partnerships (UNESCO, 2015).

At the various international conferences on CC that have been held since the 1992 Earth Summit, Education has been highlighted as a powerful tool for preparing societies to address the challenges associated with CC. Since then, the global community has had numerous opportunities to deliberate on the measures to be embraced to ensure that CCE is no longer an empty undertaking. For example, in 2012, more than 250 representatives partook in the launch of the United Nations Alliance on CCE, Training, and Public Awareness (UNESCO, 2014). The need to train teachers on CCE and the importance of the Global Action Programme on ESD for advancing CCE were two key outcomes of the international conference on CC, COP24 (UNESCO, 2019). COP24 also called for greater boldness in integrating CC into national education policies at all levels (UNESCO, 2019). COP28, has achieved the major milestones towards the integration of CC into education through greening of the curriculum and engagement of the indigenous groups of people.

The notion that climate change education is crucial to redirecting teaching and learning in the face of today's climate emergency (Reid, 2019). To achieve this, UNESCO, the worldwide UN body responsible for CCE, makes two main recommendations: that CCE should be integrated into all levels of formal Education and that Indigenous knowledge (IK) be integrated into CCE to improve its quality and relevance where it is being implemented (IPCC, 2019). Such integration should allow CCE to be interdisciplinary and cross-sectoral in approach, enjoy high-level support from the government and curricula developers, and involve active teaching and learning approaches while at the same time addressing local context (UNESCO, 2015).

Climate Change Education in Zimbabwe

In Zimbabwe, issues about CCE are better understood in the context of Environmental Education (EE). In Zimbabwe, Environmental Education (EE) is tracked back to the colonial era when it was provided as conservation education to farmers in schools and colleges (Chikunda, 2007). The Natural Resources Board (NRB), a department in the Ministry of Lands and Agriculture (established in 1941), played an important role in both research and the implementation of EE (Whitlow, 1988). Nevertheless, throughout colonial times and up to 2000, Zimbabwe did not have a formal EE guiding principle. Subsequently, the various government departments and organizations which provided EE did so independently.

According to Chikunda (2007), this fragmented approach to EE proved unsuccessful and had to be abandoned when promulgated the Environmental Management Act (Chapter 20:27) of 2002. This development brought about the establishment of the Environmental Management Agency (EMA), which harmonised the provision of EE at local and national levels (Government of Zimbabwe (GoZ), 2016). When Zimbabwe gained membership in various international organisations, especially the United Nations and its agencies such as UNESCO and UNICEF, there was an urgent need for school curriculum reforms (UNESCO, 2001). The early 1990s saw the introduction of educational programmes such as 'Better Environmental Science Teaching (BEST),' which introduced Environmental Sciences as a subject in primary schools, and the 'Secondary Teacher Training Environmental Education Programme (STTEEP)' (Risiro, 2014), which for the first time in Zimbabwe incorporated environmental issues into teacher education curricula (Chikunda,

2007). Following the recommendation of the Committee of Inquiry into African Primary Education in 1999, EE became integrated into Geography, Science, Agriculture, Civic education, and Biology (Nziramasanga, 1999). However, CCE did not receive special attention within EE (Nziramasanga, 1999; Lotz-Sisitka & Urquhart, 2014).

Since Zimbabwe ratified the various CC treaties, the integration of CCE into the Zimbabwean primary and secondary school curriculum has been intensified (GoZ, 2014). For example, between 2009 and 2012, several workshops were organised to raise CC awareness and provide CCE training (GoZ, 2014). Furthermore, Zimbabwe has put in place numerous initiatives to facilitate the integration of CCE into the formal education system. Additionally, the government of Zimbabwe has mandated MoPSE to respond to national and international initiatives to integrate CCE into the school curriculum. CC is now a recognised theme in the curricula for all levels of Education in Zimbabwe. This is also in line with the *Presidential Commission of Inquiry into Education and Training* (Nziramasanga, 1999), which recommended that EE (including CCE) be integrated into the school curriculum.

In this view, Zimbabwe's national SD strategy also supports the integration of CCE into the school curriculum, which highlights CCE as a national priority in attaining food security, stimulating sustainable agriculture, and ensuring entrance to affordable, dependable, and clean energy for all (Nziramasanga, 1999).

Similarly, MoPSE has developed materials on CC, which are incorporated into the school curriculum as cross-cutting themes for primary and secondary Education (GoZ, 2016). For example, the new curriculum for Early Childhood Development (ECD) incorporates CC topics and themes in all learning areas. Hence, aspects of CC are mainly covered in agriculture, science, and social studies, as well as in teaching languages at primary school (from grades 3-7). Likewise, the secondary school curriculum teaches CC as a cross-cutting theme in all subjects (Manjengwa et al., 2014). At Form 5 and 6 (Advanced Level), more detailed coverage of CCE is found in Geography in topics such as Climatology, Hazardous Environment, and Arid and Semi-Arid Geography (ZIMSEC Advanced Level Syllabus, 2015-2022; GoZ, 2014, p. 59).

However, several challenges have been identified in the way CCE is currently being implemented in Zimbabwean schools, notably the lack of locally relevant educational materials to support the teaching of CCE (Manjengwa et al., 2014) and the failure to integrate Indigenous knowledge (IK) into the CCE curricula (Naide, 2019). This is despite the UNESCO recommendation that IK be integrated into CCE to improve its quality and relevance. Informed by the UNESCO recommendation, this research explored the integration of IK into CCE in the Advanced Level Geography Curriculum to develop a workable framework.

2.6 Defining Curriculum

Franklin Bobbit developed the word curriculum after working on several courses and studying the social, economic, and political changes that came with World War I. The term curriculum was coined to mean those experiences the learner acquires in a learning establishment (Mopolo et al., 2018). Hence, every establishment has objectives that need to be achieved. In this regard, an instrument that serves as a vehicle of operation is required to achieve the objectives of Education: that instrument is the curriculum (MOPES, 2015). Thus, the curriculum can be defined as all the learning experiences and intended outcomes. The school systematically plans and guides this through the reconstruction of knowledge, which is recognized as the learner's cognitive, affective and psychomotor development (Aneke, 2016). The school curriculum is a conscious statement of the intentions and aspirations of decision-makers for school children, capturing the national goals of a country, school syllabuses, teacher guides, pupils' books, timetables, evaluation strategies, and schemes of assessment and examinations (Mapara, 2022). Yobe (2011) conceived curriculum as all a child's learning experiences under a teacher's guidance. Curriculum programme is made up of three components: a programme of studies, a programme of activities, and a programme of guidance. This programme should in essence dictate every educational system's affair and is the vehicle through which knowledge and other learning activities are disseminated (Fullam, 2015). As an abridge on the definition of curriculum, MOPSE (2015: 2) concludes that it is the sum of all learning experiences and opportunities provided to learners in the context of formal and non-formal Education. The curriculum is, therefore, derived from the country's ideology that shapes the social realities and defines the direction of its development

(MOPES, 2015). This study opined to look at how the integration of IK into CCE in the Advanced Level Geography Curriculum is being done.

2.6.1 Pillars of the curriculum

There are several stakeholders in curriculum implementation. The curriculum for primary and secondary education from 2015 to 2022 was founded on the following five pillars: legal, regulatory framework, teacher capacity development, teacher professional standards, infrastructural development, and research and innovation (MOPSE, 2015). These pillars play a crucial role in curriculum implementation and integration.

Table 2.1 following shows the major participants in the curriculum and their roles.

Participants in the curriculum and their roles

Stakeholder	Expected roles in schools
The school Head	Involves education partners in decision-making, Monitors learner assessment and profiles, Supports and provides school-based in-service training for teachers, Active in the crafting of the school vision and mission statements, Provides a child-friendly and conducive environment for learning Fosters the designing and implementation of the school development plan.
The teacher	Employs different methodologies to cater to all learners, Promotes integrated learning, Integrates cross-cutting themes like climate change education, gender equality, Holds intercultural knowledge, Links the school and the community, Employs both formative and summative assessments.
The learner	Knows learning objectives, Is active in learner-centered methods,

	Active in the construction of learning experiences and has a choice Involved in all forms of assessment, Makes suitable career choices
School Development Committee and Parents	Provide financial and material support to their children, Interacting with schools on teaching and learning, Help in the development of the school, Promotion of the vision, mission, goals, and strategies of the school, Actively participate in meetings,
Professional Association	Represent teachers in the setting and maintenance of educational standards Help in policy formulation Influence on best practices in schools Help in the professionalization of curriculum implementation.
Business community	Provision of strategic priorities in Education, Help in the evaluation of the curriculum, and the products of the school system Act as points of attachment for the learners.
Non-Governmental Organisations	Work with the Ministry to provide finances, technical support, and monitoring.
ZIMSEC	Produces and provides a model for the learner profile, Researches and monitors the different forms of assessment, Responsible for assessment of learners' performance in the system.

Adapted from MOPES (2015: 44-48)

For the curriculum to be well implemented, each of the pillars must actively take its role. Thus, this research also sought to investigate the strategies, support, and challenges faced in integrating IK into CCE in the Advanced Level Geography Curriculum.

2.7 Understanding Curriculum Reform

Since CCE and IK are relatively new concepts in the different curricula globally, there is a need for a paradigm shift in the approach. The whole aspect of the curriculum is dynamic as it changes from time to time. Curriculum reform refers to this official alteration in the desired, intended, and practiced learning activities and outcomes (Viennet & Pont, 2017). Accordingly, change is a process through which institutions and people gradually move away, come to an understanding, and become skilled and even competent in meeting the expectations of the new paradigm (Chimbi & Jita, 2020). In addition, change is not a linear process that goes through a sequence of events but rather an interface of various factors acting at different stages so that whatever happens in one phase may impact and alter what happens in another (OECD, 2020).

In the 1960s, the United States of America radically changed curriculum reform following Russia's launching of the first unmanned Soviet satellite to orbit the Earth, Sputnik (Trowbridge & Bybee, 1990). The launch caused panic among Americans, who feared their nation was falling technologically behind. The Americans envisaged producing scientists who could master modern techniques developed from scientific principles. Consequently, this brought major revisions to school science curricula (educational research, research results, and theories relating to curriculum reforms). Developing countries like Zimbabwe and Lesotho also adopted good practices in developed countries (Lewin, 1985). In light of this, curriculum implementers can use lessons from the theories to help and guide teachers successfully in implementing the curriculum as intended. Hence, innovators tend to overlook the intricacy of educational change. The change involves multiple factors that interact and influence whether an innovation is successfully implemented (OECD, 2020). The changes teachers are expected to make are frequently too radical, with ambitious objectives prescribing changes that deviate widely from normal practices (Alabe, 2011). As a result, the intended curriculum is not implemented; instead, a transformed form of what the developers had in mind is implemented (OECD, 2020).

Thus, the reformers need to know that successful implementation depends on teachers' capacity. Hence, successful implementation depends on supporting these teachers with effective developmental programmes and staff training. Fullan (2001) believes educational reform can happen in three areas:

1. in the use of new or revised materials,
2. in the use of new teaching approaches and,
3. in altering beliefs and understandings about curriculum and learning practices.

Teachers need to change their roles and classroom practices and previously held attitudes and beliefs before successfully implementing the required changes. Such a shift in the way of doing things also calls for a change in the kind of training and support teachers will need to meet these new challenges. Hence, teachers need information about the background of the new curriculum itself, as well as information on what the necessities are and what they are projected to do (Allen & Penuel, 2015).

2.8 Curriculum Implementation

One of the objectives of this research was to look at the strategies teachers used to integrate IK into CCE in the Advanced Level Geography Curriculum. Curriculum implementation is normally discussed as devoid of the complexities around it. Poor performance by learners is usually blamed on shortcomings in the curriculum, whereas the fault should be sought in the teaching-learning interaction. Thus, implementation is a phase that follows curriculum dissemination, where and when facilitators use the curriculum. Malopo (2018) views curriculum implementation as the period when the intended or relevant design is implemented. Thondhana, Ngara, Mutemeri, Mateveke, Gudyanga, and Kadodo (2014) conclude that curriculum implementation is a stage when the curriculum is put into use by the user system, such as the policymakers, teachers, and other stakeholders. It is the delivery process, usually by the teacher to the classroom.

Hence the definition by Carl (1995:166),

> *the application phase of the core syllabus and the school's broad curriculum, subject curriculum, and lesson unit.*

Curriculum implementation is putting into practice a new curriculum. This process requires restructuring and replacing personal habits, behaviour, programme emphasis, learning spaces, and the existing curricular schedules (Ornstein & Hunkins, 2007). Dekeza et al (2017) conceptualized the term implementation simply as putting an agreed plan, decision, proposal, idea, or policy into effect. Hence, curriculum implementation includes the provision of organised assistance to staff (teachers) to ensure that the newly developed curriculum and the most powerful instructional strategies are delivered at the classroom level.

Curriculum implementation involves helping the learner acquire knowledge or experience (Akwesi, 2012). It is important to note that curriculum implementation cannot occur without the learner. The learner is, therefore, the central figure in the curriculum implementation process, including other factors that influence Curriculum Implementation, such as the resource materials and facilities, the teacher, the school environment, culture and ideology, Instructional supervision, and assessment (Mogoshoa, 2021). Similarly, implementation occurs as the learner acquires the intended experiences, knowledge, skills, ideas, and attitudes that enable the same learner to function effectively in society (Akwesi, 2012). Therefore, implementing the curriculum requires an implementing agent. Stenhouse identifies the teacher as the agent in curriculum implementation. She further argues that implementation is how the teacher selects and mixes the various aspects of knowledge in a curriculum document or syllabus into practice.

Curriculum implementation, therefore, refers to how the teacher translates the planned or officially designed course of study into syllabuses, schemes of work, and lessons to be delivered to students. As an essential part of curriculum development, implementation brings the anticipated changes into existence. The changes can occur in several ways, as Ornstein and Hunkins (2007) stated.

The two most obvious ways are:

i) Slow change: This occurs, for instance, when we incorporate minor adjustments in the course schedule, when we add some books to the library, when we update the unit plan, etc., and is a slow change.

ii) Rapid change happens due to new knowledge or social trends influencing the curriculum, such as computer education being introduced in the curriculum.

Curriculum implementation is the practical application of theory into practice in a way that the eventual outcome is evidenced through the learners' performances in and outside the classroom (Mogoshoa, 2021). When teachers deliver curriculum contents and instructional strategies in the way they were designed to be delivered, curriculum implementation is said to have occurred. However, the ability and effectiveness of the teacher to carry out curriculum implementation depend largely on variables like knowledge/experience qualification, availability of resources, and motivational issues, among others.

Macdonald (2006:4) observes that

> *… much attention is paid to the outcomes or results of our activities regarding student results, and less energy is expended in finding out how well we carry them out*.

As Hameyer (2003) noted, the quality of a curriculum can only be as good as the quality of the curriculum process, depending on the self-renewing capacity of the individual school. Likewise, Viennet and Pont (2017) emphasize that student achievement can only be enhanced when the nature of the pedagogy required is targeted with precision and implemented with rigour, and with assessment for outcomes that are in tune with the entire process.

Therefore, Yobe (2011) and Glatthorn, Boschee and Whitehead (2006:73) point out that it is essential to develop a fundamental understanding of curriculum theory by providing the tools necessary when analysing curriculum proposals, illuminating practice, and guiding reform.

In effect, three distinct levels, perspectives, or representations, namely, intended, implemented, and attained curriculum, are often confused so that it is easily and superficially concluded from the outset of the initiative that the curriculum change, which is innovation, is doomed to failure.

As Lovat and Smith (2003:133) point out, the truth is that a good curriculum is theory and development, planning and practice, as one. When we opt for one against the other, we damage good learning. Indeed, a critical analysis of curriculum implementation needs to proceed with due deference to this observation. Therefore, all curriculum approaches (e.g., behavioural, managerial, systems, academic, humanistic, and reconceptualized) must be given their due in 24 overall curriculum development, and curriculum theory must guide all curriculum activities (Marsh, 2004). Thus, accurate analysis and understanding of curriculum implementation are made possible by considering the curriculum concept, the perspectives on and approaches to the school curriculum, and curriculum theory and development.

Accordingly, the idea of curriculum is hardly new, but how we understand and theorize it has altered over the years, and there remains a considerable dispute about its meaning (OECD, 2019). Defining the word curriculum is no easy matter since it consists of fragmentary parts (Mapara, 2022). This fragmentation makes the definition and fields of curriculum elusive (OECD, 2018). What it is supposed to entail is open to much debate and misunderstanding. Actually, the word (curriculum) itself is used in many different contexts: by principals in schools, by teachers, by curriculum writers in education systems, and increasingly by politicians (Lovat & Smith, 2003:6). It can mean different things in each of these contexts. Definitions of curriculum abound in the literature in various autonomous discourses using key terms in complex and even contradictory ways (OECD, 2019).

The core meaning of curriculum is embodied in its Latin derivation from a course or track to be followed. Marsh and Stafford (1988:2) confirm that the word curriculum comes from the Latin root meaning racecourse, and, for many, the school curriculum is just a race to be run, a series of obstacles or hurdles (subjects) to be passed. Marsh and Stafford (1988) further highlight three dimensions of the curriculum concept.

First, they explicitly stated that the curriculum includes not only syllabi or a listing of contents but also a detailed analysis of other elements such as aims and objectives, learning experiences and evaluation, and recommendations for interrelating them for optimal effect. Second, the curriculum comprises planned or intended learning, calling

attention to unexpected situations that may necessarily occur in classroom practices. Third, curriculum and instruction are inextricable. Lovat and Smith (2003:16) rightly contend that curriculum is part of teaching, not separate from it. Therefore, the most agreed basic notion of the curriculum is that it refers to a plan for learning (OECD, 2020). This concept of curriculum limits itself to the core of all 26 definitions, permitting all sorts of elaborations for specific educational levels, contexts, and representations.

Correspondingly, discussing this curriculum concept, Marsh and Stafford (1988:4) argue that curriculum is an interrelated set of plans and experiences a student completes under the school's guidance. Furthermore, Marsh and Stafford (1988:4-5) clarify the comprehensiveness of this definition as follows:

1. The interrelated set of plans and experiences refers to the point that curricula implemented in schools are typically planned, but almost inevitably, unplanned activities also occur.

2. The phrase a student completes under the school's guidance is included to emphasise the time element of every curriculum.

3. Under the school's guidance, it refers to all persons associated with the school who might have had some input into planning a curriculum and might normally include teachers, school councils, and external specialists such as advisory teachers. Strikingly, in line with this curriculum concept, an encapsulated definition was given earlier by Richmond (Mapara, 2022), who stated that curriculum is a slippery word, meaning in the broadest sense, the educative process as a whole and, in the narrowest sense, synonymous with the syllabus, a scheme of work, or simple subjects. However, as Lovat and Smith (2003) point out, the main concern is not to arrive at a specific definition of the curriculum; rather, it is to be aware that:

4. Curriculum means different things to different people; it is, therefore, important to consider the context in which the term is used.

5. The meaning of the word curriculum is associated with a particular ideology or set of beliefs about education and the world.

6. Different usages and meanings of the term curriculum suggest several issues and concerns central to curriculum work.

Incidentally, Middlewood and Burton (2000) make the relevant point that the debate about the meaning of curriculum is destined to continue, but deciding upon a precise meaning is unimportant compared with ensuring that the learning experiences of children, young people, and adults in individual schools and colleges are of the highest order of the appropriate purpose. Thus, the curriculum may be looked at from different perspectives and approaches, which should be clarified if the curriculum change process is to be understood. According to Van den Akker (2003), a basic analysis concerning curriculum improvement comprises three distinct levels, perspectives, or representations: intended, implemented, and attained curriculum. Consequently, as stated, the three salient characteristics of curriculum tend to be modulated by perspective. Nevertheless, they are intrinsically connected to the extent that curriculum implementation cannot be considered without considering the intended and the attained curriculum.

The intended or planned curriculum comprises the ideal or abstract conceptual and formal or written curricula (Hameyer, 2003). The ideal curriculum is the vision, including information that presents an overview (bird's eye view) of why, when, how, and what is supposed to be taught and learned. It is the rationale, the basic philosophy, or the epistemological base underpinning the curriculum. The formal, written curriculum covers the practicalities of why, when, how, and what is expressed, for example, in curriculum documents, syllabi, or school resources such as textbooks and other materials. Sibanda and Young (2019) refer to it as the official curriculum. How the curriculum is implemented depends on users' perceptions and, therefore, how they are influenced by the implementation, which is the actual teaching and learning process (the enacted, the observed, and the operational curriculum) (Liu & Wangu, 2019). It is the real curriculum, the curriculum-in-action, and how the official curriculum is translated into classroom practices.

The users whose interpretations of curriculum implementation depend on their various viewpoints are the students or parents (Hameyer, 2003) and the teachers whose influence takes pride in place. Users' views greatly determine how the implementation is

achieved. In other words, it is a reciprocal process; users' views are influenced, and the intern influences implementation.

The attained curriculum has a twofold meaning: it comprises an experiential and learned curriculum. The experiential curriculum includes knowledge or skills gained by the learners as a result of learning experiences, which depend on how the curriculum is implemented and, therefore, on factors such as overall learning organisation and school climate. Hence, one intrinsic effect of the experiential curriculum is the so-called hidden curriculum, which, according to Glatthorn, Boschee, and Whitehead (2006:23) is also referred to as the unstudied or implicit curriculum, which might be seen as those aspects of the learned curriculum that lie outside the boundaries of the school's intentional efforts. The learned curriculum is what learners have learned. It refers to knowledge, skills, and competencies gained by learners as a direct result of the teaching and learning process. As Penuel and Pellegrino (2018) observe, what teachers teach is not necessarily what students learn. This fact should lead us to bear in mind the remark by Broussard (2002:71) that,

> *each student is different, and … each situation is unique and must be handled with lots of thought.*

Referring to Africa, in particular sub-Saharan Africa, Sedel (2005:31) points out that less than one-third of the school-going learners acquire the knowledge and skills specified in their national primary education curriculum. The learned curriculum is, in the last analysis, the learning outcomes of learners in comparison with the intended curriculum and the implemented curriculum. Summing up the above discussion of the curriculum concept, the researcher agrees with Lovat and Smith (2003), who assert with Van den Akker (2003) that curriculum is essentially a practical activity that is creative and artistically informed by theory. The curriculum is concerned with decision-making, with choosing the most appropriate or justifiable alternatives, given the learners, the teachers, the resources, and the learning context integrating both perspectives of intention and actuality, as well as the process and product in classroom practices.

Lovat and Smith (2003), referring to the interrelatedness of the different curriculum levels, observe that curriculum at a national, state, system, or even faculty (school) level can

only be as intention. It is only at the classroom level, at the level of experience of teachers and learners, that the curriculum is not only intentional but also actual. From discussing curriculum as a concept, we may finally conclude (Doll, 2002, p. 46):

> *Looking at curriculum- not as a linear course to be run but as a complex and dynamic web of interactions evolving naturally into more varied interconnected forms- requires vision and perseverance.*
>
> *The curriculum concept implies different approaches, as will be reiterated and detailed in the following section.*

Liu and Wangu (2019) state that a clear vision of the curriculum and good documents are the first steps (at the school or national level). Investments in teacher participation, teacher development, and management education are significant. Under the motto Reviving Schools and Expanding Opportunities, the Mozambique Education Sector Strategic Plan (ESSP, 1999-2003) emphasized the need to review the existing curriculum for basic education to ensure a clear vision of the curriculum in action toward successful change. The efficiency of delivered education was extremely low.

2.8.1 Levels of curriculum implementation

Two levels of curriculum implementation can be observed as presented by Carl (1995), namely:

Local implementation and Wider implementation.

Local curriculum implementation happens when micro decisions are taken. In this case, the teacher implements core syllabi at the school and classroom levels. This local involvement of stakeholders usually leads to high morale. The broader implementation involves the application of policy and curriculum initiatives at the national level (Liu & Wangu, 2019).

Implementation is when one uses the curriculum with the pupils. Penuel and Pellegrino, 2018) define curriculum implementation as the process of the school facilitating the interaction between the learner and the curriculum. In Zimbabwe, this process, follows the following pyramid:

Fig 2.1 below shows the curriculum implementation process.

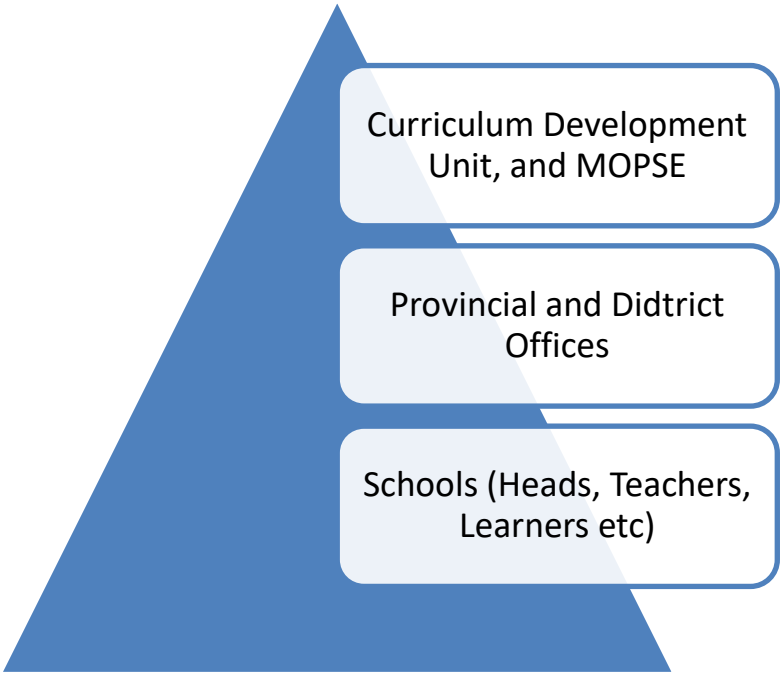


Fig 2.2 Process of curriculum implementation (adapted from Mawere et al., 2006).

From the discussions presented above, curriculum implementation can be viewed from two different angles: where the teacher is wholly involved in designing, planning, and implementing the curriculum. The second angle is where the teacher is only a receiver whose major role is to pass the curriculum to students as instructed and conceived by an outsider higher office. In this case, the teacher is an agent in the curriculum implementation process. Given this, implementation is how a teacher selects and mixes the various aspects of knowledge in the curriculum or syllabus (Liu & Wangu, 2019). Curriculum implementation is thus classroom interaction.

Marsh and Stafford (1992:137) define curriculum as putting a new curriculum into actual use. They cited the implementation as having to be directed by the following questions:

How do I do it?

Will I ever get it to work smoothly?

To whom can I turn to get assistance?

Am I doing what the practice requires?

What is the effect on the learner?

The definition of curriculum implementation recognises the learner as the central figure in this process. Implementation occurs as the learner acquires the planned or anticipated experiences, knowledge, skills, concepts and attitudes that enable the same learner to function effectively in society (Sibanda & Young, 2019).

2.8.2 Approaches to curriculum implementation

Thondhana, Ngara, Mutemeri, Mateveke, Gudyanga, and Kadodo (2014) identified two extreme ways of implementing the curriculum. These ways are as follow: the Laisses-faire approach and the authoritarian approach.

The designers and implementers of the curriculum usually take either the laisses-faire or the authoritarian approach. The laisses-faire approach allows the teacher to do what they want in class and best to be implemented in the curriculum. Thus, teachers could teach the lessons they think the learners should have. They also choose strategies to help them deliver what they want. In this case, teachers are not being followed up, and the learners have the freedom to learn what they want (Liu & Wangu, 2019). This approach suffers from the weakness that the implementation becomes chaotic and uncontrollable.

The other approach that has been used in curriculum implementation is the authoritarian approach. This is the most common approach, where the top-down approach is used. In this approach, teachers abide by what the authorities have instructed, designed, and planned. The school heads have the power to direct what is to be taught. This makes implementation a directive from the powers above. This top-down approach leads to the fidelity of implementation. Chimbi and Jita (2020) comment that teachers need to be thoroughly trained in curriculum fidelity as they are passive receivers. There is also a moderate approach where the teacher is more mutually consulted. In this case, there is an agreement between the curriculum's designers and implementers.

This approach allows for contextual and cultural settings in which the curriculum is being implemented. The integration of IK into CCE is based on contextual education and heritage-based knowledge. The moderate approach in curriculum implementation is well suited for sustainable development, climate change education, and the integration of indigenous knowledge into the curriculum and, thus, the best fit for this study.

2.8.3 Strategies of Curriculum Implementation

The study's second objective was to look at the strategies used by teachers to integrate IK into CCE in the Advanced Level Geography Curriculum. Thus, it is pivotal to look at the different strategies used in curriculum implementation. Several strategies are used in curriculum implementation, but for this research, only three strategies, subject-centered, learner-centered, and problem-centered, are going to be looked at.

Subject centered - strategy

The curriculum implementers have generally employed the subject-centered strategy making it the most traditional, most popular, and widely used in curriculum implementation. According to Mohtah (2016), the subject-centered strategy mainly focuses on theoretical knowledge and assumes that knowledge and content are well accepted as integral parts of the curriculum. Ornstein and Hunkins (2007) add that the subject-centered strategy is grounded on the belief that what makes humans distinctive, and individual is their brainpower. This means that the searching for and the fulfilment of knowledge are the natural completion of that intellect. In this view, under the subject-centered strategy, the curriculum is organised according to how important knowledge has been developed in the various subject areas. The subject-centered strategy engages the teacher actively in curriculum implementation (Molopo, 2018).

The major tools used in the subject-centered strategy are the lecture, recitation, and large group discussion. According to Ornstein and Hunkins (2007), the major advantage of using the subject-centered strategy is the availability of complementary textbooks and support material, while its major shortfall is its ridged nature and failure to promote individualization of instruction as it downplays the role of the learner while leading to

compartmentalization of knowledge. In circumstances where resources are limited, especially in new subjects being introduced in the curriculum, the subject-centered strategy has helped so much where the teacher is the focal point. However, it suffers from the fact that learners are not well engaged. Integrating IK into CCE sometimes requires a subject-centered strategy, especially where materials are not readily available. This works as a contingent measure to the shortage of resource materials. Rogan and Grayson (2003), in their curriculum implementation framework, recommended the need for material support in schools. Thus, the aim of this study is to explore the integration of IK into CCE.

Learner-centered strategy

Under this strategy, the focus is on creating valuable curricula for the learners because learners are the fulcrum in the drive for curriculum implementation. Ornstein and Hunkins (2007) believe learners must be dynamic and engaging to optimise learning. The integration of IK into CCE requires learner-centered strategies. IK is part and parcel of learners: learning is not detached from learners' ongoing lives, contrary to the subject-centered strategies. Taba (1962) noted that the rationale for the learner-strategy was that people learn only what they experience. IK requires learning that is related to active purposes and rooted in experience, and this kind of learning translates into behaviour change. In other countries like Canada, the use of a learner-centered strategy reformed the curriculum into a culturally appropriate education rooted in the locals (Marom, 2019).

Problem centered strategy

The integration of IK into CCE is an educational mode aimed at sustainable development. It aims to solve topical issues, specifically climate change, through education. Climate change, however, cannot be solved using universal methods. It requires strategies that are issue specific. Ornstein and Hunkins (2007) identified a problem-centered strategy in solving problems of living on the perceived realities of institutional and community life. Problem-centered strategies underpin cultural traditions and address those community's unmet societal needs. For the above reason, an integral approach is used where content from subjects across the curriculum addresses a specific problem. The strategy capitalises on the needs, concerns and abilities of students. This strategy was recommended by UNESCO (2019), which called for including IK in the school curricula.

The use of problem-centered strategy helps to explore the strategies being used in schools to integrate IK into the school curricula.

2.8.4 Curriculum changes in developing countries

Across the globe, the curriculum has been dynamic. Developing countries like Zimbabwe have also been involved in curriculum change. Literature is awash with evidence of curriculum change (Beeby, 1966; Guthrie, 1990; Walberg, 1991; & Tabulawa, 1997). The need for curriculum reform and innovation is subject to changes in societal needs and expectations. What is challenging is that whenever there are reforms, developing countries usually adopt what seem to be "ideal" science education systems from developed countries. Little effort is made to look at the feasibility, appropriateness, or sustainability of such systems in the context of developing countries (Stronkhorst & van den Akker, 2006). These reforms did not live up to the expectations of their reformers. For example, the need for curriculum reform is an issue on CC. The global approaches that are scientifically proven to reduce CC are not necessarily effective in some traditional communities. However, it is found to be true that in such native surroundings, there is sustainability. Hence, there is a need for a culturally specific curriculum. Some African governments have superficially adopted it, while others have not successfully adopted the Western curriculum reform approaches. In Botswana, for example, the Education Department had advocated that teachers shift from their usual practices as information providers to a learner-centered approach (Tabulawa, 1997).

In this study, Tabulawa found that teacher-centered teaching persisted among teachers. Mass teaching occurred, with teachers asking close-ended questions, which were said to alienate students. Most importantly, students and parents expected teachers to impart knowledge to the learners in preparation for the examinations. This rendered dysfunctional the interactive, flexible practices that characterize learner-centered teaching, which was the intention of the reform. Tabulawa attributed the reasons for failure to the imported "bureaucratic authoritarian" model of education imposed on Botswana prior to independence. This was further compounded by a lack of adequate human resource development and physical resources, which seemed to have been overlooked by the reformers (Tabulawa, 1997). Similar results were obtained in the studies done in Nigeria by Adeniyi, cited by Walberg (1991), where implementation was

unsuccessful because of foreign language barriers, inadequate resources, and a lack of trained science teachers (Walberg, 1991). Inadequate teacher training to meet innovation needs in developing countries seems to be a common problem (Beeby, 1966; Guthrie, 1990). These studies create a solid background for the aim of this research: to explore the integration of IK into CCE in the geography curriculum. How is the integration being done? What challenges are being faced?

2.8.5 Factors that affect Curriculum Implementation

Implementation is explained as implementing new ideas (Fullan, 2001).

> *It involves a transition period in which implementers in the school context (teachers) become increasingly skillful, consistent, and committed in their use of innovation* (Klein & Sorra, 1996, p. 1057).

Across the globe, implementing change has proved to be difficult. Challenges of curriculum implementation have racked havoc even in developed countries like America, with highly skilled, motivated, and dedicated teachers who receive continuous professional development and support in terms of physical resources.

Implementing innovations in developing countries like Zimbabwe is much more difficult due to a lack of physical infrastructure and the experienced professionals needed to ensure successful results (Mogoshoa, 2021; Ronoh, 2017). The integration of IK into CCE in schools is relatively a new paradigm. Thus, it is bound to be subjected to many challenges. Lessons can be drawn from vast amounts of literature derived from other subjects. The following factors have been identified that could explain why implementing innovation has not been successful:

Top-down management.

This approach is common in developing countries. The top-down approach imposes innovation on users as curriculum innovations tend to be large-scale, national initiatives and imposed from the top by small groups of specialists (Lewin, 1992). The assumption is that implementation will be unproblematic, and the innovation will be implemented as

planned. Hall and Hord (2006) believe that top-down management can work if continuous communication, ongoing teacher development programmes, continuous monitoring and feedback, and realistic timelines for implementation accompany it. One problem, as indicated by Rogan and Grayson (2003), is that changes and innovations implemented through bureaucratically structured education systems tend to be far removed from the realities of most classrooms in developing countries. Innovations often require skilled, well-qualified teachers who can understand and internalize the new approaches, which is often not the case in real situations. As a result, problems manifest themselves in the gaps between the intended curriculum (as expressed in the policy document), the implemented curriculum (expressed by real life in schools and classroom practices), and the attained curriculum as expressed by learners' experiences (OECD, 2020; Fogleman & McNeil, 2005).

Another factor that leads to failure in curriculum implementation is the lack of explicitness regarding the required changes. According to Fullam (2015), in most cases, there is a lack of clearly stated, known, and agreed-upon goals for innovation. In the 1960s, many curricula were aborted or failed due to inexplicitly curricula policy (Yager, 1992). According to Fullan (2001), the extent to which innovation will be implemented as planned depends upon the extent to which users are clear about it. Ogborn (2002) warns that the receivers of innovations will make sense of what has been communicated to them if communication is unclear. Appropriate policy documents play an important role in helping teachers understand the various components of innovation, such as its:

> *Philosophy, values, assumptions, objectives, subject matter, and implementation strategies* (Fullan & Promfret, 1977, p. 364).

Lack of such information denies teachers an understanding of what they must do and thus inhibits the successful implementation of the innovation. Reforms that are too ambitious and ignore classroom realities: Some implementation problems seemed to have originated from the design problem (Rondinelli et al., 1990).

The teacher

Teachers are major stakeholders in curriculum reform. They are the bearers and implementers of the curriculum. Teachers must be well informed about the curriculum reform (Allen & Penuel, 2015). In the 1990s, it was noted that the human resources (teachers, learners, and parents), knowledge, time, sense of mission and commitment, as well as:

Textual material (especially textbooks and syllabus documents) (Jita, 1998, p. 52) is a major factor in the success of curriculum implementation. Teachers are key to the successful implementation of new curricula, as they are the means used to turn innovations into classroom realities (Marom, 2019). Teachers are expected to adopt and implement the new ideas in their teaching, i.e., a change in curriculum requires a change in teachers' practices (Korteweg & Fiddler, 2018). These demands strain teachers as they require them to change their practice and resume the role of "novice" again (Fogleman and McNeil, 2005).

Teachers select and decide what to teach from the prescribed syllabus or curriculum. The teacher is a mediator between the learner and the planned learning opportunities. The question, however, is, "To what extent is the teacher involved in curriculum planning activities?

Teachers must be involved in curriculum planning and development to modify the curriculum for the benefit of their learners.

If the teacher can translate curriculum intentions into reality, the teacher must understand the curriculum document or syllabus well to implement it effectively (Mawere et al., 2006).

Lack of In-service training

Hall and Hord (2006) argue that when people are first confronted with change, they approach it with mixed feelings irrespective of how good and valuable the change is. The mixed emotion comes for several reasons as follows:

Firstly, they are uncertain about the demands of the change.

Secondly, they often doubt their ability to succeed in implementing new ways. Thirdly, they may be "grieving" the loss of old ways of doing things (Marom, 2019). As a result of

the three reasons above, when teachers interact with the innovation, they may accept, reject or modify some parts to make it suit their context (Pinto et al., 2005). The innovations get transformed in the process, as:

The new and old overlap to create a zone of turbulence and challenge (Marom, 2019).

Self-Informational concern.

Teachers would like to get more information about the innovation. Personal Teachers show concern about whether they will cope with the demands of innovation. Task concerns Management Teachers' concerns start to focus on how best to implement the changes. Consequences Teachers start asking questions about the effects of the innovation on clients. Collaboration Teachers wonder how they will collaborate with colleagues to use the innovation.

Impact concerns Refocusing Teachers focus on finding more ways to improve the innovation and present it the best way they can. The implication of "stages of concern" is that change facilitators must know that teachers may have different concerns as a new curriculum is implemented. At the start of the innovation, most tend to have concerns at the "self" (informational and personal) stage. This includes even experienced teachers, as changes make them novices again (Fogleman & McNeil, 2005).

Hence, Hall and Hord (2006) warn that change facilitators should understand and empathize with teachers' concerns, and their intervention strategies should align with their concerns. Unfortunately, this is where the root of the problem lies because if change facilitators do not know what the teachers' concerns are, then their in-service training will not necessarily meet the teachers' needs and, as Korteweg and Fiddler (2018) point out, teachers will find the training irrelevant as it does not answer the questions they are asking. Inadequately trained change facilitators can seriously impact how information is passed on to the implementers. For successful implementation, changes must be effectively introduced to the users (Fullan, 2001), which requires knowledgeable and experienced change facilitators.

According to Hall and Hord:

> *A major reason that widespread change often occurs only modestly across a school is that implementers, change facilitators, and policymakers do not fully understand what the change is or what it will look like when it is implemented in the envisioned way (*Hall & Hord, 2006, p. 11)

However, Fullan calls for empathy towards people in authority positions responsible for leading implementations they may not understand. Their lack of understanding may be because the innovation was not well developed; two, they may not have been involved in deciding on the change; and three, they may not have received adequate orientation or training themselves (Marom, 2019).

Perceived value of the innovation

"Perceived value" refers to how teachers perceive various components of the programme they will implement (Stein & Wang, 1988). If the goals and values of the programme are not in line with the teachers, then the chances of the innovation being superficially implemented or not being implemented are very high. On the other hand, if the suggested values are congruent with teachers' beliefs, they are more likely to be implemented. According to Korteweg and Fiddler (2018), perceived values of innovations are related to the teachers' belief in the programme's success and have a positive impact on their students. Additionally, whether the proposed changes could lead to the teacher's professional growth, and lastly, the values the community places on innovation.

Inadequately qualified teachers and the level of training

According to Rogan and Grayson (2003), other factors, such as their content knowledge and training, influence whether teachers change and how fast they change. Empirical evidence from a study done by Lewin (1995) indicates that well-trained teachers could better understand the complex spiral structure of their science curriculum, while the spiraling was a confusing repetition of topics by the under-trained teachers. Training teachers is a crucial step for successful implementation so that teachers understand the changes and how they can put them into practice (Marom, 2019).

The study by Allen and Penuel (2015) showed that teachers could successfully implement required changes if given appropriate training that provides the necessary knowledge and skills development. Training also helps foster teachers' interest and commitment to using gained expertise (Marom, 2019). Teachers require training in the skills required by new practices, and time and space are important as teachers adjust their attitudes and beliefs and move through the psychological processes associated with change (Korteweg & Fiddler, 2018). The change presses are not linear nor universal to all participants. Some teachers take longer to reach the change, while others take less time. Thus, in the 1960s, Beeby (1966) warned that it is important to consider teachers' level of change. In Beeby's experience, teachers cannot all be expected to reach the same development level even when given training and support. Beeby (1966) further put teachers into four progressive stages, moving from the lowest to the highest level of qualification.

He believes that when given training, teachers in each stage can only reach a certain level of change and that only a few very good teachers can reach the highest level of attainment. The implication is that expecting teachers at lower levels of qualification to implement learner-centered approaches is not a realistic demand for teachers who lack the knowledge and the skills.

Lack of continuing support and constant monitoring.

In the face of new curriculum like CCE, it is noted that there are many challenges being encountered. There is lack of tracking on how CCE and IK are being implemented (McKenzie, 2021). Teachers also often receive short in-service training to inform them about innovations in the form of workshops, which have little impact on classroom practices (Fullam, 2015). It has to be noted that successful implementation of the curriculum depends on a well-trained workforce (Lewin & Stuart, 1991). In developing countries, it has been observed that there is an insufficient supply of adequately trained science teachers (OECD, 2020). The situation is further compounded by many science teachers leaving teaching posts yearly (Ware, 1999). Lack of appropriate support material for teachers: Teacher support materials serve as a compass that directs teachers on how to enact the curriculum (Korteweg & Fiddler, 2018). Teacher support materials are integral to teachers' daily work as they support classroom instruction (Fullam, 2015).

Curriculum materials play an important role in implementation as they clarify to teachers on the implications of innovations and how they can be implemented (Allen & Penuel,

2015). Having a clear direction on executing the curriculum helps reduce teachers' concerns about early implementation (Korteweg & Fuller, 2018). Thus, support materials can be educative, as they support teachers in thinking about the context of their classrooms, planning and structuring students' activities (Ball & Cohen, 1999).

Teachers' support materials are catalysts of curriculum change (Ottevanger, 2002). In chemistry, catalysts reduce the activation energy needed to start chemical reactions. Similarly, well-prepared teacher support materials can catalyse implementation by reducing the load and effort teachers expend as they make the expected changes (Ottevanger, 2002). The support materials can help teachers overcome the uncertainty barrier, reduce the work involved in implementing the new approaches, and reduce stress levels. This study delves on how IK is integrated into CCE, looking at the strategies, challenges and support.

In addition, they can orientate teachers to the new subject matter and teaching methods (Ottevanger, 2002). Suitable policy documents, textbooks, and teachers' guides can support teachers. However, policy documents are often less accessible for teachers than the other two resources. When there is a carefully constructed syllabus documents, teachers' work becomes easier, and eventually, facilitating in schools change (Jita, 1998). In a study done by van den Akker and Keursten it was found that the use of "specially designed teacher materials with concrete procedural suggestions" on how to execute the innovation played an important role as they led to a higher degree of implementation (cited by van den Akker and Voogt, 1994, 509). The problem, however, is that few reform-based curriculum materials have been explicitly designed to support teachers' learning. Although textbooks are support materials for learners, as indicated below, they can also serve as support documents for teachers. Ensor et al. (2002) and Jita (1998) claim that textbooks are important to support documents for teachers, as they help them plan their lessons, construct questions, and provide work for their learners.

Teacher burnout

Teacher burnout involves changing attitude and behaviour in response to a demanding, frustrating, unrewarding work experience.

Buchberger, Campos, Kallos, and Stephenson (2000: 36) reiterate that the status of teachers affects the development towards professionalization of the teacher force.

Raising educators' salaries raises teacher quality, reduces dropout rates, improves the quality of education (Loeb & Page, 2000), and improves student outcomes (Lavy, 2002, p. 45). Teacher burnout leads to discouragement and motivation and a decline in effort and involvement in work.

The learner

Learners are also a critical element in curriculum implementation.

While teachers are arbiters of classroom practice, the learners hold the keys to what is transmitted and adapted from the official curriculum. The official curriculum can be quite different from the curriculum implemented because the learner factor influences teachers' learning experiences.

The interest groups

These include parents, parents' and teachers' associations, School Development Associations (SDAs) and School Development Committees (SDCs) in Zimbabwe, religious organisations, local authorities, companies, and private school proprietors.

These groups can influence curriculum implementation in the following ways:

a) Provide schools with financial resources to purchase required materials.
b) Demand the inclusion of certain subjects in the curriculum.

Influence learners to reject courses they consider detrimental to the interests of the group (Mawere et al., 2006)

Culture and ideology

Lawton (1975) believes that curriculum is a selection from culture. The preceding implies that curriculum implementation should mirror learners' socio-cultural experiences.

Ideology also sets out the operational parameters of curriculum implementation.

Instructional supervision

Successful and effective curriculum implementation depends on a school head's supervisory role.

The head monitors and guides curriculum implementation by ensuring that schemes of work, lesson plans, and marks records are regularly prepared.

The head teacher maintains a school tone and culture that create a social responsibility climate.

Effective curriculum implementation does not occur in a school where the head cannot execute supervisory functions.

A mismatch between innovations and modes of assessment

Assessment, especially in the form of examinations, influences curriculum implementation.

Due to the great value given to public examination certificates by communities and schools, teachers have concentrated on subjects that promote academic excellence and little else. In other- words, teachers tend to teach for exams.

This practice by teachers could affect the achievement of broad goals and objectives of the curriculum. Fogleman and McNeill (2005) noted the lack of alignment between intended curriculum changes and other system components such as teacher education and assessment.

Lewin (1995) cites a study in which examination papers from eight African countries were analysed. It was found that recall questions still dominated examinations and that there were few, if any, questions meant to measure affective outcomes as required by the new curriculum in those countries. Even the countries that claimed to have reformed their examination and assessment systems so that examinations reflected more of the curriculum objectives were found not to have changed sufficiently to reflect the requirements of the new goals (Lewin, 1995). The content of examination items rarely changed, and their styles and quality often fell short of comprehensively assessing key aspects of new science curricula (Lewin, 1995). As a result, backwash from examinations

was found to be undermining instead of reinforcing fundamental changes (Lewin & Stuart, 1991).

What countries embarking on curriculum reform must learn from these experiences is that the attention of reformers should be focused holistically on the design of the curriculum, from teacher training down to the mode of examination. According to Lewin (1995), curriculum reform can be reinforced if changes in the examination items closely reflect the learning goals emphasized by the curriculum. The changes to the Israeli education system in the 1960s and 1970s support this claim. In this regard, they realized the importance of assessing all objectives in the curriculum, and curriculum developers were allowed to develop their examination that would align with the curriculum (Sanders,1993). They developed an examination format that ensured skills were taught and meaningful and practical work was done (Sanders, 1993).

Feasible objectives

Effective implementation needs the use and selection of feasible objectives informed by available human, financial, and technological resources (Rondinelli et al., 1990). However, this was not the case in most innovations carried out earlier in many parts of the world. In the 1970s, a review study of innovations by Fullan and Promfret found that many curriculum innovations involved as their main objective an *increase in student autonomy and control over their classroom learning situations and … foster learner-directed inquiry modes* (Fullan & Promfret, 1977, p. 337). This requires learners who can think independently and be willing to seek additional information. Teachers are asked to consider learners capable of making their own choices. This implies that the teachers had to be facilitators rather than learning directors. Such demands are often unrealistic in real life. Most of the innovations reviewed by Fullan and Promfret (1977) were highly ambitious and unrealistic as they introduced new processes to teachers with little or no experience in the new approaches required.

Teachers were expected to develop practices that varied significantly from how they taught, which was more complex than what they were used to doing daily and, in most

cases, different from the professional training they had gone through (Ball & Cohen, 1999).

According to Ball and Cohen,

> *they must do so with materials that often under-support the goals towards which they are to work, in the face of assessments that are weakly aligned with materials and goals, and without adequate opportunities to learn. All these encompass an ambitious set of aims* (Ball & Cohen, 1999 p. 1).

The above quote suggests how ambitious and complex approaches like learner-centeredness may be. They look attractive on paper but are not practical in real situations. Carless (1997) and Jones and Eick (2007) suggest that less ambitious approaches (looking at achievable goals) and more gradual implementation are more likely to lead to feasible change. The new curriculum in Zimbabwe is meant to move from teacher-centered pedagogy to learner-centered learning, with more involvement of learners in learning and more concern for developing skills and appropriate attitudes. However, to achieve all these requirements, well-qualified, motivated teachers working with adequate resources who understand and have internalized the needs of the new curriculum are needed. The implication is that if change facilitators had been aware of the problems brought about by such ambitious innovations, they could have avoided them, considered the context of the schools where innovations would be implemented, and attempted smaller, less ambitious improvements.

Lack of support materials for learners

According to Korteweg and Fiddler (2018), for an innovation to be successful, it must be well-resourced with good-quality student materials. Textbooks play an important role in promoting student involvement in lessons and significantly impact achievement in most subjects as they serve as the main source of authoritative information accessible to most learners (Lewin & Stuart, 1991). Viennet and Pont (2017) argued that textbooks can mediate how students engage with the content to be learned. Research has shown that appropriate textbooks, although costly, have positive implications for students' learning (Manyanhaire & Chitura, 2015). However, if materials are not of good quality or "do not accurately reflect the principles of the innovation, their production may be counter-productive" (Carless, 1997, p. 361). Lack of appropriate resources, mainly textbooks, has

been identified as an implementation problem in many developing countries (Risiro, 2019; Naido, 2021). In South Africa, a review of the new curriculum implemented in 1998 revealed that in some cases, old books that were not designed for the new curriculum were being used (Chisholm et al., 2000).

Lack of equipment and resources

Guthrie (1990) asserts that in developing countries, teachers have often been held responsible for the failure of innovation and argues that focus should rather be directed at the context and local conditions that make implementation difficult, even for good teachers. Rogan and Grayson (2003) claim that the lack of resources or the poor quality of resources has often been identified as undermining the effort of even the best teachers and can seriously hinder the implementation of new ideas. The results of studies done in Nigeria by Adeniyi, cited by Walberg (1991), and in Botswana (Tabulawa, 1997) show that implementation was unsuccessful in those countries because of inadequate resources, amongst other factors. In this view, schools need adequate resources such as textbooks, teaching gadgets, and stationery to implement the curriculum fully. Additionally, resource materials enable teachers and learners to play their roles satisfactorily in the curriculum implementation.

It is also important that the central government provide physical facilities such as classrooms, laboratories, workshops, libraries, and sports fields in order to create an environment in which implementation can take place (University of Zimbabwe, 1995:2). The availability of appropriate facilities and quality resource materials has a great influence on curriculum implementation. The physical frame within which a curriculum is implemented includes the built environment of the school and classroom, for example, laboratories, equipment, and materials provided for teaching and learning- resources that disadvantaged schools lack. School support is dependent on its location. Some schools situated in less affluent or poor communities lack adequate support in their curriculum implementation efforts.

Coverage and mastery

The realities of teaching include coping with content coverage, especially in an examinations-driven education system. However, coverage is not sufficient. Students

must learn the material to a certain degree of mastery. The more the teacher emphasises coverage, the less the teacher will spend on any one part of the curriculum, thereby sacrificing mastery. On the other hand, the more the teacher emphasises mastery, the less the teacher can cover. Therefore, according to Posner (1995), the teacher is always faced with trade-offs between breadth and depth of curriculum implementation.

Teacher-student ratio

Democratization of education has resulted in school enrolment numbers. Faced with large numbers and diversity of students, the pressure to adhere to a schedule presents the teacher with a difficult task.

The literature on factors that hinder the implementation of the curriculum discussed before is a springboard to this study on integrating IK into CCE. They are also aligned with the theoretical framework that informed this study, especially the construct on support for curriculum implementation.

2.9 Curriculum Implementation Models

The last objective of this study was to design a model that would inform the integration of IK into CCE in the Advanced Level Geography. It is prudent at this stage to look at one of the models utilized in curriculum implementation, namely the Concern-Based adoption model (CBAM). CBAM is used to address change implementation on a system level and helps supervisors understand the process of change, how individuals respond to change, and how to ensure that the correct actions are followed to help ensure the change initiative's success. It also informs the supervisors on the fidelity and integrity of the implemented programme (Hall & Hord, 2020). As a result, the model helps facilitate change that helps leaders and researchers understand, lead, and monitor the complex process of change in education. Integrating IK into CCE is a complex process that needs a well-defined model.

CBAM is a theoretical model for facilitating change that helps leaders and researchers understand, lead, and monitor the complex process of change in education. The researcher's focus is to look at the users attempting to implement an expected change. It

looked at the increased use in schools based on change facilitators' strategies and actions. The changing facilitator uses CBAM's main constructs, namely:
Stages of Concern (SoC),

Innovation Configuration Map (IC Map), and

Levels of Use (LoU).

The Change Facilitators assess individual motivations and needs from these components when adopting an Innovation.

Thus, the change facilitator reduces perceived threats to users, thereby aggregating the likelihood that the Innovation will be adopted with Fidelity before it is adopted or changed (Hall & Shirley, 2020). The effective implementation of a new programme is a highly personal developmental process.

2.9.1 Components for assessing and guiding CBAM:

The Innovation Configurations Map provides a clear picture of what constitutes high-quality implementation. It serves as an exemplar to guide and focus staff efforts. Stages of Concern: At this stage, data is collected using questionnaires, interviews, and open-ended statements to enable leaders to identify staff members' attitudes and beliefs toward the new initiative. When this knowledge is collated, the leaders can take action to address individuals' specific concerns.

Levels of Use: At this stage, the interview tool helps determine how healthy staff, individually and collectively, are using a programme. Levels range from non-use to advanced use to help staff implement a new programme effectively.

The CBAM has been used effectively in various educational contexts, such as K-12 science and medical schools, to sustain the implementation of various curricula,

instruction, and assessment approaches. It has also been successfully used in many countries, including Australia, the Netherlands, and South Africa (Norman et al., 2002).

Assumptions

According to Hall and Hord (2020), change is complex and dynamic at all levels, and the following twelve principles guide CBAM:

1. Change is learning,
2. Change is a process,
3. Implementing change is a whole system effort
4. Organisations adopt change; individuals implement change
5. The school is the primary organisational unit for change
6. District- and School-Based leadership is essential to long-term change success
7. Facilitating change is a team effort
8. Interventions are key to the success of the change process
9. Appropriate interventions can reduce resistance to change
10. All-way communication is needed all the time
11. Mandates can work
12. Sustaining change requires additional time, interventions, and leadership.

Weaknesses

Hall and Shirley (2020) say that although CBAM has been used in various educational settings, it was developed and researched primarily within K-12 settings. Two core assumptions may limit its applicability to Higher Education. First, unlike Diffusion Theory, which emphasizes users' decisions to adopt an innovation, CBAM assumes that the innovation will be adopted. In addition, its emphasis on fidelity in implementing new programmes (such as curriculum adoptions and educational kits) may not adequately address the complexity of change in higher education.

However, these factors may not apply during COVID-19 because the switch to online instruction is not something faculty decide about. In addition, online instruction requires greater fidelity in online course design principles.

2.10 Curriculum Integration

This study aimed at the integration of IK into CCE. Thus, a discussion on curriculum integration should be better understood. Forms of integration have been subjects of many studies from the 20th century by educationists like Dewey and Kilpatrick (Vars, 1991). Curriculum integration incorporates the idea of unity between forms of knowledge and perspective disciplines (Nehm, 2019). Every subject requires knowledge of the other subject. For instance, physical geography requires knowledge of physics and chemistry, while mastery also requires a good command of English. For all this to happen, the solution is an integrated curriculum.

According to MOPSE (2015), an integrated curriculum (IC) is a curriculum that does away with borders drawn around a subject. In curriculum integration, subjects rely on one another. This makes a critical connection for learners and cuts across subject matter to emphasize key concepts. An integrated curriculum leads to a better understanding of the concepts as topics are reemphasized (Drake & Reid, 2018). IK and CC are better understood when the walls between them or the content area and their teaching are removed (Mohtar, 2016). This kind of training is perceived beneficial as it is multidisciplinary and leads learners to solve real-world problems (Wang et al., 2016). Furthermore, instructing through integration develops the expectation of increased interest in sciences and other learning areas, especially if it begins when students are young (Nedha, 2015).

Two common approaches to integrative instruction are multidisciplinary and interdisciplinary integration (Nehm, 2019). The multidisciplinary approach focuses on the disciplines themselves. On the other hand, the Interdisciplinary approach focuses on what the teachers and instructional designers do as they organise the curriculum into common learning themes across involved disciplines.

Nehm (2019) explains that interdisciplinary integration begins with a real-world problem, such as CC. To conclude, it incorporates cross-curricula content with critical thinking, problem-solving skills, and knowledge. Multidisciplinary integration asks students to link content from specific subjects, but interdisciplinary integration focuses student attention on a problem and incorporates content and skills from various fields. Hence, the study's objective is: How can integrating IK into CCE be done best? Fig 2.2 following shows a model for the integrated approach.

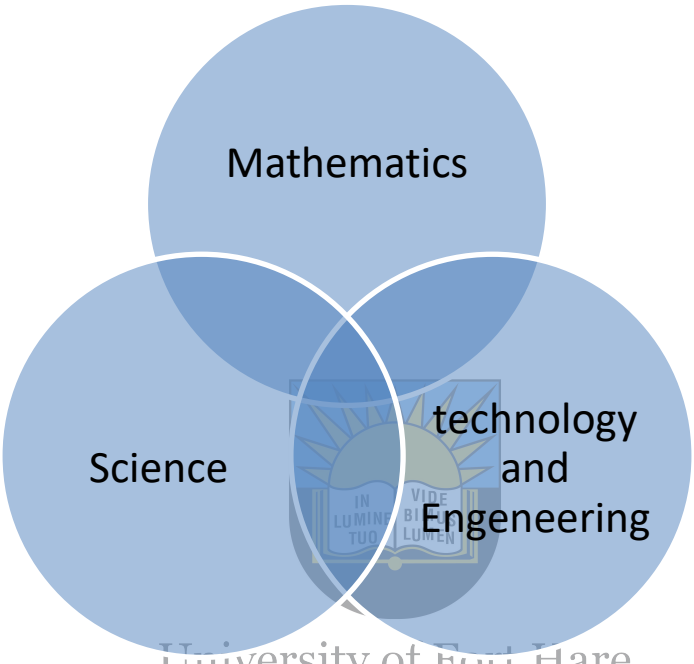


Figure 2.3 The Integrated Approach (Adapted from Roberts and Cantu, 2012).

Integration can be done with a minimum of two disciplines (e.g., IK and CCE) but is not limited to two disciplines.

Benefits of curriculum integration

The integration of two or more subjects has many benefits. For example, when IK is integrated into CCE, it leads to real-life examples for the learners, and subjects are connected to what is found in the environment around them (Nehm, 2019). When subjects or disciplines are integrated, learners learn in a way that is sensitive to their needs. The integrated curriculum also allows for a successful and flexible product at the end of the course. For example, students who are good at science could also be good

communicators because of the English they would have learned (Vars, 1993). According to Roberts and Cantu (2012), an integrated curriculum also leads to higher student engagement in a classroom.

An integrated curriculum is a more authentic approach as it connects learners to their previous real-life knowledge. Teachers also find the lessons interesting in class as learners will be active (MOPES, 2015). Curriculum integration leads to problem-solving skills among learners, more extraordinary intellectual ability, and improved attitudes toward schooling, making education relevant to the local community (UNESCO, 2017). Lastly, an integrated curriculum leads to teachers having thorough preparations, brainstorming, aligning the lessons with the standards, and even leading to co-teaching.

2.11 The Integration of Indigenous Knowledge into Climate Change Education

Recently, there has been an improved appreciation of the central role of IK and communities in addressing environmental challenges (Stevens et al., 2017). The need to value IK as part of EE is traced back to the Tbilisi UNESCO Meeting in 1977, which called for including learners' backgrounds into EE (UNESCO, 2017). Since then, there have been numerous other initiatives and international conferences on the addition of IK in EE, such as the 1987 Brudtland Declaration, the 1992 United Nations Conference on Environment and Development (UNCED), the 1992 Earth Summit in Rio de Janeiro, Brazil (Zazu, 2008), and the 2002 World Summit on SD in Johannesburg, South Africa.

The UNCED (1992) positioned the foundation for incorporating IK into formal education to respond to environmental matters and risks (UNESCO, 2017). Agenda 21, the blueprint for SD agreed on at the Rio Summit in 1992, called on world regimes to recognize indigenous people's beliefs, traditional knowledge, and resource management practices to promote environmentally sound practices and SD. The International Union for the Conservation of Nature (IUCN) report (1991) also defended and advocated for the need to give reverence to and consider indigenous peoples and their various knowledge systems in both conservation and EE (Reid et al., 2004). Principles 7 and 9 of this report

were significant in determining and encouraging research in IK and EE. Principle 7 upholds that:

> *Environmental education must recover, recognize, respect, reflect, and utilize Indigenous history and local cultures and promote cultural, linguistic, and ecological diversity* (O'Donoghue & Neluvhalani, 2002 p. 123).

Principle 9 supports the idea that environmental education values all different knowledge systems. In Chapter 36 of Agenda 21, the blueprint for SD that came out of the 1992 Rio Earth Summit, IK was identified as another highly effective ground supporting the attainment of indigenous people's environmental knowledge (McGregor, 2004).

In addition, UNICEF (2020) posts that all children have the right to a system of education that values the child's culture, dialect, and community. Consistently, children's rights to education in cultural contexts that are accustomed to them are also found in the Conventions on the Rights of Indigenous People and the Preservation of Indigenous Knowledge (United Nations, 2005). Responding to this, Zimbabwe's Presidential Commission of Enquiry into Education and Training of 1998 points out that one of the goals of education in this country is to promote local cultural values and norms (Shizha, 2007). In addition, Zimbabwe's Environmental Management Act of 2002 states that:

> *Environmental education, environmental awareness, and the sharing of knowledge and experience must be promoted to increase communities' capacity to address environmental issues and engender values, attitudes, skills and behaviour consistent with natural resource management for sustainable development* (MoET, 2002, p. 12).

2.12 Defining Indigenous Knowledge (IK)

There are several alternatives to the term IK, such as home-grown, traditional, vernacular, or folk knowledge (Ellen & Harris, 2000). Numerous differing definitions of IK exist in literature. UNESCO (2019) defines IK as the understanding, skills, and philosophies established by societies with extended histories of relations with their natural surroundings. This knowledge informs societies' interactions with their immediate environment (Berkes, 2012). For Hoppers (2005:2), IK refers to "a total of knowledge and

practices, whether explicit or implicit, used in the management of socioeconomic, ecological and spiritual facets of life, stored in the collective memory and communicated orally among members of the community and to the future generations (through, stories, myth, songs, etc.).” According to the International Council for Science Study Group on Science (2012),

Indigenous Knowledge is an accumulated body of knowledge, know-how, practices, and representations preserved and established by peoples with protracted histories of interaction with the natural environment.

These sophisticated understandings, interpretations, and meanings are part and parcel of a cultural complex that incorporates language, identification and classification systems, resource usage practices, ritual, mysticism, and worldview (Mapara, 2022).

In this chapter, the term IK refers to an aggregated body of knowledge, practice, and belief working by adaptive progressions and given down through generations by cultural diffusion about the relationships of living beings (humans included) with one another and their environment (UNESCO, 2019).

Nature of Indigenous Knowledge (IK)

According to UNESCO (2017), IK has several key physiognomies that discriminate it from other knowledge systems. The attributes of IK based on the UNESCO definition are that it is adaptive, cumulative, vibrant, holistic, modest, inter-generational, irreplaceable, unique, moral, non-linear, observant, relative, responsible, spiritual, invaluable, and valid. The term indigenous signifies that knowledge is distinctive and belongs to people from specific places with common cultural and social links (UNESCO, 2019). In this regard, Mapara (2022) points out that IK is local in that it is ingrained in a particular place and a set of experiences produced by people living there. The outcome of these factors is that conveying IK from one place to other risks losing its essence.

Moreover, IK results from practical rendezvous daily and is constantly polished by familiarity and trial and error (UNESCO, 2018). In addition, according to Ogbebor (2011), IK is established in the rigorous laboratory of existence and is the invention of many age groups of intellectual reasoning. Since its miscarriage has direct consequences for the

lives of its practitioners, its success is often a good measure of Darwinian aptness. It is, as Hunn (1993: 13) gracefully puts it:

'Tested in the rigorous laboratory of survival.'

Another characteristic of IK, according to Ogbebor (2011), is repetitiveness. Repetition is an essential characteristic of institutions, even with supplementary new knowledge (UNESCO, 2019).

Ford (2016) says repetition aids retention and reinforces ideas. Repetition is thus an essential characteristic of tradition (Hobsbawm & Ranger 1983), even when new knowledge is accrued. One can then say repetition and redundancy aid in remembering and reinforcing ideas. This repetitiveness, as indicated by Ogbebor (2011), brings in another attribute of IK: frequently changing, being formed as well as reproduced, discovered, and misplaced. However, it is often represented as being stagnant (Wasongo et al., 2011).

In addition, IK is verbally transmitted or communicated through intrinsic dramatization (Mafongoya & Ajayi, 2017). This means that writing down changes some of its important belongings, although it makes it more transferrable and everlasting. Ogbebor (2011) notes that the oral character of IK obstructs the kind of organisation indispensable for developing conjectural knowledge. Although writing makes it more portable and permanent, it also reinforces its e dislocation.

Indigenous Knowledge is symptomatically shared to a much superior degree than other types of knowledge comprising global science. As a result, it is sometimes called `people's science,' a designation which also arises from its generation in situations of everyday production. However, its dissemination is still socially bunched and segmentary (IPCC, 2019). It is generally asymmetrically distributed within a population, by age and gender, for example, and preserved through distribution in the memories of dissimilar individuals. Specialists may be by advantage of experience but also by ceremonial or political authority. It does not exist entirely at any point or within a distinct person.

Hence, Indigenous Knowledge is characteristically beseeched within cultural traditions; therefore, separating the technology from the non-technical and the rational from the non-rational is problematic (Mafongoya & Ajayi, 2017).

2.13 Indigenous Knowledge and Western Science

Indigenous Knowledge and Western science are characterized by different dualistic ways of observing the world around us**.** Western science (Western Knowledge) refers to the form of knowledge that many individuals think of when they hear the term science, and it is the most shared form taught in schools (Baker et al., 2011). Western science banks on certain regulations determined using scientific means to enlighten the natural world, which is *testable* (Baker et al., 2011). Western knowledge structures are considered part of the whole concept of modernity, whereas IK is allegedly part of a lasting, old-fashioned, retrograded way of life (Mapara, 2022).

A grounded analysis of the divide between Western science and IK alludes to the fact that the subject matter between the two knowledge systems differs. UNESCO (2019) posts that the presupposition is that IK is apprehensive about the instantaneous and concrete necessities of people's daily livelihoods. Western knowledge tries to hypothesize universal explanations, but it is one step detached from people's daily lives and does not hold water. There is hardly any aspect of life in the West today that does not bear the inscription of science (Baker et al., 2011).

Another difference is that Western science is seen as open, methodical, impartial, and dependent on an isolated center of rationality and intelligence (Mandikonza, 2019**).** In contrast, IK opines to understand the world more completely by observing the linkages between the parts (The Living Knowledge Project, 2008). IK is often seen to be locked, unsophisticated, unchallenging, primitive, and emotional (Koenher, 2017). It is non-systematic, universal rather than analytical, without an overall theoretical framework, and advances on the foundation of new experiences, not based on a coherent thought (Mawere, 2015). Furthermore, the methodological and epistemological grounds between the two knowledge systems differ. The two forms of knowledge engage, unlike methods, to scrutinize reality. Some IK academics have contended that science is open, systematic,

impartial, and analytical, and advances by meticulously building on prior achievements (Mafongoya & Ajayi, 2017).

In addition, the contextual grounds make a huge difference between the two knowledge systems. As pointed out by UNESCO (2021), IK is more profoundly rooted in its environment since it occurs in a local context, secured in a specific social group in a precise setting at a particular time. On the contrary, Western knowledge is divorced from that framework in the search for common validity (Mafongoya & Ajayi, 2017). As such, modern scientific knowledge is centralised and associated with the machinery of the state, and those who are its bearers believe in its superiority. In contrast, IK is dispersed and connected to low-prestige rural life, and even those who are its conveyors may believe it to be substandard to scientific knowledge (Mafongoya & Ajayi, 2017). Issues about the similarities and differences between Western and indigenous knowledge are summarised in Table 2.2.

2.13.1 Similarities and Differences between Western Science and Indigenous Knowledge

Table 2.2 shows similarities and differences between Western knowledge and Indigenous knowledge (Adapted from Agrawal, 1995).

Type of Knowledge	Indigenous Knowledge	Similarities	Western Knowledge
About the Universe	It is all inclusive: includes physical and is linked to moral codes	Regard the universe as a united body of knowledge stable but subject to modification	Part to the whole, Limited to evidence Exploration within the physical world
Habit of the mind	Emphasise practical	Habit of mind: honesty,	Skepticism

	application of skills and knowledge	inquisitiveness, perseverance, and open-mindedness	
Wisdom	Inherited wisdom	Patten recognition, verification through repetition	Controlled by experimentation to falsify the hypothesis
Approach	Respect for all things Practical experimentation Local verification, Qualitative oral record	Imperial observation in natural settings, inferences, and prediction knowledge	Global verification, quantitative written knowledge
Communication And Models	Communication through metaphors and stories connected to life, values and proper behaviour Integrated and applied to daily living and traditional subsistence practices	Plant and animal ecosystem, properties of objects and materials, the position of objects and materials, Position of motion of objects, Cycles, connections and changes in Earth's systems	Communication of procedures Evidence and theory, Discipline-based, Micro and micro theory, e.g., atomic theory and plate tectonic, Mathematical models

As a result, Western science and Indigenous Knowledge are often obtainable as two opposite knowledge systems, characterized by a binary divide (Agrawal, 1995). This divide has arguably evolved out of the epistemological foundation of the two knowledge

systems. Hence, they may be treated as unnoticeable entities distinguishable from each other in space, which precludes dialogue and learning between them (Mohan & Stokke, 2000).

Scientists have also articulated concerns that the advancement of IK is tantamount to endorsing pseudoscience and anti-science (Agrawal, 1995). Mafongoya and Ajayi (2017) and UNESCO (2019) argue that even in Africa, one of the monopolies of IK is that it is considered regressive, static, and an interruption to modernization until recently. Pseudoscience constitutes an attempt to be perceived as scientific, while anti-science constitutes an opposition to science (Agrawal, 1995). However, IK is established with a different intent and context to pseudoscience and anti-science in that it is neither endeavoring to subterfuge as science nor does it regard itself in disagreement with science (Mafongoya & Ajayi, 2017).

For a long time, the importance of IK in enhancing education quality and relevance has been neglected (UNESCO, 2019). The side-lining of IK resulted from the prominent hegemonic positioning of Western knowledge in the curriculum at the expense of IK (Shizha, 2014). A power struggle has controlled policies of knowledge generation, production, and distribution in the non-Western world and the formerly colonized countries (Mawere, 2015). Similarly, formerly colonized countries, including Zimbabwe, have faced choosing between Western knowledge and IK. For the greater part of post-colonial history, Western knowledge has been valued more than IK (Agrawal, 1995). O'Donoghue, Shava & Ngcoza, 2016) indicate that to counter this Western hegemony of knowledge in the curriculum and extricate IK from its current position of subjugation, there is a call for the mixing of the two knowledge systems together

However, SSA IK is rapidly being eroded and lost (Hassan & Nhemachena, 2008). The loss is primarily ascribed to the disturbance of intergenerational knowledge diffusion. The aspects contributing to this are the deficiency of IK in recognized school curricula, globalization (incorporation of SSA inside the global economy), interior and exterior migration to urban cities, and comparatively easy access to imported food and popular culture (Muguti & Maphosa, 2012).

Bridges and McClatchey (2009) attribute the destruction of IK to the prevalent abandonment of oral record guardianship in dance and song, which can codify complex pieces of information and successfully transfer them across multiple generations.
This breach in intergenerational traditional knowledge transmission needs instant consideration, and integrating IK into CCE offers a means to address this (Hassan & Nhemachena, 2008). Hassan and Nhemachena (2008) point out the other grounds contributing to the steady loss of IK in SSA comprise the dominant uptake of the English language, the dissension of youths concerning traditional ecological knowledge, and the replacement of many traditional agricultural production approaches and food culture with western administered foods. Children can acquire traditional knowledge at a very young age. From this, they are gifted to develop the skills of indigenous people in weather forecasting, food conservancy, and risk reduction strategies.

The unification of IK with modern science will foster the development of crossbreeding skills. UNESCO (2019) advises that an education system that rubbishes traditional knowledge harvests a generation uninformed by their historical roots. Across the globe, many countries agree that formal education adds to the erosion of IK (Dei, 2002). Formal schooling removes children from the clan and community setting and presents children with external values that may clash with or weaken traditional teachings. Bridges and McClatchey (2009) note that the loss of IK lessens the social principle of younger generations.

Guidelines that endorse ‘brothering’ education and nurturing IK together with mainstream education will provide generations with sources of origination to strengthen community pliability in the face of CC (UNESCO, 2021). In this view, IK has the probability of complementing the system of Western science in pushing the SD agenda (The Living Knowledge Project, 2008). In addition, IK has been much-admired as a substitute and highly effective field that ropes the acquisition of environmental knowledge from the local people (Mcgregor, 2004). In the same regard, the reconstruction of the education policy in contemporary Africa calls for a critical dialogue concerning the utility of African education, the engagement of Indigenous African theoretical and philosophical ideas at the centre of African education policy design, the renaissance of African epistemology

and the establishment of a counteractive critical theory of African education and knowledge (Itibari & Zulu, 2006).

2.14 Sustainable Development (SD)

SD is a fluid concept that is comparatively new in the development discourse. This concept was mentioned by Leister Brown (1981) first, and six years down the line, the Brundtlandt Commission defined it as:

> *Development that meets the needs of the present generation without compromising the ability of future generations to meet theirs* (WCSD, 1987:8).

However, this definition of SD is political and fails to present a yardstick on how it should be done. This has led to a failure to achieve sustainability, albeit more than half a century of development cooperation, as the donor community thought sustainable development in colonized communities meant higher gross domestic product growth rates. There are several threats to the survival of humanity. For example, humanity is threatened by desertification, fast degradation of arable land due to abusive and inappropriate use of fertilizers, and polluted rivers, air, and soil caused by industrial effluents (Eyong et al., 2004). These are speeding the process of biodiversity loss. Global warming threatens our common future, and so far, coping mechanisms remain inadequate to safeguard our common future.

The life support systems of the earth (seas, rivers, oceans, soils, forests, and air) can be likened to a boat; any leakage on one part of this boat will cost the entire globe and not only the affected part. Co-operation at all levels, including Indigenous peoples with differing knowledge systems, is needed to protect the earth's life support systems in our quest to meet present development needs while considering that future generations need these life support systems. The idea is to transfer enough natural capital to future generations. Hence, the capital bequest is an intergenerational contract for sustainability based on ethics because, so far, no robust legal framework exists to hold deviants accountable for their actions. Protection of the earth's life support systems requires knowledge and coherent information. All sorts of knowledge are needed to protect the environment.

The absence of this explains why imported Western models and technologies have failed in alien settings. The so-called 'experts' should try to understand the people who intend to help and consider IK and perceptions rather than denigrate and relegate them to the background in development interventions.

The concept of SD should contextually consider issues of cooperation, stakeholder participation, commitment, long-, medium-, and short-term effects of current actions, common concerns, inter and intra-generational equity, justice, and moderate production and consumption habits. As such, SD requires efficient communication, tacit knowledge and its transfer between and within generations, capacity, and willingness to act based on available knowledge. So, SD calls for including local knowledge as a coping mechanism. Within the SD framework, this research investigated the integration of IK into CCE.

2.15 Climate Change and Sustainable Development

Globally, there is agreement that climate change can only be contained and managed through a societal transformation involving politics and all societal forces. The importance of the local action level and CCE is becoming increasingly recognized. However, the practical implementation still requires much development. A need for good community-based, individual measures and projects regarding CCE is insufficient. It is also necessary to systematically develop and network the diverse activities of CCE in all educational areas to provide citizens with an opportunity for lifelong learning and link climate-related activities and political measures.

At the UN Conference on Environment and Development in Rio de Janeiro in 1992, several resolutions were passed that had a major global historical impact, especially on sustainable development. These resolutions include Agenda 21 (UN, 1992) and the UN Framework Convention on Climate Change (UNFCCC). The objective of this Convention was to 'stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system' (UN, 1992b). At

that time, education, training, and public awareness were already considered factors contributing to climate protection (Article 6 of the UNFCCC).

In the broadest sense, this important aspect of education was also formulated as Principle 10 in the Rio Declaration on Environment and Development in 1992, together with social participation. Furthermore, education was described in detail as a general instrument for sustainable development in Chap. 36 of Agenda 21, while atmosphere protection was a central topic in Chap. 9.

Simultaneously, the importance of action at the community level was recognized in both UN documents, and Agenda 21 even dedicated a separate chapter, Chap. 28. Although the prominence of these factors is internationally recognized, there is great variation in how consistently the individual states have implemented the far-reaching UN resolutions from Rio de Janeiro in 1992 and from the many follow-up conferences. The same is also true for resolutions from the annual Conferences of the Parties (COP) in the area of climate change. There is still the need to investigate how this is implemented in schools.

2.15.1 Recent Developments in Sustainable Development and Climate Change Education

Climate change has been an important international issue since the UN proclamation of the Decade of Education for Sustainable Development (DESD) 2005 to 2014 (UNESCO, 2009). Additionally, CCE played a key role during the second follow-up UN Conference, Rio+20, which was again organised in Rio de Janeiro in 2012, as reflected in the resolution '*The future we want'* (UN, 2012). Despite these calls, the educational deficit in climate strategy and politics remained apparent worldwide until 2011. Thus, UNESCO sought to address this deficit, and the following is on its website: 'Through its Climate Change Education for Sustainable Development programme. It aims to make climate change Gerhard Becker (2017): Climate Change Education for Sustainable Development, the programme aims to help people understand the impact of global warming today and increase "climate literacy" among young people.

1. The issue of climate change education (CCE) was expected to be given much higher priority after 2015, a year in which the UN and UNESCO set foundations for future action at two global conferences, Agenda 2030 and the UN Climate Conference in Paris. In

September 2015, Agenda 2030 (UN, 2015a) was issued with 17 Sustainable Development Goals (SDGs).

2. The following three SDGs are the most relevant for CCE:

• 'Ensure access to affordable, reliable, sustainable and modern energy for all' (SDG 7),
• 'Take urgent action to combat climate change and its impacts' (SDG 13)

• 'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all' (SDG 4).

The UN Climate Conference that was held in Paris at the end of 2015 differed from the previously organised International Climate Conferences in so far as it is generally regarded as a breakthrough in global politics. The highly ambitious aim of keeping global warming below 2 °C or 1.5 °C nevertheless requires consistent global climate policies right from the start that aim at reducing greenhouse gas emissions to zero as quickly as possible.

In this view, adaptation and mitigation are two fundamental terms in the debate on climate change. The International Panel on Climate Change (IPCC) defines mitigation as 'an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases. Adaptation may be defined as understanding how individuals, groups, and natural systems can prepare for and respond to changes in climate or their environment'. It would be impossible to achieve this target of adaptation and mitigation, which is vital for humanity, without relying on systematic educational measures regarding lifelong learning, whose aim is to significantly shape the attitudes and behaviour of as many people as possible. In the general terminology of the Paris Agreement on climate change (UN, 2015), which has been recurrently mentioned in the international UN resolutions since 1992, the important role of education is emphasized:

> *'Affirming the importance of education, training, public awareness, public participation, public access to information and cooperation at all levels on the matters addressed in this Agreement.'*

Due to the great importance of climate change, it makes sense to use a special term for related education: climate change education for sustainable development (CCESD or CCE).

The previously mentioned Chap. 28 from Agenda 21 (‘Local authorities' initiatives in support of Agenda 21’) (UN, 1992) was the preliminary point of numerous sustainability initiatives and processes (Becker, 2017): CCESD. The cumulative importance of the home-grown action level can be seen in the founding of two international organisations representing the towns, cities, communities, and rural districts. Regrettably, neither organisation mentions CCESD explicitly within the scope of climate change and sustainability.

In 1990, the International Council for Local Environmental Initiatives (ICLEI) was founded after the first World Congress of Communities for Sustainable Development at the United Nations in New York. This council includes a worldwide association of towns and cities, communities, and rural districts, which has gone by ICLEI – Local Governments for Sustainability.

Although one focus of their work is climate change, CCESD is not mentioned in any of their publications (ICLEI, 2015; 2016). Within the context of ICLEI, the Aalborg Charter of European Cities & Towns Towards Sustainability was adopted in 1994 and signed by approximately 2,500 local and regional administrations in 39 countries (http://www.sustainablecities.eu). In the Basque Declaration (ICLEI, 2016), updating the network’s objectives refers explicitly to the SDGs and the Paris Climate Agreement. However, it is a surprising point of criticism that the issue of CCESD is not mentioned explicitly in any of the ten Local Agendas or the 15 pathways to sociocultural, socioeconomic, or technological transformation in the Basque Declaration. Another example of such an organisation is the group European Network of Cities, Towns, and Districts in Partnership with Indigenous Rainforest Peoples for the Benefit of the Global Climate (Climate Alliance), which was initiated in 1990 and has grown to about 1,700 member groups from 26 European countries.

Climate justice for the indigenous people in South America is a central aim. Neither of the two organisations explicitly declared local CCESD as one of their major targets, although the latest publication was the Climate Alliance Transforming Our World.

Local Authorities for Global Sustainable Development (Climate Alliance, 2016) includes the network's offerings on CCESD. These only refer to informal forms (international campaigns, expositions). Other international networks of municipalities also express the importance of the local level for different fields of action, such as the network of Transition Towns and Fair-Trade Towns. Hence, 4But education, or CCESD, does not play a significant part. This apparent deficit concerning education in all these networks underlines the necessity (Becker, 2016).

2015 the UN formulated sustainable development goals (SDGs) in its Agenda 2030. One example is SDG 11:

'Make cities and human settlements inclusive, safe, resilient, and sustainable.' This SDG and SDGs 4, 7, and 13 on climate change form an argumentative basis supporting local CCESD. In Sect. 3.2. the SDGs are related to the ESD learning objectives (UNESCO, 2017). 1.3 On climate policy, climate science, and climate education. All the conferences, resolutions and programme on sustainable development (SD) and climate change mentioned so far were met with a strong positive response in Germany.

The term climate change education (CCE) is already a subject of a UNESCO initiative (UNESCO, 2010) and is a widespread term in academic publications (Mochizuki & Bryan, 2015). Unfortunately, the field of education science has so far largely ignored the topic of climate change. However, education is one of the six dimensions of Sustainable Development. Firstly, there is a highest ethical goal that is repeatedly cited in the Brundtland Report (UN, 1987)27:

> *Humanity can make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.*

An integrated view should be taken as a basis for analysis and planning to achieve this goal. Generally, this will include ecological, economic, and social aspects, which must be

considered. This pattern is often called the Triangle of Sustainable Development and is presented graphically in many forms. Already in the Framework Convention on Climate Change of 1992 in Rio de Janeiro (UN, 1992b) and the Paris Agreement (UN, 2015b), as well as in the entire global climate debate over the past 25 years, these two additional dimensions have arguably played as great a role as the other three dimensions. In the meantime, further reasons for considering the cultural dimension of SD have been expressed in UN resolutions:

The Convention on Cultural Diversity (UNESCO, 2005) states in Art. 13 (Integration of Culture in Sustainable Development):

> *Parties shall endeavour to integrate culture in their development policies at all levels to create conditions conducive to sustainable development and, within this framework, foster aspects relating to the protection and promotion of the diversity of cultural expressions.*

Additionally, in Agenda 2030 or the SDGs (UN, 2015), (intercultural aspects are of great importance. Thus, cultural change is indispensable in most cultures to achieve the goals of climate conventions. Hence, many countries and communities are becoming increasingly 'multicultural' societies. The knowledge of the local people is being included in the school curriculum as observed from the policy proclamation of many nations.

2.15.2 Indigenous Knowledge and Sustainability

Every society has a history behind its knowledge resources, which guides its development process. IK is holistic and results from centuries of tight bonds with the environment to produce a deep understanding, not snapshots of the inter-relationships among the different elements of a habitat. The challenges faced by IK are that as time progresses and with contact with others' knowledge systems and a society's development, the value system is lost. These linkages and guidelines for social equity brought relationships with non-human beings, ecological responsibility, and respect for the super-nature. Moreover, environmental changes are best countered by diversified indigenous survival strategies and adaptive responses developed at intra and inter-household and community levels.

Another challenge IK faces is the change from extended to nuclear families, weakening links with the grandparent generation that holds much knowledge. The second filial generation is alienated from IKS due to the huge power of *modernity*.

Central African education planners have less esteem for this knowledge in school curricula, and the transition from oral to written culture is losing most of the knowledge. The lack of trust and unwillingness of many elderly herbalists to share their knowledge, agree to its transcription, or transcribe it themselves is also worrying. This can be understood because bio-prospectors have extracted the local knowledge in the area, commercialized it, or published it without any attribution or benefit sharing, leading to resistance by the custodians of the culture (indigenous healers and local communities).

The wearing down of IK threatens our existence, and embracing new cultures puts us at a crossroads as it becomes difficult to conserve what we do not know. As a result, the values of resource usefulness in the current generation are lower because of the loss of knowledge about the resource.

Conserving biodiversity without conserving associated knowledge systems is a short-term sustainability solution, as future generations will not benefit from centuries of experimentation and knowledge accumulation by indigenous peoples. Most advances in discovering new drugs from medicinal plants have resulted from Indigenous Knowledge. According to Melchias (2001), recombinant DNA research originated from indigenous people choosing and selecting seeds.

Tapping into the intellectual resources and increasing the economic value of IKS is a viable tool for sustainable development in the region. Hence, IKS continues to prove its viability and strength at economic sustainability, self-reliance, and cost-effectiveness. They are part of the second economy dominated by small-scale producers, manufacturers, and bankers and part of the most vibrant sectors of economies cur. In some cases, it contributes more than half of total economic growth. How far this has been done in schools or the role of schools in preserving IK has not been looked much into.

2.16 Indigenous Knowledge and Sustainable Development Goals

Education for Sustainable Development (ESD) is a type of education that intends to foster sustainability aptitudes in students. In recognition of education's crucial role in developing the competencies required for sustainable development, in 2002, the UN proclaimed the decade starting from 2005 as the United Nations Decade of Education for Sustainable Development. In 2012, UNESCO reiterated the significant role of education in sustainability by including education as one of the SDGs. However, the ESD discourse is criticized for being confined to Western education and ignoring IK. In many African countries, the major limitation of modern education is disregarding IK. Therefore, the Eurocentric approaches which dominate and overtake the IK education system fail to help prepare learners for the complex challenges of sustainability.

Hence, this study aims to explore the integration of IK into CCE in the Advanced Level Geography Curriculum. The study seeks to identify the types of IK into CCE, the strategies used to integrate IK into CCE, the challenges faced during the integration of IK into CCE, the support provided for the integration of IK into CC, with the overall aim of coming up with a workable framework.

In this study, the international initiatives concerning sustainable development goals, the role of education to facilitate sustainability, sustainability competencies, learning approaches, and IK vis-à-vis enhancing such competencies are investigated. The 17 SDGs adopted in 2015 were intended to deal with serious global challenges, including IK and CC. Sustainability competencies are integrated knowledge, skills, and attitudes that facilitate efforts to sustain relevant human and natural resources to enable current and future generations' social, environmental, and economic progress.

2.16.1 Learning approaches in Sustainable Development (SD)

ESD involves the use of learner-centered approaches. The learner centered approach make learners active knowledge producers instead of passive recipients. These active learning strategies frequently suggested for sustainability include problem-based learning, experiential learning, action-oriented learning, and “real-world experience and service-learning. IK and Sustainability Competencies is a comprehensive system of a particular society that encompasses its worldviews, practices, laws, holistic know-how, and guidelines regarding interrelationships within the society and the natural environment.

It includes the means of learning and perpetuating knowledge. This approach utilises native resources for sustainability' as one of the competencies required to facilitate efforts towards a more sustainable life. This competence entails capabilities to recognize and utilise the potential of IK for sustainability.

The practice and potential of indigenous ecological knowledge and natural resource management have been documented. The use of IK for wildfire management is another example of several potential applications of IK for sustainability. It also has the potential to help students learn the ways that socio-ecological systems are integrated into specific cultures.

The long-term knowledge of complex local ecosystems is a powerful tool for conserving biodiversity, often providing valuable deep-time information that is inaccessible in the shorter timeframes of western scientific research projects. The western higher education system is argued to be trended toward knowledge specialization, reductionist thinking, and the creation of disciplinary silos. Therefore, holistic thinking is recommended to deal with sustainability issues by integrating knowledge about natural and human systems. Hence, exploring and integrating alternative worldviews and ways of knowing is important to complement the dominant modern education. Agrawal (1995:158) notes that there are potentially as many ways of knowing as there are knowers. However, even in some attempts to integrate IK, it is usually considered inferior to mainstream knowledge. Despite the significance of IK for sustainable development, there is limited research on developing SCs utilizing IK.

2.17 Indigenous Knowledge and Climate Change

For many years, native people have been using IK to deal with the issue of CC. However, with the coming in of Western knowledge there has been a decline in the appetite to include IK to CC. Researchers like Saitabau (2014), recognise that climate information needed to forestall and manage the impacts connected to climate risks is obtainable from two main sources: meteorological predictions and IK. Given the fact that scientific projections are still not easily obtainable in Sub-Saharan Africa (SSA) farmers promptly (IPCC, 2007), Moonga and Chitambo (2010) argue that IK-based climate data can help farmers to manage their crops and livestock to lessen risk during undesirable seasons and maximise chances during favourable conditions. IPCC (2010) adds that there is

scope in SSA to substantially increase the use of IK- based climate information and services in planning to reduce the hazard of CC and achieve SD goals.

More effective practice of IK-based climate information and services by both vulnerable assemblages and organisations charged with managing the impacts of CC will enable the climate-sensitive sectors of SSA societies to cope better with the natural inconsistency of the climate system (Moonga & Chitambo, 2010).

The conception of IK-based climate information has turned out to be very topical. Academics and development practitioners are progressively embracing it as integral to addressing livelihood challenges faced by rural communities in developing countries and as a basis for locally driven adaptation strategies to address CC (Moonga & Chitambo, 2010; Saitabau, 2014). For example, in Botswana, recent studies have shown that resilience building for smallholder farmers is a process that starts with the ability to anticipate change and adjust farming practices accordingly. This is important as it creates the basis for sound food security, particularly in the context of climate variability and change (IPCC, 2007). One of the objectives of this research was to identify the type of IK integrated into the school curriculum. The discussion following is an exploration of the different IK that are found in the school curriculum at global level.

2. 18 Examples of Indigenous Knowledge-based Climate information

Various communities in the different parts of the world have diverse examples of IK related to CC. Before the advent of modern scientific methods, rural communities relied on some types of faunas, birds, insects, and floras to detect and react to changes in the atmospheric condition (Manyanhaire & Chitura, 2015). However, with modernization, these traditional methods of weather forecasting have increasingly been ignored (Risiro, 2019). The IIPFCC (2017) recognizes the need to strengthen local communities' knowledge, technologies, practices, and efforts in addressing and responding to CC. As a result, IK is attracting increasing attention from researchers and policy makers in several places across the globe to alleviate the effects of CC in different ways. It is this call for the use of IK in climate related challenges that becomes the major aim of this study through the use of education.

To begin with, IK has been integrated into government policies to help manage the varied microclimates in different regions of Australia (Australian Government Bureau of Meteorology, 2010). In the Northern Territory of Australia, Indigenous people's burning practices are being second hand to harness traditional fire management tactics to mitigate carbon dioxide emissions that would otherwise happen due to unrestrained late-season wildfires (Northern Territory Government, 2008). This involves burning negligible patches of land (mosaic burning) to allow for greater control of the fire font (Green, Billy, & Tapim, 2010). This indigenous practice can also contribute to Australia's greenhouse gas mitigation effort (Department of Climate Change (DoCC), 2008).

Among the Indigenous people of Australia, it is believed that when hawks (*Accipitridae*) assemble so close unruffled on a tree branch that latecomers are not able to land, then the drought has reached its lowest point (DoCC, 2008). Thus, it is belief also exemplified in the behaviour of the ibis *(Threskiornithinae),* when these birds congregate in large numbers in dry waterbeds or cleared flat ground and do their famous dance for hours on end (Australian Broadcasting Corporation, 2001). The use of IK to predict the weather is s also practiced in the Philippines, where subsistence farmers and fishermen rely on observing the behaviour of animals and insects to predict the coming of rains and bad weather (Galasgac & Balisacan, 2003).

In the Arctic, remote sensing and other scientific methods such as meteorology and modeling are being used with IK of Sanic and Nerdic reindeer herders to co-produce data series for improved decision-making, herd management, and adaptation strategies (Maynard, Yurchak, Sleptsov, Turi, & Mathieson, 2005).

A report by the Thomson Reuters Foundation (2012) showed that the traditional rain makers of Western Kenya rely on sacrosanct shrines with indigenous trees to predict the weather. This IK of forecasting weather is joined with that from the Kenyan Meteorological Department to produce more precise weather reports. Mhita (2006) observed that before modern procedures of weather projection, rural communities in Tanzania witnessed the behaviour of plants, animals, and birds for weather forecasting.

To foretell whether a season will have good rainfall or early rains, farmers in Tanzania use an amalgamation of local pointers, such as the flowering of peaches and plums and the presence of swarms of butterflies, frogs, ants, and grasshoppers. In Burkina Faso, apart from perceiving the behaviour of animals and plants, cultural and ritual professionals use visions, dreams, and divination to envisage weather (IPCC Fourth Assessment Report, 2007).

Coming to Zimbabwe, a study by Manyanhaire and Chitura (2015) in the country's Eastern highlands showed that most people believe that rainmaking ceremonies can bring rain if properly done. This study explained that rain marking ceremonies are done at sacred forests or under extraordinary trees, such as the Fig tree *(muonde) (Ficus carica)*, which is associated with water. It involves preparing beer, roasting meat, singing, and dancing. Soon after the function, if the Ancestral spirits are pleased, they will respond by delivering some rain to the community (Muguti & Maphosa, 2012).

Nevertheless, it was also noted that certain taboos must be discontinued for the Ancestors to give a positive answer. These include incest, abortion, homosexuality, and working on a *chisi day* (resting day). Other taboos that may anger the Ancestors and therefore cause drought and even drying of rivers are killing sacred animals such as *haya* (*cuckoo*) and frogs, baby dumping and washing dirty clothes in sacred pools (Manyanhaire & Chitura, 2015).

The swallow (*Hirundinidae*) and the white and black stock (*Ciconia nigra),* a Zimbabwean type of Kingfisher (*Alcedines*) are associated with heavy falls within days of their appearance because the sounds that they produce resemble the clattering of rain drops characteristic of a heavy downpour (Manyanhaire & Chitura, 2015). On hearing the kingfisher sounds, farmers start preparing their land to take advantage of the impending rains. In some parts of Zimbabwe, large numbers of ants emerging from their holes have traditionally been associated with an impending long wet spell (Muguti & Maphosa, 2012). It is further reported that rock rabbits and frogs squeak in unusual ways to announce the onset of the rainy season (Muzvidziwa, 2010).

Moreover, in Zimbabwe, different plant species are used to make weather predictions in a variety of ways (Muguti & Maposa, 2012). As reported by Mureverwa (2011) in the Manicaland Province of Zimbabwe, plants such as *msasa (Brachystegia spiciforms)* and *mnondo (Julbernardia globiflora),* announce the onset of the rainy season by changing their morphology and producing tender leaves. It is further reported that the abundance of fruits from trees such as *mazhanje* (*Uapaca kirkiana*) and *hacha* (*Parinari curatellifolia*) signals drought in the coming season (Mureverwa, 2011).

Local communities in Zimbabwe also use celestial bodies to predict weather patterns. Among the Shona tribe, when the sun is coated by mist, it indicates the rain season is about to commence (Muguti & Maposa, 2012). Again, in Zimbabwe, the new and full moon phases are perceived as linked to the movements of rain-bearing winds (Risiro, 2019). However, if there is a new moon in the sky but no rain, this is perceived as a signal for a prolonged dry season. This usually occurs between December and January, a period that has also been established by the meteorological office in Zimbabwe as characterized by mid-summer dry spells. Under such uncertain weather, farmers respond by growing drought-resistant crops such as millet and cassava (Manyanhaire & Chitura, 2015).

2.19 Benefits of integrating Indigenous Knowledge into Climate Change Education

The value of incorporating IK into formal education systems is advocated worldwide by scholars, national governments, and leading global educational and environmental organisations such as UNESCO and the IUCN (UNESCO, 2021).

The fourth assessment of the Intergovernmental Panel on Climate Change (2007) prompted an enhanced emphasis on CC adaptation, which goes along with improved attention on impacts and responses at the local, subnational, and national levels, and on the involvement of IK.

There are numerous benefits to be gained from the integration of IK into CCE. The first benefit is that the challenges of CC are responsible for an excellent chance for indigenous people and their knowledge to be successfully integrated into a societal discourse concerning CC and environmental stewardship (Risiro, 2019).

Furthermore, the integration of IK into CCE boosts relationships that link local communities straight to their environment and fluctuations that emerge within it, including CC (Ajani, 2013). It also enhances citizens' sense of stewardship for the environment, who become encouraged to actively participate in addressing CC issues (Hiwasaki, Luna, Syamsidik & Shaw, 2014).

Another benefit of integrating IK into CCE is that it nurtures and expands learners' identities, preparing them for living in both the indigenous and the scientific worlds (Risiro, 2019). Whereas IK on its own may lead to rigidity and conveying IK from one place to the other runs the danger of losing its gist, when it is integrated with Western Science, learners have the benefits of borrowing from the other knowledge systems and improve what the locality lacks (Mawere, 2015).

Another benefit of integrating IK into CCE is the generation of greater student interest and a more positive attitude toward learning (Mandikonza, 2019). In this regard, learners develop a positive mentality toward learning. This is because the learners have clear traditions of custodianship over knowledge (Koehnler, 2017). Moreover, generally as observed by the DoBE (2012) for South Africa, the inclusion of IK in the CCE curriculum is an effective strategy for creating a flexible curriculum. On its own, contemporary scientific knowledge is centralised and connected with the machinery of the state, whereas IK is dispersed and connected to rural life (Mafongoya & Ajayi, 2017). This attribute makes the integration of IK into CCE beneficial to all groups of people.

Another benefit is that the integration provides a vital foundation for community-based CC adaptation strategies (Theodory, 2014; Hiwasaki, Luna, Syamsidik & Shaw, 2014), thus helping to link the outside community with the school (UNESCO, 2019). Through their IK, learners and local communities can interpret and respond to the impacts of CC in ingenious ways.

Mixing Indigenous Knowledge and new technologies to deal with Climate Change impacts may help communities effectively respond to forthcoming CC (Dhal, 2019). When IK is integrated into CCE, the approach provides the vital underpinning for community-based adaption that withstands the resilience of social- ecological systems at various scales

ranging from local, regional, and universal levels (Raygorodetsky, 2011). In this light, many local populations acknowledge that climate and environmental modification are not new phenomena. Thus, past knowledge that has not been contained in science could be an asset in mitigating their impact.

Another benefit of integrating IK into CCE discourse is that it can broaden the conversation about ESD to embrace the cultural and spiritual mechanisms of knowledge and social aspects (Risiro, 2019). As UNCEF (2020) pointed out, IK is specific to a place, having progressed in response to local conditions. Yet, it is varied in content, with concepts that may combine agro ecology with social relations of production (Faihead, 1991). In supporting the integration of IK and western science, the Ministry of Primary and Secondary Education in Zimbabwe claims that it fosters cultural survival, environmental responsibility, and SD (Dziva, Mpofu, & Kusure, 2010). Likewise, IK has been sustainably used in perceiving the environment for a long time and produced a vast body of knowledge pertinent to responding to different CC scenarios (UNCEF, 2020).

Moreover, the Government of Kenya (2005) showed that the integration of IK in education helped answer the needs of the native people. This supports the idea of a growing number of scholars since the 1970s on how IK and traditions could contribute to more culturally suitable ESD (IPCC,2019). Current debates in education, including CCE, now include how IK can be effectively integrated to improve teaching and learning (O'Donoghue, Shava, & Ngcoza, 2016). However, the importance of IK in enhancing education quality and relevance has been neglected (UNESCO, 2021).

The integration of IK into the school curricula nurtures and expands learners' identities, preparing them for living in both the indigenous and the scientific worlds (Mawere, 2015). Risiro (2019) also noted that IK integration into the school curricula gives a sense of stewardship to the environment for the indigenous people who become encouraged to actively participate in addressing CC issues as a result (Hiwasaki, Luna, Syamsidik & Shaw, 2014). Research by Kugara et al (2022) reports that the integration of IK into CCE enhances greater student interest and a more positive attitude towards learning.

Integrating IK into CCE provides a vital foundation for community-based CC adaptation strategies (Theodory, 2014; Hiwasaki, Luna, Syamsidik & Shaw, 2014), thus helping to link the outside community with the school (UNEP, 2019). Despite the widely acknowledged benefits of integrating IK into school curricula, research into how far this is being implemented is limited (Lotz-Sisitka & Urquhart, 2014). IK integration into is much needed based on the various benefits presented. However, how the integration has been implemented needs to be explored.

2.20 Status of Indigenous Knowledge into Climate Change Education in schools

According to Sheya (2014), incorporating IK into formal school curricula, particularly (EE) / CCE, is an important approach to making education relevant to learners. This will also encourage the intellectual diversity required to manage the scope, complexity, and uncertainty of local and global environmental concerns, including CC (Hana & Olvia, 2016). Numerous countries across the globe have put in place various initiatives to support and implement the integration of IK into CCE in schools. This section provides an overview of these initiatives in a sample of countries across the globe.

Global perspective

As study by Marom (2019) submitted that the Canadian government called for the decolonization process of the school curricula. Thus in 1997 the government of Canada endorsed a collective Framework for Science Learning Outcomes, which called for a sustainable environment, and a link between Science Education and the broader humanistic context (Aikenhead, 2006). The government deemphasised the overreliance on the western curricula. There has been massive curriculum reform, with the Canadian Constitutional Act of 1982, Section 35 highlighting the role of IK and heritage in refining education (The Association of Canada Education, 2010).

The government in Canada called for culturally appropriate curricula that was rooted in the locals (Marom, 2019). As a result of this call, many institutions responded by incorporating IK into the school curricula. For example, the Canadian Teachers Federation recognises the inherent right of indigenous people to self-government and their rights to define the goals of education for their children.

The truth and reconciliation commission of Canada also recommended that IK be integrated at all levels of education (Keliipio et al, 2018). Hence research done in Canada by Marom (2019) puts it that the integration of IK into the school curricula, has become popular in Canada.

The Federal government allows each province to deliberate and implement the education deemed appropriate to their region. This brings diversity in education and approach to CCE in this country. For example, in the province of Nunavut, where most of the population is Inui, IK is integrated into EE as part of a socio-cultural and humanist approach to education (Government of Nunavut, 1999). This approach calls for a vigorous interconnection of mind, body, spirit, and the environment (Government of Nunavut, 1999). Integrating IK in CCE is treated as a cross-curricula issue, and the people of Nunavut have developed their own policy to reflect the essence of ESD in which IK and CCE issues are integrated (Government of Nunavut, 1999).

The integration of IK into the school curricula in Canada is being implemented based on the following strategies: there has been the promulgation and provision of the policy by the government for example in Saskatchewan (Government of Saskatchewan, 2018). There has been also the use of indigenous elders in the teaching of IK in the school curricula. These elders are the bearers of IK needed in schools (Keliipio, 2018). Apart from these strategies, the government of Canada has also been supporting the integration of IK into the school curricula by providing with teaching resources. As an example, the use of online tools for the Aboriginal perspectives for teachers (Marom, 2019).

According to Nazil, Pedretti, Wallace, Montemurro, and Inwood (2009), in Canada, the major challenges faced in the addition of IK into EE and the curriculum, in general, is that there is little post-secondary education that roots the curriculum in local cultures and content. There is a need to develop a curriculum that involves both western and IK environmental issues (Mawere, 2015).

Most of the teachers in Canada are Western trained and are better aligned with the western curricula (Maron, 2018). It is also noted that there is a need for teacher training workshops to enhance the integration of IK into CCE and the establishment of provincial

ESD Working Groups and guidelines for benchmarking and tracking sustainability literacy in school curricula (Maron, 2019). Most teachers also lack confidence when presenting IK in the curricula (Korteweg & Fiddler, 2018). A study by Swayze (2008) in schools in the Manitoba District of Canada uncovered one major challenge with the integration of IK into the curricula as the substantial gap between the provincial sustainability frameworks and constituency or school policies. The study specified the imperfect responsiveness of provincial policy around IK and EE at the school level (Korteweg & Fiddler, 2018).

In South Africa

In South Africa, the status of IK integration into CCE is related to the history of EE in this country. When apartheid came to an end in 1994, South African Education embraced the Tbilisi Declaration on EE (Le Grange, 2010), the NGO principles, and the Earth Summit resolutions, which acted as the basis for the integration of IK and EE into schools' curricula (O'Donoghue & Neluvhalani, 2002). The South Africa Education policy labelled EE as a "vital element" for all educational stages and programmes to create "environmentally literate and active citizens" (DOE, 1995:18). This policy was derived from the NGO Principles (1992), which also advocated for the inclusion of IK in formal education including CCE. Moreover, Jansen and Christie (1999) pointed out that the new South African science curriculum called on all science teachers to integrate school science with IK. The inclusion of IK into the science curriculum was a challenge to all science teachers because the present teaching and learning materials included none or very few topics from IK.

The challenge of assimilating IK in school curricula has been brought up in the National Curriculum Statement policy documents (DBE, 2011), which mandate that elements of IK and EE (including CCE) should be integrated into all learning areas and subjects. Since then, deep eagerness and deliberate intentions have existed to incorporate and integrate IK into South Africa's education systems (Odora-Hoppers, 2002). Although CCE is not a stand-alone discipline, it is found within EE, which provides a vehicle to incorporate IK into the school curriculum (O'Donoghue, Masuku & Janse van Rensburg & Ward, 1999). Thus, CCE progressed into the formal school curriculum, not as a subject but rather as a theme to be infused across all subjects, and it is the responsibility of every teacher (DOE, 2003).

However, research findings have shown that contemporary EE / CCE processes in many of South Africa's schools are decontextualised, leading to learners being exposed mainly to the scientific worldview of the school curriculum (Shava, 2005). It is further observed that the addition of IK in education is mainly found in the Sciences (Van Damme & Neluvhalani, 2004; Asafo-Adjei, 2004). O'Donoghue and Neluvhalani (2002: 123) noted that whereas in the last few years, there has been an explosion of interest in IK among environmental educators within Southern Africa, "not much that is tangible has materialized, and as yet, little has been translated into curriculum perspectives and learning support material."

In Namibia

In Namibia, during the colonial period, IK was dismissed as "primitive, unsophisticated, and inferior" (Kuokkanen, 2000: 411). According to Smith (2005), approaches to EE, including CCE, have expanded over the past two decades. From the 1990s, many EE and CCE policies were derived from the international developments that led Namibia to add EE to the formal education curriculum. CCE is taught in EE as a cross-curricular theme that becomes part of most school subjects, such as Geography and the Sciences (MoE, 2010). The Namibia school curriculum necessitates learners and teachers to "develop and enhance respect for, understanding of, and tolerance of other people's beliefs, cultures and ways of life" (MoE, 2010). Conversely, an investigation by Mosimane (1998) revealed that in the Eastern Caprivi region of Namibia, IK was still excluded from the local curriculum at the classroom level.

In Zimbabwe

The integration of IK in CCE in Zimbabwe is tracked back to the 1992 Earth Summit in Rio de Janeiro when Zimbabwe became a signatory to the Rio Declaration, which concentrated on the requisite to ensure quality ESD in every nation of the world.

Additionally, the Presidential Commission of Enquiry into Education and Training of 1999 notes that one of the educational objectives in Zimbabwe should be to stimulate local cultural values and norms (Nziramasanga, 1999).

In addition, in 2000, Zimbabwe set up Environmental Education Consultative Forum (ZWEECF), which recognised and legitimised the existing EE activities equally in the formal and non-formal sectors. This would cater to children's right to education and to a system that respects their culture, language, and community and entrée to schooling and participation without discrimination or interference (UNICEF, 2020).

Zimbabwe is also a member of several worldwide agreements supporting the integration of IK into EE and CCE (Risiro, 2019). Zimbabwe has adopted the cross-curricular thematic approach in the country's EE programmes (Peschar, 2000; Reid and Scott, 2002) as it allows the integration of IK plausible. Risiro (2019) further points out that in Zimbabwean primary schools, the integration of IK into CCE has followed the interdisciplinary and multidisciplinary approach. However, it is mainly found in the subject of Geography.

While the Zimbabwe Government appears to appreciate the necessity for learning to be culturally appropriate, it is silent on how this should be implemented (Gopal, 2006). One of the major challenges for schooling in Zimbabwe is the need to scheme a holistic education steered by the indigenous philosophy of *unhu* (respect) (Makuwaza, 1996) that stimulates cultural values (Chombo, 2000) in CCE. In developing countries such as Zimbabwe, the execution of EE is at the transition Stage (Jones, Selby & Sterling, 2010), and many developing nations still hinge on the education systems that were structured by the colonial governments (Zvobgo, 2004). Chombo (2000) recommended that education in Zimbabwe should move from distant cultures' predominant and pervasive influence and integrate local knowledge into CC issues. In this regard, in Zimbabwe, while IK and EE/ CCE ingenuities are on the ground, these have been clumsy due to a shortage of an overall national IK in the EE policy process. Shava (2003) notes that it is worth bearing in mind the involvement of various stakeholders in the formulation and implementation of these processes.

Status of Environmental Education / Climate Change Education the globe

The implementation of Environmental education in both developed and developing nations has been long overdue.

Environmental education has been seen to be the most effective strategy through which the character of human interaction with the environment can be transformed. However, implementation of the programme in both advanced economies and Third World countries has not been without challenges. Environmental education originates from the human manipulation of nature that has led to habitat degradation, reduction in composition, soil erosion, siltation, and pollution. The chief human problem has been a failure to perform activities within the carrying capacity of natural support systems and a low commitment to environmental protection (Rischard, 2001). Humanity can exercise sustainable utilization of resources.

The origin of Environmental education as a discipline is related to key events that raised awareness of the need for the protection of nature. The implementation of the programme in schools is governed by an internationally agreed set of guidelines which has encouraged educationists to consider Environmental education to be a lifelong process beginning from the preschool level and continuing through all formal and non-formal education structures. It must draw experiences from indigenous history and local culture (Ronoh, 2017). In education, various curriculum development paradigms are at the disposal of environmental educationists. In this study, the curriculum has been a factor influencing the implementation of the environmental education programme.

One option is the interdisciplinary approach in which the environmental education programme acts as a single discipline and can be subjected to independent assessment and evaluation. One can relate it to the integrated curriculum action paradigm (Bialach & Dunphy, 2005). Only a few countries have affected Environmental Education this way. On the other hand, the multi-disciplinary approach fuses components of Environment Education with other disciplines. This approach falls under the green curriculum paradigm. It has been observed that the interdisciplinary approach can be easily implemented and uses fewer teachers but demands higher budget allocations (Barton & Smith, 2000). It may be regarded as ideal for the secondary school situation. In the interdisciplinary model, the subject is managed like other subjects.

The set- up is common in the education systems of Third World countries. School authorities appoint a coordinator to manage the education programme. His or her task is to manage the effectuation of the programme and monitor the progress being made (Busher & Wise, 2011).

Apart from these roles, they direct the department's main activities and prepare and chair departmental meetings. Regular meetings provide platforms for discussions and prepare educators to face didactic challenges confidently and competently (Anderson, 2002). On the other hand, concerning the multi-disciplinary approach, curriculum reorganisation is in the hands of the teacher. As a subject specialist in Mathematics, Physics, Chemistry, Mathematics, Geography, or any other subject, the officer handles the social, political, and cultural dimensions of Environmental education.

The school authorities must ensure appropriate staff development of officers to empower them so that they can implement the programme (Joyce & Showers, 2002). In implementing environmental education in schools, the educator is a key factor. The teacher is believed to have the knowledge and skills to transform the learner into an informed and active participant in fruitful production in his or her community and society (Price, 2004). The didactic situation permits him or her to determine on behalf of the learner the quality and quantity of learning in addition to material and when and how the didactic activities are executed (Kemp, 2002). The educator has the autonomy to determine objectives, content, activities, and apparatus in teaching and learning. They are known to possess a command of the theoretical subject content, an understanding of child behaviour, and a repertoire of teaching skills and techniques that best enable them to handle the didactic situation (Woolfolk Hoy, Demerath, & Pape, 2002).

A competent teacher carefully monitors the lesson as it progresses and examines the teaching-learning sessions' results (Price, 2004). In Environmental Education, the importance of the availability of relevant literature cannot be over- emphasised. In Third World countries, a common feature is a shortage of material resources needed to facilitate learning. Financial constraints have always forced school authorities to acquire quantities far below what is required.

The teaching-learning programme considers education about the environment, education for the environment, and education through the environment (Udry, 2003). Without sufficient relevant literature, effective implementation of the Environmental Education programme is difficult to achieve. Didactic strategies employed by educators are also a key factor in the teaching-learning of environmental education. Several theories have been put forward, and educationists strongly recommend the transmission teaching model. The transition model suggests that the educator used to show and tell, solitaire, and communicate with learners using various teaching media (Milner & Woolfolk Hoy, 2003).

This approach has been of limited use in Environmental education due to its consideration of learners as passive participants in learning. Environmental educationists favour constructionism which is more learner centered. The theory considers pupils as active participants in learning. It regards them to have potential since they bring their own experiences and understanding into the didactic process. This model brings the learner into touch with environmental phenomena. Behaviourists stress on the teachers' role in changing the learners' behaviour and its advocates include Thorndike, Bruner, Skinner and Pavlov to mention a few. Behaviourism, however, draws some criticism because it ignores the learners' ideas, meanings, and experiences in the teaching–learning process (Woolfolk, 2011). Co-curricular activities are also regarded as a significant influence in environmental education. The learner gets the opportunity to participate in programmes outside of intellectual work, allowing him or her to attain an inner-consuming experience (Holloway, 2002). The school can organise environmentally oriented clubs, and student participation in the activities sensitizes them on the value of wise utilization of the environment. Work on environmentally oriented projects also strongly influences learners' development of attitudes, skills, and knowledge on the importance of environmental quality.

The physical outlook and maintenance of school infrastructure and surroundings also promote environmental awareness among learners. In other words, the appearance of institutions reveals the environmental consciousness of planners and cultivates a sense of environmental consciousness among observers (Tuncer, Ertepinar, Tekkaya & Sungur, 2005).

A well-established and maintained system of lawns, shrubs, and flowers instil in learners a deep appreciation of the beauty of nature. Piaget, a leading educational psychologist, stresses that a highly stimulating environment has a solid pedagogical impact on the child's learning. Some learners understand better through their own personal experiences (IK) outside formal learning programme (Tuckman, 2004). In this view, there is a need to identify the types of such knowledge in the school curriculum.

2.21 Types of Indigenous Knowledge in the School Curriculum

Although studies on integrating IK into various school subjects are common in literature, those focusing on the specific types of IK integrated into CCE are relatively hard to come by. One example of such a study was done in the Philippines among the Timor-Leste community. According to (UNESCO, 2015), during CCE lessons, schools in this community use observations of the sun, moon, and even clouds to predict storms, floods, and drought. Tanyanyiwa (2019) in his study in Zimbabwean secondary schools recommended the use of observation of the celestial bodies, the sky, sees, and the wind when teaching CCE and related natural phenomena in Geography.

Another similar study by Abar, Mashebe, and Denuga (2015) recommended that IK types, such as the traditional beliefs on the position of the sun, could be integrated into the teaching of Sciences in Africa. Another example was in Uganda where Kagoda (2009) observed the integration of IK in Geography lessons, through observation of the moon, its appearance, and disappearance were assimilated into lessons for weather forecasting. This knowledge helped in making Geography lessons more relevant to the needs of the local population. In South Africa and Kenya, traditional beliefs in Astronomy as a type of IK that could be integrated into the school curriculum were recorded by Ronoh (2017).

Subsequently, observing vegetation conditions is common in many African communities, including Zimbabwe. Thus, the observation of vegetation condition is another IK type that was found to be integrated into CCE in Zimbabwe. For example, a study by Tanyanyiwa (2019) in Zimbabwe showed that the observation of vegetation knowledge was integrated into Geography on the teaching of CC in Secondary schools.

In his study, Tanyanyiwa argued that Geography is rooted in the environment, and, from the environment, observation skills are learned, especially observations of vegetation. Kugara, Kugedera, Sakudzo, Chivhenga, and Museva (2022) also noted the integration of observation of plants and the production of fruits in CCE in Zimbabwe.

They argued that the knowledge could be used to teach Disaster management and Agriculture Geography. Abar, Mashebe, and Denuga (2015) recommended Science teaching in Africa and highlighted that schools tap information from Biodiversity and Resources Management through a close watch of their vegetation.

2.21.1 Observation of animal behaviour

Animals exhibit knowledge of their surrounding through their behaviour. Abah, Mashebe, and Denuga (2015) observed that in Africa, the integration of IK into the teaching of sciences is recommended as using the knowledge about the observation of animal behaviour helps move learners from abstraction to application. Kugara, Kugedera, Sakudzo, Chivhenga, and Museva (2022) also noted the integration of the observation of animals (libido of donkeys in Tanzanian communities) signifies an above-normal rain season. In Zimbabwe, Tanyanyiwa (2019), in his study on the integration of IK Geography in Zimbabwe Secondary schools, also recommended using the knowledge of observation of animal behaviours in relation to CCE.

2.21.2 Knowledge about insects

Kugara, Kugedera, Sakudzo, Chivhenga, and Museva (2022) saw the integration of observation of insects like black and brown ants, the appearance of black butterflies being some IK that could be used in schools in Weather studies, Agriculture and Climatology. Abar, Mashebe, and Denuga (2015) described how‑traditional knowledge about moths and weather prediction‑can be integrated into the school curriculum. In a study that was conducted in Namibia by Sheya (2014), it was noted that termites' behaviour as a predictor of rainfall was integrated into the EE curriculum of selected schools.

Table 2.3 showing the types of IK that are found in school (adapted from Makwara, 2013: 2(1), 98–141).

Feature	Observation	Implication
Birds	Some birds build their nests in the dry season near the river	If this happens, birds will anticipate low rainfall and therefore are confident that rains will not sweep away their nests; but when they build their nests high up, farmers know that rains will be above normal that season.
	Large numbers of white and black stock appeared in October and November.	Indicates imminent onset of the rain season and is above normal, and a lot of insects as bird food will be anticipated.
Insects	Black and brown ants collecting food in large numbers	Impending rains and long wet spell
	Bring out the dead and damp food after a dry spell	Short dry weather, after which the rains will resume
	The appearance of black butterflies in some areas.	A very good rain season over that area
Wild fruits	Significant flowering of Water berry	If fruits are seen from July to October, then there are good rains in the coming season

	Fig trees flowering and having new leaves	Imminent rainfall season
	Kagelia giving a lot of sap during the dry season	Signifies abundant rains in the coming season
	Bean pod tree (Brachystegia speciformis: many flowers from July to October	A signal of good rains in the coming season
	Sousage tree shooting	Onset of the rain season
	Muchakata and Mashuku (Uapaca kirkiana and Wild loquat) have significant flowering and good fruit bearing	It is generally agreed that it is a good indicator of inevitable drought in the area

The types of IK that are found in school adopted from Makwara (2013: 2(1), 98–141).

2.21.3 Nature conservation practices

Nature conservation practices are found to be integrated into CCE. Three forms of explicit IK types are involved: totems, taboos, and sacred places. In Namibia, for example, a study by Sheya (2014) on the integration of IK in EE revealed the use of taboos in biodiversity conservation during EE lessons. Similarly, in South Africa, a study by Nnadozie (2009) described the use of taboos among the Zulu as part of integrating IK in the teaching of grade 10 life sciences. However, the knowledge of totems as a type of IK in integrating IK into CCE is scanty. In Zimbabwe, the use of totems in Geography and CCE is being done, although rarely so, noted Kugara, Kugedera, Sakudzo, Chivhenga, and Museva (2022). In their study, Kugara, Kugedera, Sakudzo, Chivhenga, and Museva (2022) post that if the knowledge about totems is used in schools, learners become active and eventually own the knowledge.

2.21.4 Traditional farming practices

A study on the prospects of integrating Africa IKS into the teaching of Sciences in Africa by Abar, Mashebe, and Denuga (2015) identified the use of mixed farming and mixed cropping in most African curricula on Agricultural sciences. While in another study by Sheya (2014) in Namibia on IK in EE, it was noted that mixed farming (keeping cattle, goats, and chickens alongside crop production), shifting cultivation, mixed cropping, intercropping, and transhumance was integrated. Correspondingly, Theodory's (2014) results in Tanzania identified storage systems and mixed cropping as being integrated into the teaching of CCE in schools. In South Africa, in teaching biodiversity and natural resource in Life Sciences education, conservation of maize and mixed farming was being integrated (Nnadozie, 2009). The use of traditional farming practices in the teaching of Agriculture Geography in schools allowed learners to use their prior knowledge of concepts and assist them in applying it in real-life situations (Abar, Mashebe, & Denuga, 2015) and made them link with their immediate environment (Rono, 2017). Another set of types of IK found to be integrated into IK into CCE is traditional farming practices such as mixed farming, conservation farming, and bush following. In Zimbabwe, these traditional farming practices were being integrated into Agriculture Geography and Biogeography (Kugara, Kugedera, Sakudzo, Chivhenga and Museva, 2022)

2.21.5 Use of folk stories

Several researchers have investigated the integration of folk stories in different science subjects across school curricula. Ronoh (2017) on IK in the school curriculum observed that communities in South Africa and Kenya advocated for integrating folk stories into the school curriculum. They argued that, in science subjects, stories would make learning interesting and have a better understanding of topics like Algebra in Mathematics (Ronnoh, 2017).

Similarly, Naido (2021) identified folk stories as a type of IK that can be used to enhance learners' understanding of Mathematics in South Africa. Another study done in South Africa by Seehawer (2018) recommended using folk stories to help learners understand Grade 10 Life sciences content.

Lastly, Sheya (2014) observed that since the practice of telling stories around the fireplace is fading away, folk stories need now to be added to the school curriculum to enhance teaching and learning in classrooms. With this evidence awash in many studies, how far is the Geography Curriculum in Zimbabwe embracing the use of folk stories in areas like CCE.

2.21.6 Use of artifacts

Many African traditional communities have artifacts they value as part of their IK. These artefacts have found their way into the school system. However, this study did not reveal the use of artefacts as part of IK integrated in CCE in the Geography Curriculum. Working in South Africa, Naido (2021) identified artefacts such as beadwork, weaving, decoration and construction as type of IK that can be used to enhance relevance in the school curriculum. Tsindoli, Ongeti and Chang'ach (2018) reported that the use of traditional artefacts was common in the teaching of Mathematics in Kenya's primary schools. Such artefacts like beadwork were found useful in teaching learners on shapes, measurement, angles and estimation (Tsindoli, Ongeti & Chang'ach, 2018). Artefacts make teaching and learning more realistic, relevant and concrete.

There are several artefacts in Zimbabwe that can enhance learning like clay pots, beads, sculptures, weaving and decoration. These artefacts can play a role in the various topics in IK into CCE.

2.21.7 Use of traditional games

Games have been in use in African communities for many years. For example, a study by Ronoh (2017) in Kenya and South Africa showed the use of games in teaching and learning in schools. While in a study by Ronoh, there was no mention or specification of the types of games that are included in classroom interaction, the use of games was clear as a type of IK into classroom. In Uganda, Kagoda (2009) also recommended that the integration of IK into Geography should include native games. The use of games in the integration of IK in Mathematics was also noted by Tsindoli, Ongeti and Chang'ach (2018) and further argued that when these games are used, learners become accustomed to the use of rules applicable then in research.

Similar study was carried out in Kenya on the teaching of Mathematics and observed the use of games as class activities and that made learning learner centered (Naido, 2021). In Zimbabwe, there are many games that the local people have, the researcher wonder how these are being integrated in the teaching and learning of CCE in schools.

2.21.8 Use of traditional calendar

Another type of IK that is commonly integrated into school curricula is the traditional calendar. Indigenous people have knowledge about the seasons which they use to navigate their lives. Sheya (2014) investigated the integration the traditional calendar into EE in Namibia's two selected rural schools. EE knowledge was found to be relevant and was made concrete using traditional calendar. Learners could then apply the knowledge they got from the names of the months to the western calendar and seasons (Sheya 2014). Traditional calendars are very important to the native people of Zimbabwe (Tanyanyiwa 2019). Tanyanyiwa (2019) recommended the inclusion of traditional calendar knowledge in the teaching of CC in Zimbabwean Secondary Schools especially in topics like Agriculture, and Climatology. The use of traditional calendar makes learners build on the knowledge from the known to the new concepts.

Table 2.4 showing the calendar of the year and how they relate to CC in Zimbabwe.

Name of the Month (English and Shona)	Events as they relate to climate change.
January (Ndira)	January (Ndira) Summer in Shona, Ndira is a black beetle which is common in this month. This is the middle of the rain season and the first month of the year.
February (Kukadzi)	February (Kukadzi) Second month of the year, women were known for their preference for meat. A woman is known as mukadzi in Shona. The sky is usually overcast with lots of rain.

March (Kurume)	March (Kurume) Autumn (Masutso) Food reserves would have dwindled and so men would go and look for fruits in the forests.
April (Bandwe/ Kubvumbi)	April (Bandwe/Kubvumbi) Kubvumbi means soft rain showers which arrive during this month.
May (Chivabvu)	May (Chivabvu) Winter (Chando) Named after the last green maize, Chivabvu, before summer season ends
June (Chikumi)	June (Chikumi) Sixth month of the year, very cold and does not support many activities. Most of the harvesting of crops is done during this month.
July (Chikunguru)	July (Chikunguru) Named after the nhunguru (Flacourtia indica) wild fruit, whose redness, which blends in with the colors of musasa (Brachystegia spiciformis) and munhondo trees (Julbennadia globiflora), underscore this dominant color in the month of July.
August (Nyamavhuvhu)	August (Nyamavhuvhu) Spring (Chirimo) The windiest month of the year just before the first rains “the windy one.” Vhuvhu in Shona means windy, i.e., August is windy and cold. Stored grain goes through winnowing because of the windy
September (Gunyana)	weather September (Gunyana) September is a slow month. It appears long after the harvest season and a month or two shy of the first rains. This is a period of relaxation as people rest a bit in preparation for the rainy season

October (Gumiguru)	October (Gumiguru) The tenth month, from gumi (10). A very hot month and is characterized by some water points drying up.
November (Mbudzi)	November (Mbudzi) Summer (Zhizha) November is rainy month that is critical for the regeneration of flora and fauna (people). To enhance the sacredness of this month, marriages are not allowed during this month. Women are regarded with the sanctity of nature because they possess power of regeneration, i.e., they are responsible for childbearing.
December (Zvita)	December (Zvita) This is the thanks-giving month to the ancestors. Activities, socially forbidden in November, can now be executed. These include marriages, memorial services, and ceremonies to welcome back spirits are held in a festive atmosphere Source.

Calendar of the year and CC in Zimbabwe. (Adapted from Tanyanyiwa, 2019:7).

2.21.9 Use of native language

Every group of people have a language as their identity. In Canada for example, the government declared a policy on the use of the native language to enhance the integration of IK into the school curriculum (Maron, 2019). In Namibia, the Ministry of Education pronounced a policy that directs the inclusion of the mother tongue instruction up to grade seven (Namibian Sun, 2014). The use of native language in teaching improves retention and comprehension of scientific concepts (Abar, Mashebe & Denuga, 2015). Ronoh (2017) noted that the Xosa of South Africa regarded the use of their language as important in the teaching of Mathematics.

The use of native language serves the needs of learners effectively and made concepts easily understandable (Ronoh, 2017). The Ministry of Primary and Secondary Education recommends the use of native language as medium of instruction in the early grades of primary schools (MoPSE, 2015).

2.21.10 Use of health sciences

Another type of IK that is found to be common in many curricula is the use of health sciences. The indigenous people rely on plants and animal medicine to meet their health care needs (Abar, Mashebe & Denuga, 2015). The knowledge of health sciences has been observed being in use in the school curricula in Ghana, and Nageria (Abar, Mashebe & Denuga, 2015). Schools in both Kenya and South Africa have also been observed integrating indigenous health sciences in the science curricula in schools (Ronoh, 2017). The knowledge of the indigenous health sciences in school, helps improve Science and Mathematics (Ronoh, 2017). Zimbabwe has many traditional medicines that can be used to improve the teaching of CCE in Geography curriculum. Topics like Population and Diseases, Agriculture, Environmental Management, and Biogeography become more relevant and understandable should the implementers adopt to local knowledge. Furthermore, diseases like COVID-19 skin cancer, malaria, can then be locally managed and preventable. This research aimed at investigating the types of IK that are being integrated into CCE in the geography curriculum in Zimbabwe

2.22 Pedagogical strategies used by teachers to integrate Indigenous Knowledge into Climate Change Education

One of the objectives of the study was to look at the strategies used by teachers to integrate IK into CCE. These strategies are the tactics that are used in the implementation of a desired programme (Business Dictionary, 2017). Such strategies involve the structure, system, methods, techniques, processes and procedures that a teacher employs during instruction (Meador, 2018). They embrace all approaches that a teacher may take to dynamically engage students in the learning process (Meador, 2018). Therefore, strategies have to do with the 'how' part of the curriculum as opposed to the 'what.' When teachers are implementing the curriculum in schools, they use various strategies to deliver the desired content in the classroom.

Curriculum application encompasses a transition period in which teachers (in the perspective of the school) become increasingly “skilful, consistent and committed” in their use of an invention (Klein & Sorra, 1996). Strategies that are used by teachers are key to effective implementation of any curriculum innovation. The integration of IK into CCE is a relatively new curriculum innovation in Zimbabwe, and there is a need to critically examine the strategies used by Advanced Level Geography teacher to integrate IK into CCE.

Teachers across the globe have used different strategies in this regard. For example, in the UK, before 2009, there was a robust prominence on ESD and empowering youth in the UK. According to UNESCO (2015), from 2009, the attention has shifted away from ESD towards CCE and unambiguously towards obtaining the necessary skills to transition to a low carbon economy. This is seen in the UK government’s *Low Carbon Transition Plan.* Consequently, the departments responsible for education and skills, as well as for energy and CC, are now working together to develop strategies on skills development for SD (UNESCO, 2015). The focus on ESD as a strategy is viewed as encompassing IK and CCE. However, there is no direct reference to IK in CCE in this country. In their study of a suitable CCE framework for the native people of Minnesota in the USA, Kern, Roehrig, Bhattacharya, Wang, Finley, Reynolds and Nam (2015) suggested place--based, inter-disciplinary and inquiry-based approaches as best strategies for CCE among local people. In this view, a place-based approach is regarded as including the use of IK.

In Canada, several strategies are being used to integrate IK into the school curricula. For example, schools engage the local elders in the teaching of IK in the school curricula. These elders are the bearers of IK needed in schools (Keliipio, 2018). IK is also being integrated as a cross-cutting theme across the curriculum.

China is another country that has a strong CCE policy. UNESCO (2015) posts that in China, CCE is most frequently implemented as a constituent of ESD. Several educational approaches have been approved to facilitate the implementation of ESD in this country.

These include integrating ESD principles into school philosophy, curriculum growth, capacity-building of teachers and educators, ESD pedagogical methodologies and ESD and CCE thematic activities (UNESCO, 2015). However, little information available on the strategies used by teachers in the integration of IK in CCE in this country.

According to the United Nation Inter-Agency support Group (IASG) (2013) and UNESCO (2021), the formulation of policies, the inclusion of paramount practices on ensuring participation and engagement of indigenous knowledge-holders are essential strategies in the integration of IK into CCE. In his study on curriculum implementation in Zimbabwe, Makaye (2014) suggests that staff development activities including activities like syllabi interpretation, teaching methods and the production of teaching and learning materials at school level could serve as good strategies in the integration of IK in CCE. Another recommended strategy in the integration of IK into CCE is the inclusion of grey literature in other languages (IPCC, 2019) so that IK information on CCE is accessible to many. In addition, it has also been suggested that educational material should be translated into native and indigenous languages, even though the difficulty of choosing the correct translation of technical positions in these languages remains (UNESCO, 2009).

UNICEF has also brought in the concept of 'Child friendly schools' as another strategy in the integration of IK into CCE in schools, but little has been done on the ground to implement this (UNESCO, 2012). The essence of a child friendly school is to create an environment conducive for the learning including the inclusion of IK from within the immediate community. In Zimbabwe, little is known about strategies used by teachers in the integration of IK into CCE. An example of such a study was conducted by Risiro, Tshuma and Basikiti (2013) who investigated the use of taboos, taboos and sacred places as a strategy for implementing EE in communities in Zaka, Zimbabwe. This study reported that people in this community had much reverence for their natural environment including the totemic animals and sacred places. A similar study was done by Zazu (2008) in the Sebakwe area in Midland's region of Zimbabwe, who reported that hands-on methods that are characteristics of indigenous methods of teaching are already being used within the Sebakwe Environmental Education programme.

These include the use of seminars which give precedence to students' presentations on the problems studied in such a way that, taken together, they build a whole picture of the topic being studied (National Center on Educational Outcomes (NCEO), 2005).

2.23 Challenges to the Integration of Indigenous Knowledge into Climate Change Education

The integration of IK into CCE is a new paradigm in education. It is thus liable to facing many challenges. Rogan and Grayson (2003), and Dzimiri and Marimo (2015) regard challenges as constrains, or problems faced in the implementation of a curriculum. These challenges may refer to inadequate financial resources, physical buildings, teaching and learning materials, and human resources (Rogan & Grayson, 2003) among others. Across the globe countries face a myriad of challenges to the incorporation of IK not only into EE or CCE, but into education in general. Litus (2012) noted that lack of teacher knowledge of CCE will for long remain a barrier to effective CCE. Risiro, (2019) in his study in Zimbabwe found out that challenges of infusing IK into science teaching/ CCE were attitudinal, institutional, and systematic. He reported that teachers have undesirable attitude towards IK and were more supportive of teaching the Western Science.

Amongst the American Indians in Minnesota, USA, the major challenge in integrating IK into CCE is the misinterpretation of the curriculum by the teachers (Kern, Roehrig, Bhattacharya, Wang, Finley, Reynolds & Nam, 2015). These researchers reported that teachers had little to no training in the incorporation of IK into the new school curriculum. Similar findings were reported among teachers in the Philippines, in addition to budgetary constraints (UNESCO, 2015). Other challenges that have been highlighted among countries in the Pacific region embrace the use of English in the teaching and learning of Science (UNESCO, 2012), the tension between a centralized curriculum and the need to stimulate locally based and locally suitable knowledge, and an overwhelmed school curriculum.

According to Nazil, Pedretti, Wallace, Montemurro, and Inwood (2009), in Canada, the major challenges faced in the addition of IK into EE and the curriculum, in general, is that there is little post-secondary education that roots the curriculum in local cultures and content.

There is a need to develop a curriculum that involves both western and IK environmental issues (Mawere, 2015). Most of the teachers in Canada are Western trained and are better aligned with the western curricula (Maron, 2018). It is also noted that there is a need for teacher training workshops to enhance the integration of IK into CCE and the establishment of provincial ESD Working Groups and guidelines for benchmarking and tracking sustainability literacy in school curricula (Maron, 2019).

Most teachers also lack confidence when presenting IK in the curricula (Korteweg & Fiddler, 2018). A study by Swayze (2008) in schools in the Manitoba District of Canada uncovered one major challenge with the integration of IK into the curricula as the substantial gap between the provincial sustainability frameworks and constituency or school policies. The study specified the imperfect responsiveness of provincial policy around IK and EE at the school level (Korteweg & Fiddler, 2018).

To date, many studies have been done in Zimbabwe on the problems faced in the execution of EE. As an example, Risiro (2013) identified absence of follow ups, financial constraints and the lack of political will as major challenges to effective implementation of EE in the country. Another challenge noted by MoPSE (2015) and Dziva, Mpofu, and Kusure (2010) is the lack of teachers to fully conceptualise the EE syllabus, poor understanding of EE content, and lack of relevant educational materials. However, none of these studies specifically investigated the challenges related to the integration of IK into CCE.

The main challenge faced during the implementation of CCE in schools in Zimbabwean is that teachers have serious misconceptions about CC (Papadimitriou, 2001). This stems from the fact that they do not have a comprehensive appreciation of the phenomenon. According to Aladag and Ugurlu (2009) the misconceptions are also probably due to the complexity of the science involved, and the uncertainties and controversies surrounding CC. The Government of Zimbabwe (GoZ) (2015) reports that in the various learning institutions including schools and colleges, there is also lack of enough qualified personnel in IK. Pruneau, Khattabi and Demers (2010) have also acknowledged situational constrains to CCE (be they be economic, social or political).

Examples are nonexistence of resources that make it problematic, if not unbearable, to implement educational undertakings; lack of partnership within communities that hinder initiatives; absence of governmental plan on CC and CCE, which leads to lack of support and financial backing. In Zimbabwe's schools there is the lack of adequate materials to support the integration of IK into CCE (Manjengwa, Matema, Mataruke, Tirivanhu, Tamanikwa & Feresu, 2014). Moreover, the non-availability of financial resources to carry out the necessary training of trainers stalls the integration of IK into CCE in schools. As reported by the Albeta Council for Environmental Education (ACEE) (2017), Zimbabwe faces political and social obstructions to CCE such as abject poverty. Accordingly, Manjengwa, Matema, Mataruke, Tirivanhu, Tamanikwa and Feresu, (2014) argue that even if educational resources were existing in such settings, the integration of IK in CCE is the bare minimum of priorities for people struggling to survive in the short-term.

2.24 Support for the integration of Indigenous Knowledge into Climate Change Education

The change and innovation to any curriculum needs backing. According to Rogan and Grayson (2003), support in curriculum execution is an attempt to apprehend and elaborate on the factors that can promote or obstruct the implementation of new thoughts and practices in a system such as a school. Curriculum support has been defined by Kauffman (2005) as sufficient guidance regarding what and how to teach or assess. Rogan and Grayson (2003) recognise four categories of support during curriculum implementation specifically: physical resources, teacher-related issues, learner-related issues, and school ecology and management.

In Canada, there is evidence of government support in the integration of IK into the school curricula as there has been the promulgation and provision of the policy by the government for example in Saskatchewan (Government of Saskatchewan, 2018). The local community also supports the implementation of IK into schools through use of indigenous elders in the teaching of IK in the school curricula. These elders are the bearers of IK needed in schools (Keliipio, 2018). Apart from these, the government of Canada has also been supporting the integration of IK into the school curricula by providing with teaching resources. As an example, the use of online tools for the Aboriginal perspectives for teachers (Marom, 2019).

In South Africa, recent research indicates that teachers require in-service training to effectively integrate IK into the school curriculum (Ronoh, 2017). MoPSE (2015) in Zimbabwe recommended that the District and Provincial officers, School heads, and their school-based supervisors should monitor the implementation of IK integration into CCE in schools. Risiro, Mashoko, Tshuma, and Rurinda (2012) and Nziramasanga (1999) reported that in Zimbabwe, there was very little outside support given to schools to integrate IK into their curricula. Largely, in Zimbabwe, a paucity of research has been done to investigate support and monitoring of the integration of IK into school curricula, let alone into CCE.

2.25 Chapter Summary

This chapter gave a synopsis of literature relating to the integration of IK into CCE into the school curricula was presented. The chapter started by unpacking the phenomenon of CC, its effects and the link between CC and SD. The discussion further unravelled the educational responses to CC including CCE globally and in Zimbabwe. Moreover, the chapter went on to describe the nature of IK, compared IK with western knowledge, presented examples of IK-based CC beliefs and practices before outlining the benefits of integrating IK into CCE. The status of the integration of IK into CCE in schools in different parts of the world was presented. The chapter also presented summaries of research findings on various issues pertaining to the integration of IK into CCE in different countries. The next chapter discusses the theoretical framework that guided the study.

CHAPTER THREE

THEORETICAL FRAMEWORK

3.1 Introduction

In the previous chapter, the literature linked to the study was presented and analysed. This chapter presents the theoretical framework that underpinned this study, which is the curriculum implementation theory of Rogan and Grayson (2003). This chapter would begin with a discussion of the connotation and role of a theoretical framework in academic research. This would be followed by a brief look at early curriculum implementation theories that served as the spring point from which Rogan and Grayson's theory was developed. The chapter would further provide a comprehensive outline of the Rogan and Grayson theory and discuss the relevance of the theory as well as explain how it was used to inform the study. Lastly, the chapter will look at the flaws of the Rogan and Grayson (2003) model and how the study addressed them.

3.2 Theoretical Frameworks in Academic Research

The overall and last objective of the study was to develop a framework for the integration of IK into CCE. A theoretical framework involves theory (or theories) that directs one's thinking with respect to how they understand and design to research their topic (Luft et al, 2022), including the concepts and descriptions from that theory that are pertinent to the topic. According to Creswell (2018), a theoretical framework works as a map, blueprint, or guide for research from previous literature that delineates a study's core theory and concepts**.** This blueprint is often 'borrowed' by the researcher to shape his /her own house or research inquiry and serves as the underpinning upon which research is built (Vinz, 2018). It is the foundation upon which research is assembled and consists of theories and their propositions which together offer a focal point for approaching the unknown research (Ding, 2019). In this research, a theoretical framework was used as a template, a guide, and a frame that informed the study on the integration of IK into CCE in the Advanced Level Geography curriculum in Zimbabwe.

The 2003 Rogan and Grayson curriculum implementation theory was used to inform this study. The study aimed at exploring the integration of IK into CCE in the Advanced Level Geography curriculum in Zimbabwe, specifically on the how, the what, with the overall goal to design a new and effective framework. The Rogan and Grayson curriculum implementation theory was adapted to suit the integration of IK into CCE.

3.3 Early Curriculum Implementation Theories

World-wide, the post-Second World War era has been a period of numerous curriculum reforms at all levels of education (de Boer, 1998; Rogan & Grayson, 2003). However, most of the curriculum modifications that have taken place, the emphasis has been on policy formulation, with scanty attention being paid to the implementation phase (Viennet & Pont, 2019). Most of the times attention and energies of policymakers and politicians are concentrated on the 'what' of preferred educational change disregarding the 'how' (Rogan & Grayson (2003). In this case, large scale curriculum reforms are a global phenomenon, the theoretical base around their implementation is inadequate (Fullan, 2007). In response this challenge, various researchers have designed theoretical frameworks and models to help inform and guide curriculum change and implementation progressions.

Some of the early curriculum implementation theories are those by Beeby (1966), and Verspoor and Wu (1990) which both suffer from their rectilinear interpretation of curriculum change, which involves moving from one development stage to the next highest, and which tends to obscure the complex and idiosyncratic nature of the processes involved. These models were also criticized for specifying distinct stages during curriculum implementation (OECD, 2020). Although they provide neat labels, they are not necessarily indicative of the complexity of educational systems. Two other weaknesses identified in the early curriculum implementation theories is their lack of attention to student as factors to be considered during curriculum implementation, as well as their deficit approach which focus on identifying and addressing weakness during curriculum implementation, rather than working with the strengths of the prevailing processes (UNESCO, 2017).

In addition, it soon became apparent that although, regarding curriculum implementation, developing countries have much in common with the more developed, the effects of poverty, political uncertainty, people's participation as well as the unique character of each developing country cannot be ignored (Hill & Hupe, 2006). It was against this background that Rogan and Grayson (2003) came up with a curriculum implementation theory that specifically addresses the contexts of developing countries.

In developing their curriculum implementation theory, the main aim of Rogan and Grayson (2003) was to speak to issues of specific applicability to developing countries, while at the same time drawing an international literature on educational change (Aldous-Mycock, 2008).

Although, the Rogan and Grayson (2003) framework was established specifically for the analysis of curriculum implementation in science education in the South African context, it has proved to be a useful instrument for examining different facets of curriculum implementation in other subjects and in different countries. Examples of such studies include the implementation of Mathematics curriculum in Mpumalanga by Aldous-Mycock (2008), integrating Physical Science and the Geography curriculum (Ndlovu 2013), and Physical Science education (Koopman, Grange & Mink, 2016) all in South Africa, the thematic curriculum in Uganda (Altinyelken, 2009), the mathematics curriculum in Namibia (Angula, Kasanda & Gaoseb, 2015), and HIV and AIDS prevention programmes in Zimbabwe's schools (Muzenda & Rembe, 2014). In this research, the Rogan and Grayson (2003) has also been adapted to inform the dynamics in the integration of IK into CCE.

3.4 The Rogan and Grayson (2003) Curriculum Implementation Theory

In the analysis of curriculum implementation, three major constructs need to be considered: profile of implementation (PoI), capacity to support innovation (CtI), and outside influences (OI) (Rogan & Grayson (2003). Each of the three constructs has its own sub-constructs as shown in Figure 3.1.

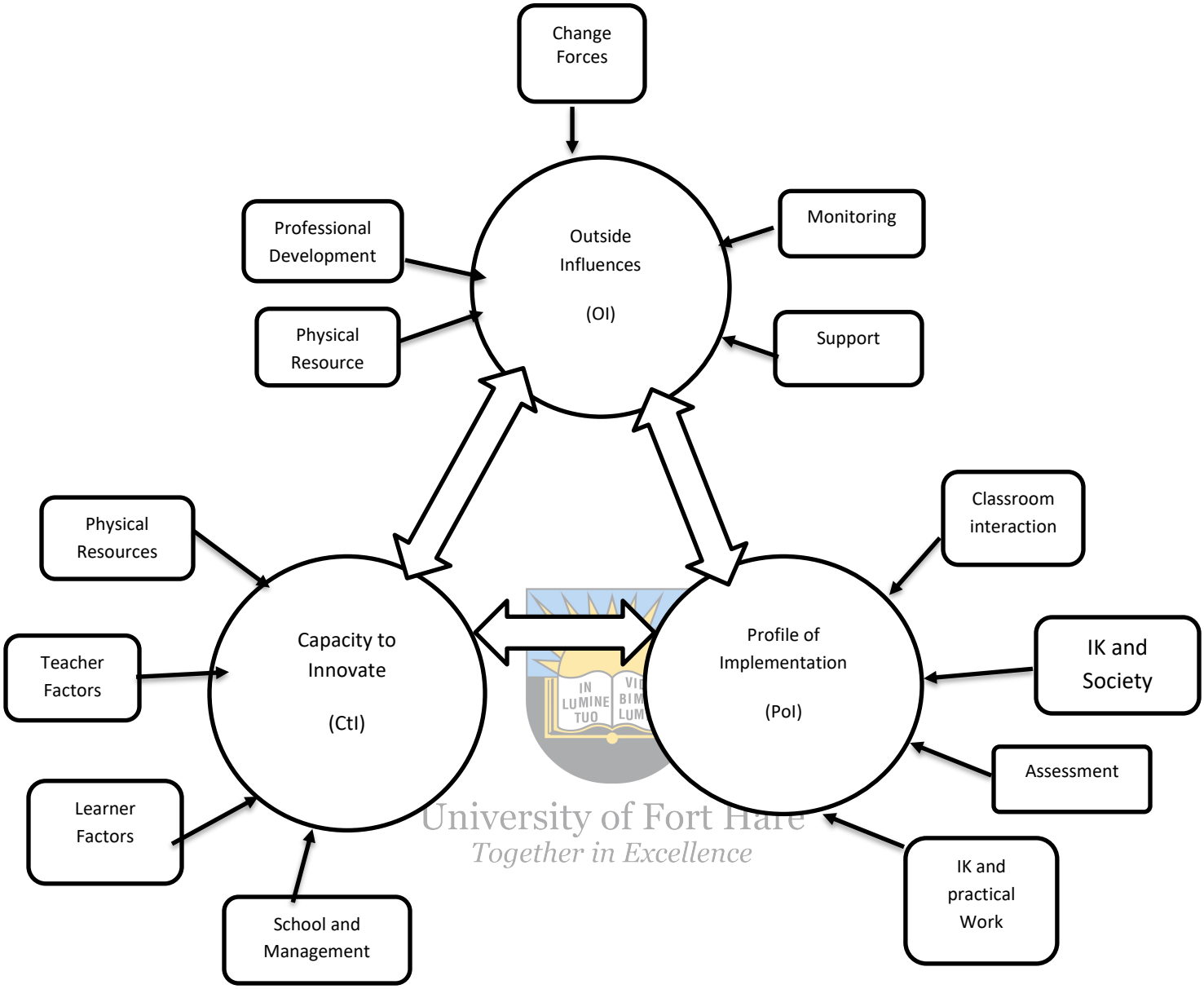


Figure 3.1: Model theory for curriculum implementation (Adapted from Rogan & Grayson, (2003: 1188).

3.5 Profile of Implementation (PoI)

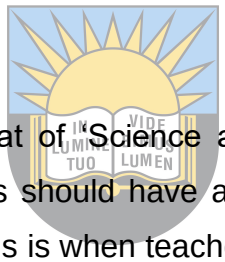
The concept 'Profile of Implementation' (PoI) relates to an endeavour to apprehend and express the degree to which the ideals of the new curriculum are being put into practice (Rogan & Grayson, 2003; Rogan, 2007). This entails the responsibility to ascertain the extent to which the approved curriculum is being transformed into reality. In schools, the transformation of a prescribed curriculum into reality is in the class and through the teachers and learners (Tawana, 2009). This construct recognises the existence of various ways of putting curriculum into action as there are teachers teaching, and that the effectiveness of the various ways is reflected through the quality or nature of the product at the end. The construct PoI plays an important role in curriculum implementation by informing policy makers and other stakeholders in education on what educators and learners do, how practical work is completed, how the lack of resources may prevent educators from doing practical work; how the learner's everyday life experiences are imparted in the classrooms and how learners are evaluated (Aldous Mycock, 2009). Therefore, the PoI allows researchers to determine where best the incorporation of new practices is (Aldous-Mycock, 2008). In the confines of this study, this construct was used to ascertain the level to which the objectives of the integration of IK into CCE are realised in the Advanced Level Geography curriculum at the selected high schools in Zimbabwe.

Within the construct PoI, Rogan and Grayson (2003) identify four sub-constructs or indicators, namely the nature of classroom interaction, science practical work, science and society, and assessment (Figure 3.1). The discussion following is a discourse on each sub-construct and how it was used in this study.

The sub-construct of 'classroom interaction' is what the teachers and learners do during the lessons (Rogan & Grayson, 2003). Within the context of this study, this sub-construct refers to what learners and teachers do regarding the incorporation of IK into CCE during the Advanced Level Geography lessons at the selected schools. This sub-construct helped the researcher to generate data on teaching strategies used by educators in the integration of IK into CCE into during these lessons.

Data on this sub-construct also provided enlightenment into the learning activities that learners engage in during the lessons involving the integration of IK into CCE during Advanced Level Geography lessons at the selected high schools in Zimbabwe.

The second sub-construct under PoI is that of 'Science practical work.' 'Science practical' work are the practical experiences for learners which aim at developing the learners' deeper acquisition of the science discipline (concepts and investigative skills) (Rogan & Grayson, 2003). These are attempts to make science more hands on. Within the confines of this research, the Rogan and Grayson (2003) sub-constructs of 'science practical work' was replaced by that of 'IK and practical work' (Figure 3.1). 'IK and practical work' were used to denote to the real-life practical happenings that learners engage during the integration of IK into CCE into the Advanced Level Geography Curriculum. The data gathered on this sub-construct provides a clear understanding of the kind of practical activities done by learners in the integration of IK into CCE into the Advanced Level Geography curriculum.



Another sub-construct of PoI is that of 'Science and Society,' for which Rogan and Grayson (2003) argue that learners should have a chance to vigorously question the application of science in society. This is when teachers and learners use examples from everyday activities to enhance the understanding and application of abstract concepts.

In this research, the sub-construct 'Science and Society' was replaced by that of 'IK and Society' (Fig 3.1) and was used to generate data on how knowledge and skills acquired through the integration of IK into CCE were applied outside the schooling context and vice versa.

The third sub-construct under PoI is that of 'assessment.' Rogan and Grayson (2003) explained that assessment refers to the different forms of evaluating progress by learners (written, reports on activities, assignments, reports on investigations, portfolios, etc.). In this study, this sub-construct was used to explore and produce data on assessment practices used by teachers throughout the integration of IK into CCE during the Advanced Level Geography lessons at the selected schools. Thus, this sub-construct helped in responding to the research questions on the strategies employed by teachers when integrating IK into CCE in the Advanced Level Geography curriculum.

3.6 Capacity to Innovate (CtI)

According to Rogan and Grayson (2003), CtI refers to the fundamentals that have influence on the implementation of fresh ideas and practices in the new curriculum.
This construct is all about how schools handle curriculum operation. Rogan and Grayson (2003) further note that different schools implement curriculum at different levels of effectiveness.

Rogan and Aldous (2005) noted that the provision of acceptable materials and resources and a beneficial working environment help as a good springboard for preparation and executing one's duties proficiently and students are likely to benefit more from such a setup. Therefore, if curriculum implementation were to be effective, teachers needed to have the necessary equipment, classrooms, textbooks, and other important resources (Rogan & Grayson, 2003). The CtI has four sub-constructs (physical resources, teacher factors, learner factors, institution ethos and management), (Rogan & Grayson, 2003). In this study, the construct CtI assisted the researcher to determine the factors within schools that support or hinder the integration of IK into CCE into the Advanced Level Geography curriculum in Zimbabwe.

Rogan and Grayson (2003), look at the sub-construct of physical resources as material resources that support curriculum implementation in schools. In this study, physical factors referred to buildings, classrooms, laboratories, offices, textbooks and other educational resources such as equipment, whose availability or non-availability have effect on the integration of IK into CCE during Advanced Level Geography lessons. Data generated on this sub- construct was used to examine whether the high schools chosen had the necessary resources to support the effective integration of IK into CCE in the Advanced Level Geography curriculum in Zimbabwe. This helped to respond to the sub-research question on challenges teachers and learners encounter in that regard.

The second sub construct under CtI is that of 'teacher factors.' Rogan and Grayson (2003) used this sub-construct to refer to teachers' own upbringing, training and level of buoyancy, and their commitment teaching. In this study, this sub-construct referred to the background of teachers (training and levels of confidence and their commitment to

teaching) regarding the integration of IK into CCE into the Geography curriculum. These attributes impact on how well the teachers can adapt and effectively integrate IK into CCE into the Geography curriculum. The sub-construct helped the researcher ascertain if teachers had the essential training and experiences to efficiently integrate IK into CCE during their Advanced Level Geography lessons. This information was collected through interviews, lesson observations and document analysis.

The third sub construct under CtI is 'learner factors.' These learner factors are the upbringing of learners: the strength and constrains that they might bring to the learning situations (Rogan & Grayson, 2003). In the context of this study this sub-construct related to the upbringing of learners, in terms of family background, proficiency in language, and support from home, etc., and was used to inform the researcher on how learners' backgrounds hindered or promoted effective integration of IK into CCE in the Geography Level Geography curriculum.

The last sub-construct under CtI is that of 'ecology and school management.' Rogan and Grayson (2003) stressed that for successful curriculum execution, good school leadership and discipline have an advantage over a disorganised school. In this study, this construct referred to school administration. Data generated by this sub-construct helped in providing an understanding into how the operations of the school administration affected the integration of IK into CCE in the Advanced Level Geography curriculum at the selected schools.

3.7 Outside Influence (OI)

During the implementation of the school curriculum, there are outside institutions or organisations that have influence on the programme. Rogan and Grayson (2003) named these organisation- Outside Influence (OI). Rogan and Grayson (2003: 1191) pronounce OI as the "organisations outside the school that interact with the school in order to facilitate curriculum innovations." Rogan and Grayson (2003) added that OI are a whole vast range of organisations with immeasurably differing agendas, all vying for and/or collaborating with one another to play a role in the implementation of educational innovations.

The integration of IK into CCE is equally influenced by external institutions. These organisations include government department, donors, NGOs, and unions. Thus, OI is envisioned to describe the kinds of actions undertaken by these outside organisations as well as the ways in which they manifest their interactions. It can be further described as the types and levels of support and pressure or motivation that many organisations bring to bear on a school to facilitate curriculum change. Depending on the credibility of the organisation, such organisations can conjure authority as a means of facilitating change within a school.

Rogan and Grayson (2003) further point out that the government department can make changes by decree, whereas NGOs do so by ether persuasion, or inspiration. This construct has five sub-constructs namely: professional development, physical resources, change forces, monitoring and support (Rogan & Grayson, 2003: 1188). In this study, the construct 'outside influence' assisted the researcher in analysing the type of external support that is being offered to schools to enhance the integration of IK into CCE in the Advanced level geography curriculum. It further allowed the researcher to identify the sources of the external support and how they influence the implementation of the desired curriculum.

Rogan and Grayson (2003) applied the sub-construct of 'professional development to refer to keeping up to date on the trends, skills, technologies, and other characteristics of the teacher's field to bring about the expected curriculum changes. In this study this construct was used to generate data on the kind of the out-side support (policy documents and professional advice and training) that have a bearing on the integration of IK into CCE in the Advanced Level Geography curriculum.

According to Rogan and Grayson (2003, physical resources promote or hinder curriculum implementation. In this study, this sub-construct referred to material resources provided from outside and was used to examine their influence on the amalgamation of IK into CCE in the Advanced Level Geography curriculum.

The sub-construct of ‘change forces’ refers to leading global and national initiatives or narratives that have a bearing on curriculum implementation in schools. According to Rogan and Grayson (2003) ‘change forces’ refer to the kind of pressure or support that can be used as leverage in bring about desired curriculum changes. In this study this sub-construct was used to generate data on the leading global and national initiatives or narratives that have a bearing on the integration of IK into CCE in the Advanced Level Geography curriculum. Lastly is sub-construct ‘monitoring.’

According to Rogan and Grayson (2003) ‘monitoring’ relates to measures taken to ensure school compliance and accountability regarding curriculum implementation.
In this study, this sub-construct was used to gather data on organisations that are responsible for monitoring the integration of IK into CCE in schools and the roles they play in the process.

3.8 Addressing the Limitations of Rogan and Grayson’s (2003) Curriculum Implementation Theory.

The Rogan and Grayson (2003) theory has helped curriculum developers to move from designing and development curriculum to the implementation stage. Rogan and Grayson (2003) identified three main constructs in curriculum implementation as discussed earlier. It has been noted however that, the Rogan and Grayson (2003) curriculum implementation model needs major adaptations if it was to be applied in different context (subjects) and environment (countries).

To begin with, the framework was specifically designed to scrutinize the implementation of a science curriculum in schools. As such the framework contained sub-constructs such as ‘science in society’ and ‘science and practical work’ that are relevant to science education in schools but are not necessarily so for other subjects. Hence these sub constructs had to be removed or modified to make the theoretical framework more relevant to the integration of IK into CCE into the Advanced Level Geography curriculum (see Fig. 3.1).

Secondly, although the theory is considered applicable in most contexts, it is unlikely to forecast every variable that might influence curriculum change in every context. Thus, it is possible that in a particular context an important variable might be omitted. There is therefore the need for the application of contextual knowledge to adopting the framework prior to using it as a research tool in different context. In this study, the researcher made sure that all key factors (internal and external) that have capacity to impact on the integration of IK into CCE into the Advanced Level Geography curriculum in High schools in Zimbabwe were examined.

The last weakness of Rogan and Grayson (2003) framework is that the framework does not provide insight into the percentage of the impact that each of the constructs and sub-constructs might have on curriculum implementation. It wrongly assumes that that all factors in curriculum change provide an identical impact, and thus are all given the same weighting. In this study however, this challenge was not important since the focus was to investigate the integration of IK into CCE into the Advanced Level Geography curriculum in High schools rather than determining the magnitude to which the various factors contributed to curriculum implementation.

3.9 Chapter Summary

This study adopted the curriculum implementation theory that was advanced by Rogan and Grayson. This theory was used as a template, a guide and frame that informed the study on the integration of IK into CCE in the Advanced Level Geography curriculum in Zimbabwe specifically on the how, the what, with the overall goal to design a new and effective framework. To begin with, early curriculum implementation theories were investigated. The next chapter looks at the research methodology that informed this study.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

The preceding chapter explored the theoretical framework that informed the study. The current chapter presents the research methodology that was used in this study. The chapter looks at the various tactics or plans of action that connect methods to outcomes and guide the choice and uses of methods (Creswell, 2018) in the integration of IK in CCE. The researcher describes the numerous steps adopted in investigating the integration of Indigenous Knowledge in Climate Change Education (CCE), within the Advanced Level Geography Curriculum in Zimbabwe. In this chapter, the researcher begins with a portrayal of the research paradigm or the philosophical orientation within which this study was anchored, then goes on to look at the study's research approach and design. This is followed by a discussion of how data were generated, managed and analysed. The chapter further looks at trustworthiness and the research ethics issues and how they were handled in this study. Finally, the chapter ended with a summary.

4.2 Research Paradigm

This study aimed to explore the integration of IK into Climate Change Education (CCE) in the Advanced Level Geography Curriculum at selected high schools in Gwanda North District of Zimbabwe. In this exploration, the researcher needed to have a deeper understanding of social phenomena through the subjective experiences and meanings that individuals attach to their actions and interactions. The researcher was informed by the belief that human behaviour cannot be fully understood through quantitative measures alone, hence the inclusion of the interpretivism paradigm. Thus, this study was informed by the interpretivism paradigm. In this view, the researcher was able to understand how the participants socially construct their world of experiences and the meanings they share and attach to these social constructs. Additionally, the paradigm assisted the researcher to achieve a deep understanding of the participants' meaning of their daily lives, feelings, and behaviours towards the integration of IK into Climate Change Education (CCE) in the Advanced Level Geography Curriculum. Creswell & Poth (2018) supported this by

highlighting that the researcher should pay attention to the participants' specific language and choice of words by linking the terms they use. The next sections expound more on the ontology, epistemology, axiology and methodology as they relate to the interpretivism paradigm.

4.2.1 Interpretivism Ontology

Ontology is a subdivision of philosophy which is concerned with being and with what exists. Ontology reflects on what types of things there are in the world and what 'portions' or 'materials' the world can be divided into (Almalkiri & Eke, 2018). Ontology is the nature of the world and what we can know about it (Kumatongo & Muzata, 2018), it relates to beliefs about the kind and nature of reality and what exist in the social world. Ontology interrogates the nature of reality. Ontology takes in for questioning the question "whether or not there is a social reality that exists independently from human conceptions and interpretations and closely related to this, whether there is a shared social reality or only multiple, context-specific ones" (Ormston, Spencer, Barnard & Snape (2014:4).

Regarding ontology, positivists suppose that the social world is outside and should be determined through unprejudiced means rather than through subjective reflections. (Almalkiri & Eke (2018). The positivist ontology believes that the world is external and there is a single objective reality to any research situation despite the researcher's belief (Creswell & Creswell, 2018). In conducting research therefore, positivist ontology uses structural approaches by identifying a flawless research topic, constructing suitable hypotheses and by adopting an appropriate research methodology (Khaldi, 2017).

Babbie (2013) adds that positivist researchers endeavour to continue detached from the participants of the research by creating distance between themselves and the participants. Positivist ontology is a distinct, external and independent reality to any research question regardless of the researcher's belief, and therefore (Perera, 2018), it is important to clearly differentiate between fact and value conclusion. The interpretivists ontology on the other hand, rely on a social constructivism which assumes that reality is multiple and relative (Amakiri & Eke, 2018).

This multiple reality posits that there is no one conventional meaning or reality of a situation whereas relative reality is a subjective reality or how different people have different meanings of the same thing. This means that reality is not out there to be observed but it is as we want it to be (Driscoll, 2011). Almiki (2016) clarifies that these multiple realities are subject to other techniques for meanings, which make it more problematic to deduce in terms of fixed realities. The interpretivist ontology adheres to the belief that knowledge gained from research is socially constructed rather than objectively constructed and perceived (Creswell, 2018). As such, instead of generalising and predicting cause and effect, the goal of interpretivist research is to appreciate and interpret the meanings in human behaviour (Almiki, 2016).

This study was informed by the interpretivist ontology and the researcher attempt to observe ongoing processes to better understand individual behaviour of a situational world. Being informed by the relativist ontology means that the researcher believed situation studied had compound realities, which can be explored and meaning made of them or reconstructed through human interactions between the researcher and research participants (Amakiri & Eke, 2018). Furthermore, interpretivism is based on a life world ontology that argues all observation is both theory and value-laden laden and investigation of the social world is not and cannot be the pursuit of a detached objective truth (Fusch, 2017). In this study, the researcher remained open to new knowledge and allowed it to develop with the help of teachers and the geography inspector. This was consistent with the interpretivist belief that humans could adapt and that no one can gain prior knowledge of time and context-bound social realities.

This was of significance to this study because it permitted the researcher to question the prevailing interpretations and constructions of teachers in the integration of IK in CCE, within the Advanced Level Geography Curriculum in Zimbabwe. Furthermore, the researcher could then gain access to the existence of multiple participants' connotations. Because these are experiences by teachers as they interact in class, as the views expressed were those of the participants as they narrate their practices (the how, the challenges, the support and their views). These multiple realities reflect the complexity of the situation, i.e., they are multiple meanings or interpretations of a single event (Creswell & Creswell, 2018). Through interpretive ontology, the researcher gained a deeper

appreciation and insight into the experiences of teachers in the integration of IK into CCE within the Advanced Level Geography Curriculum in Zimbabwe.

4.2.2 Interpretivist Epistemology

Epistemology is the division of philosophy which deals with knowledge and how we come to know things (Selvam, 2017). It is the ideas we have about the kind or the nature of knowledge or what is possible to discover or realise about the world (Amakiri & Eke, 2018) and so is the study of our knowledge of the world (Kumatongo & Muzata, 2021). Epistemology responds to questions such as how we know what we know (Cohen, Manion, & Morrison, 2011). To gain a profound understanding of Epistemology, a brief distinction between positivist and interpretivist epistemology is discussed below.

The positivist epistemology is about objectivism (Selvam, 2017). The positivists believe that information should be sought impartially from the world and that absolute knowledge is discovered in objective reality (Perera, 2018). The researcher and the participants of a study are self-governing entities in positivist epistemology. Accordingly, positivist researchers try to continue disconnected from the participants of the research by making a gap between themselves and the participants (Creswell, 2018). Positivists claim this is important to remain emotionally neutral to make vivid discrepancies between reason and feeling and between science and personal experience. Epistemologically, positivist believe it is significant to undoubtedly discriminate between fact and value judgement. Positivistic statements are descriptive and factual. Positivist researchers therefore pursue objectivity and use reliably rational and logical tactics to research (Creswell, 2018).

The interpretive epistemology, on the other hand, is one of subjectivism which is grounded on personal experiences (Cohen, Manion, & Morrison, 2011). Interpretivists circumvent rigid structural frameworks such as those in positivist research and assume more personal and malleable research structures (Selvam, 2017). The interpretivist says the world does not exist autonomously of our knowledge of it (Khaldi, 2017). Subjectivist in epistemology means that the researcher generates meaning of their data through their thinking and cognitive dispensation of data (Creswell, 2018) enlightened by their interactions with participants. In other words, epistemologically, the interpretivist paradigm is knowledge of reality seen as a social construction by human actors (Kivunga

& Kuyini, 2017). Under interpretivism paradigm, knowledge is based on subjective beliefs, values, reason and understanding. In this paradigm, theory is revisable, and sensitive to context (Creswell, 2018).

The insights into the inclusion of IK in CCE, within the Advanced Level Geography Curriculum in selected High Schools in Zimbabwe were better obtained through an in-depth subjective correlation of events, bringing to consciousness hidden social forces and structures rather than the researcher relying on objective facts whose main aim is for generalisation. In all, the researcher assumed the interpretivist epistemology because the researcher supposed understanding obtained in this research is socially constructed rather than objectively established from the standpoint of individuals who are participating in it (Mohajan, 2018).

4.2.3 Interpretivist Research Methodology

Research methodology refers to the research design, methods, approaches and procedures employed in an examination, well planned to achieve a result (Kivunja & Kuyini, 2017). The design of instruments, selection of participants, gathering of data, and data analysis all form different aspects of a broader field of methodology. It also includes assumptions made, limitations encountered and how they were mitigated or minimised. There are diverse methodological positions grounded on a researcher's ontological and epistemological orientations.

For example, in positivism, methodology is focused on illuminating relationships (Kumatongo & Muzata, 2021), attempts to relate causes and outcomes (Creswell, 2018). Positivists try to formulate laws and to apply them as a basis for generalization, using correlation and experimentation to decrease complex interfaces to their constituent parts (Scotland, 2012). Generally, formalised statistical and mathematical methods predominate positivist methodology with the aim of generating facts from figures (Khaldi, 2017). The positivist research is considered good if its results are due to the independent variable, can be generalised to other populations or situations (Scotland, 2012) and different researchers can record the same data in the same way and attain the same conclusions. The positivism research uses experiments, quasi-experiments and survey (questionnaires and interviews) methods as data collecting methods.

In contrast, interpretive research methodology is bound for an understanding phenomenon from research participant's viewpoint, investigating interface between and among individuals as well as the historical and cultural settings which people inhabit (Creswell, 2018). This explains why most interpretive methodology are either case studies, phenomenology, hermeneutics or ethnography (Kumatongo & Muzata. 2021). Interpretive theory is customarily grounded (inductive), being generated from the data, not preceding it (Kivunga & Kuyini, 2017), as in the case of positivism. The interpretive methods yield insights and understanding of behaviour, explain actions from the participants' perspective and not dominated by statistical aspersions (Scotland, 2012). Methodology under interpretivism is appropriate and suitable if it delivers rich evidence and offers credible and justifiable accounts, can be made use of by someone in another situation, and the research process and findings can be replicated (Muzata, 2020). In this study the researcher concentrated on tolerating and interpretation of the participant's meaning and experiences. As such the researcher used interpretivist research methods such as Interviews, lesson observations and document analysis to help generate thick descriptions of the participants' meanings and experiences regarding the integration of IK into CCE, within the Advanced Level Geography Curriculum in Zimbabwe.

4.2.4 Interpretivist Axiology

This branch of philosophy covers the role of position of values in research. In research, therefore, axiology helps in the valuation of the role of researcher's own values in all phases of the research procedure. Axiology is the role and place of the researcher's personal values and ethics in the research process (Simui, 2018). These beliefs and values of the researcher should be made known so that participants and readers know the settings in which the research is being undertaken (Muzata, 2020). According to Scotland (2012) positivist view knowledge generated from their methodology as value neutral. Whereas, in the positivist axiology, research is undertaken in a value-free way, and the researcher is autonomous from the data and upholds an objective stance, the interpretivist axiology is of the stance that research is value bound and the researcher is part of what is being investigated, cannot be separated and so will be subjective (Scotland, 2012).

Informed by this position, in this study, to understand the values echoed in this research, the researcher needed to be a part of the process and remained open minded and or subjective in the integration of IK into CCE, within the Advanced Level Geography Curriculum in Zimbabwe.

4. 3 Research Approach

This study adopted the qualitative research approach that employs a wide and deep angle lens, probing human choices and behaviour as it happens naturally in all its details (Mohajani, 2018). The researcher favoured qualitative methods under the interpretivist paradigm because these techniques facilitate a more nuanced exploration of how the integration of IK into CCE was being done in the selected high schools. The researcher had to be present physically at the two selected schools to explore through interviews, to observe, and to analyse the documents in their natural state. The researcher immersed themselves in participants' environments (the schools) and experiences (classroom interaction), leading to a richer understanding of how the teachers construct meaning in their lives about the integration of IK into CCE.

This gave the researcher an inquest aimed at describing and clarifying human experiences as it appears in people's lives (Belloto, 2018) at the two schools. The case of integrating IK in CCE needs the culturally specific and real-life experiences. The real-life experiences led to the researcher to produce findings not arrived at by means of statistical procedures or other means of quantification of data. Mack (2010) envisages qualitative research as interpretative and grounded in the assumption that features of the social environment are constructed as interpretations by individuals.

The process of qualitative research involves emerging questions and procedures, data typically collected in the participant's setting, data analysis inductively building from particulars to general themes and the researcher makes interpretations of the meaning of the data (Thanh & Thanh, 2015). The researcher engaged in this form of inquiry because the integration of IK into CCE is inductive in style (Creswell, 2018), it focuses on individual meaning, and the importance of rendering the complexity of a situation.

The use of qualitative approach helped the researcher to generate in-depth understanding of human behaviour and the reasons that govern such behaviour (Thanh & Thanh, 2015). Through the qualitative approach, the researcher could investigate the why, and how of decision making, not just what, when and where (Creswell & Creswell, 2018) when integrating IK in CCE at the selected schools. In this view, the researcher used the qualitative approach to collect rich data in respect of specific phenomenon with an intention of generating understanding of the integration of IK into CCE.

In this study, the researcher wanted to generate profound information on the integration of IK in CCE in the Advanced Level Geography Curriculum by making use of naturalistic research methods such as observation and interviews and document analysis rather than experimentation or hypothesis testing. This is in line with what Johnson and Christensen (2008) who posited that qualitative research is a naturalistic inquiry, which encompasses studying real world situations as they unfold naturally.

This approach fitted well with the study as the chief goal was to generate in-depth understanding of the integration of IK into CCE in the Advanced Level Geography Curriculum at selected schools in Zimbabwe. In addition, there were no quantitative measurements taken during the study, but the generation of rich narratives to describe the integration of IK into CCE. This qualitative data was used to answer questions such as “why?” and “how?” and to capture the *Erleben* or the “lived experience” of research participants (Carroll & Rothe, 2010).

Since this research was guided by the interpretivist paradigm**,** the qualitative approach which emphasises studying phenomena in their natural setting was found to be fitting in that interpretivist researchers also stress the importance of ordinary day-to-day experiences of the subject of the research study (Stahl & King, 2020). Through the face-to-face interactions, it was imaginable to obtain exhaustive information on participants’ experiences, their views, the challenges, and the support in the integration of IK in CCE in the Advanced Level Geography Curriculum in selected high Schools in Zimbabwe.

4. 4 Research Design

Since the aim of the study was to explore the integration of IK in CCE in Advanced Level Geography curriculum, the researcher adopted the case study method. This design allowed the researcher to have an in-depth exploration of the integration of IK into CCE at the two selected schools. This intensive study provides detailed insights that are often unattainable through other research methods. Furthermore, a case study was used in this study to explain the 'how' and 'why' questions which suits well the qualitative approach. This design has an in-depth nature, which helped to bring to the fore information that was not anticipated in the study initially. Secondly, the case study design empowered the researcher to carry out the study in natural settings, which in this case consisted of high schools and grades where CCE was being taught as part of the Advanced Level Geography curriculum. This enable the researcher to cover the contextual conditions which were relevant to the study. Exploration of contemporary issues like IK and CCE heavily involve case studies which are experiential research in design. Case studies are used to explore dynamics of phenomena within its real-life context (Ridder, 2017).

Mohaja (2018) approves this view when he defines a case study as an empirical inquiry in its real-world settings bounded system, which can be a single or multiple case, using an assortment of data generation methods over a period. A case study investigates real-life, composite, dynamic and unfolding interfaces of events, human relationships and other factors in a unique stance (Heale & Twycross, 2018). A case study design is the study of an individual institution incidents or situations, in a unique setting in an intense and as detailed a manner as possible (Kumatongo & Muzata (2021). In exploring the dynamics of the integration of IK into CCE, the researcher had to find the research questions and issues, be with the participants, and involve them in a contextual and often in a casual context (Ridder, 2017).

Through the use of case study design, the researcher was engaged in rigorous thinking and had sufficient presentation of evidence and finally reached appropriate conclusion (Yin, 2014). Using case study, the researcher observed and experienced richer account of what was occurring than through a case study (Nail & Sal Kind (2012).

The researcher used the case study design to explore integration of IK into CCE because of its in-depth nature which allowed him to intermingle with the participants as they participated in the study (Kumatongo & Muzata, 2021). In this regard, the use of the case study was useful in this research to allow the facilitators, and the inspector to give their personal experiences regarding the integration of IK in CCE in Advanced Level Geography curriculum. It was noted however that the use of a case study had the major drawback that their findings and conclusions often cannot be generalized to broader populations. Thus, this research, based on the use of several different research methods (Heale & Twycross, 2018), ranging from interviews, document analysis to personal observation to get the necessary information concerning the integration of integration of IK in CCE in the Advanced Level Geography curriculum. The researcher also provided detailed descriptions of the case study design, data collection methods, and analysis techniques so that other researchers can attempt to replicate the study under similar conditions. Furthermore, since the researcher focused on how IK was integrated at only two schools, and specifically advanced level geography; it was made clear that insights derived may only apply to that context.

4.5 Selection of Participants

In this section, the selection of high schools, grades, teachers, and subject inspector who contributed and participated in the study is discussed. This research used convenience sampling and purposeful sampling to select the study sites and the study participants, respectively. Sampling is an assortment of the subsets from the entire population for the purpose of research study (Ramamurthy, 2014) and is helpful in cases where it is neither possible nor feasible to study every element of a population.

In this case, convenience sampling, which is sometimes so-called opportunity sampling, includes choosing the nearest units or characters to assist as participants and or those who happen to be accessible and reachable at the time (Fischler, 2019). Ramamurth (2014) adds that convenient sampling is a non-probability sampling method in which elements from a given bigger population are chosen because of their easy accessibility and nearness to the researcher. In this case, two Gwanda North High Schools were selected out of the six high schools within Gwanda North District. The two schools were coded School A, and School B.

These two selected schools were close to the workplace of the researcher, which helped the researcher to cut down on time and transport costs during the study. Moreover, the two schools offer Advanced Level Geography as part of the school curriculum.

Purposeful sampling involves the selection of subjects because of some characteristics they possess (Atiken etal, 2015). Purposeful sampling means that the researcher must select objects and or participants who can superlatively help them understand the research problem and respond to the study's research questions (Creswell, 2014). Choosing the purposive sampling strategy has mainly been informed by pragmatic considerations-namely, that the units may provide the requisite relevant data key to the research and resources available to the researcher (Emmel, 2013). Hence during the study, the researcher targeted rich sources of information about the integration of IK into CCE in the Advanced Level Geography curriculum at the selected two schools.

The participants who were purposefully selected were four Advanced Level Geography teachers (two from each school). These teachers were teaching Advanced level Geography and had at least five years' experience. The other participant was the Gwanda North District Inspector for Geography coded as (R1). The R1 had experience in teaching, monitoring and assessing the Advanced level Geography in schools. The sample size of five participants gave the researcher a thorough study rather than a general examination. A small sample and qualitative methods helped the researcher to produce the necessary data to answer the study's research demands. The participating teachers were coded T1, T2, T3, and T4.

4.6 Research Methods

In this study, semi-structured interviews, lesson observation and document analysis were used to generate data on the integration of IK into CCE in the Advanced Level Geography curriculum at the selected schools. Using various types of data collection methods helped the researcher to generate a rich depiction of the integration of IK into CCE in the Advanced Level Geography curriculum.

It also allowed data triangulation (Aguinis & Solarino, (2019) as a means of cross-checking and re-affirming data from different sources. Employing different data collection

methods in one study strengthens the credibility and transferability of a study (Belloto, 2018). The following sections describe each of the three research methods used in the study and explain how they were utilized.

4.6.1 Semi-structured interviews

In this study, the researcher intended to generate an in-depth exploration of the integration of IK in CCE in the Advanced Level Geography curriculum at the two selected schools. To do this, the researcher identified semi-structured interviews as one of the data collection methods. This allowed for an extendable discussion between the researcher and the participants to have 'profound information' about a certain topic (Ruslin et al., 2022) and through which the integration of IK into CCE could be understood in terms of the meaning interviewees bring to it. Kumar (2014) upholds that an interview is a verbal conversation between at least two people with the target of generating relevant information for the purpose of research. The researcher has an in-depth discussion with the participants. The interview targets to conduct an in-depth study of the research problem (Deterding & Waters (2018). The use of this method was found to be a valuable for exploring the building and negotiation of meanings in a natural setting (Kakilla, 2021). The use of interviews in research makes a move away from seeing human subjects as simple manipulatives and data as somehow external to individuals, towards regarding knowledge as generated between humans, (Kakilla, 2021) often through conversation.

The semi-structured face-to-face interviews were conducted during data collection from one District Inspector for Geography and four Advanced Level Geography teachers (two from each selected high school). The inspector interview sought information on support and monitoring policies and practices regarding integrating IK in CCE in the Advanced Level Geography curriculum (Appendix 1). The information solicited through the teachers' interviews included the strategies used by the teachers, the challenges faced, and the support given to enhance the integration of IK into CCE during the Advanced Level Geography lessons (Appendix 2).

The researcher discussed the consent form with the participants before engaging in the interviews and allowed them to sign it and assured them that their names would be kept

anonymous, and they had the right to withdraw from participating if they did not feel uncomfortable.

During the interviews, the researcher used the combined questions and situational or environmental questions as guidelines in generating data as more follow up questions are undertaken. The interviews were conducted in English and captured using field notes and audio-recorded with permission from the participants.

The voice recording ensured a fuller record of the information and allowed the researcher to focus on how the interviews were progressing without missing any shared experience (Greef, 2011).in addition, the field notes helped the researcher with the transcription and describing his/her observations of the participants (Barrett & Twycross, 2018). These field notes also helped him/her not to forget anything that happened during interviews. Subsequently, the researcher transcribed all data collected from the semi-structured individual face-to-face interviews, with added information from interview field notes. All data were transcribed word for word, and no data was added or left out by the researcher. The interview field notes also helped the researcher understand how the participants felt when answering questions on the phenomenon under study.

4.6.3 Lesson observation

The researcher employed lesson observation as a second research method in this study. The overt observation was adopted, and the participants were informed to get their permission that he would observe them during the geography lessons. During lesson observation, the researcher gathered teacher data by observing behaviour and events or noting physical characteristics in their natural setting. The researcher was involving all senses to examine the experiences of the participants in their natural settings (Ramamurthy, 2014: 155). Additionally, the researcher was taking field notes on the behaviour and undertakings of individuals at the research site.

As Hora and Ferrare (2013) noted, the lesson observation provided rich and detailed accounts of the teaching and learning on IK into CCE. They further explained that it is through observation of action that researchers can obtain richly contextualised accounts of what teachers do, how they do it and when.

Moreover, observational data, allowed the researcher to understand the integration of IK into CCE to an extent that is not exclusively possible using only the insights obtained through interviews or documents. Thus, like Cohen, Manion and Morrison, (2011), observation enhanced the researcher to experience facts, such as the number of learners, resources, and assessment tasks during the teaching process. The researcher had experiences on events as they happen in the classroom such as the kinds of groupings done in to perform tasks, and the behaviours or qualities of the teacher including their friendliness or the veracity of aggressiveness. While observations can be participatory or non-participatory (Creswell, 2014). In this study, the researcher conducted non-participatory lesson observations. Non-participatory lesson observation is a sub-method of observation method where the researcher observes the behaviour of people without intervention (Ramamurthy, 2014). This method involves minimum interference from the researcher (Creswell, 2014).

Lesson observations enabled the researcher to have direct experience with participants and being able to record information as it occurred. They enabled the researcher to focus on observing and recording what was taking place during the geography lessons regarding the integration of IK. They were also helpful in triangulating of data with what was generated in document analysis and semi-structured interviews regarding the integration of IK in CCE in Advanced Level Geography curriculum. Four Advanced Level Geography lessons were observed at each school through the permission from the teachers. The researcher gathered information on the teaching strategies (e.g., group work, notes taking, learner presentations, etc.), the resources used (textbooks, resource persons, internet, teaching aid etc.) and the assessment tasks set with regards to the integration of IK in CCE in class by the teachers. The information gathered was recorded on an observation schedule **(Appendix 4).**

4.6.4 Document analysis.

The researcher used document analysis as a third research method to analysis and interrogate the different forms of documents and giving voice and meaning on the integration of IK in CCE in Advanced Level Geography curriculum.

This involved the examination of standardised artefacts in many formats spreading from notes, case reports, contracts, annual reports, or experts' opinions which were used as institutionalised traces on evens that characterise an institution (Borg & Gall, 2006). Ritchie and Lewis (2010) posit that documents serve two purposes in that they are a basic source of background information, activities as well as ideas about important questions to pursue through more direct observation and interviewing. Two groups of documents were analysed according to Bowen (2009) namely: primary and secondary source. The primary documents which were analysed had direct physical relationship with the events being examined (Cohen, Manion & Morrison, 2000). These documents were those which were prepared by the school or by the implementers of the curriculum following what is laid down in the secondary documents. In the case of this study, such documents included the school syllabus, the scheme books, teachers' lesson notes and assessment tasks (examinations and class test) that schools use to teach Advanced Level Geography in Zimbabwe.

Secondary sources, on the other hand do not have a direct physical relationship with the event under study (Maree, 2007). Thus, the researcher included the curriculum policy statement, the National Syllabus, teaching guides, publications and textbooks documents that schools use in the Advanced Level Geography curriculum, or the integration of IK into school subjects. The researcher carefully read each document and extracted the information relevant to the implementation of IK into CCE in the Advanced Level Geography curriculum in Zimbabwe, with the aid of a document analysis schedule **(Appendix 3).**

4.7 A summary of the research methods

Table 4.7.1 is a summary of the research methods and tool that were used in the study.

Research Method	**Participants**	**Research tools**
Semi-structured interviews	• One Geography District Inspector • Four Advanced Level Geography teachers (two per school)	Interview schedule (Appendix 1) field notes Interview schedule (Appendix 2). Field notes

Lesson observation	• Eight Advanced Level Geography lessons (four lessons per school)	Observation schedule (Appendix 4) and Field notes
Document analysis	• Primary documents (scheme books, and Lesson plans). • Secondary documents (Nziramasanga, National Syllabus, Geography Syllabus, Curriculum Framework for Primary and Secondary Education 2015-2022 (MOPES, 2015), ZIMSEC Advanced Level Geography Question Papers.	Document analysis schedule (Appendix 3) and Field notes

4.8 Data Analysis

The research aimed to explore the integration of IK into CCE in the Advanced Level Geography curriculum. The researcher used a qualitative approach and a case study design for this quest. To make sense of data, the researcher had to scrutinize, clean, transmute, and model data to discover useful information, propose conclusions, and support decision-making (Ramamurthy, 2014). Since the interpretivism paradigm was adopted for this study, the researcher attempted to derive data through direct collaboration with the phenomenon with teachers at the two selected schools and the district inspector. The researcher adopted an inductive approach to analyze, describe, interpret, and select codes to construct themes from the collected data. Therefore, an inductive approach was suitable for this study because it allowed the research findings to emerge from the common, most dominant, and significant themes natural to the raw data (David, 2003). In this case, the researcher had to do an in-depth reading of raw data to develop concepts and themes through interpretations made from the raw data. This allowed research results to arise from recurrent, dominant, or significant themes innate to the raw data without the restrictions imposed by structured methodologies (Agunis and Solarino, 2019).

In addition, the researcher made sense of data regarding the participants' definitions of the situation, noting patterns, themes, categories, and regularities" (Cohen, Manion & Morrison, 2011:461).

Finally, the researcher transcribed data word for word. This was followed by coding the data into different themes. In transcribing data, the interview field notes helped the researcher understand how the participants felt when answering questions on the phenomenon under study. The researcher identified consistent, interesting, and relevant patterns through the inductive data analysis, as shown in the data collected concerning the researched topic.

Using inductive approach, the researcher split the data analysis process into five main phases as suggested by Denscombe (2007) which are:

1. Data preparation and organisation,
2. Identification of obvious trends,
3. Grouping of data,
4. Presentation and display of data, and
5. Validation

During Phase 1 (Data preparation and Organisation), at this phase, the researcher collected data, organised it and transcribed it for analyses using the mental model technique.

The mental model technique of data analysis involving listening to the interview responses, transcribing it and thoroughly reading the transcribed data severally (Lonchmiller & Lester, 2017). Thus, at this phase, the researcher gathered data from interviews, classroom observations and documents. The researcher read and listened to the data several times and noted down basic ideas. Furthermore, at this phase of data analysis, the researcher transcribed all interviews on a word processor, coded, categorised and checked the data for correctness. The next phase was identification of obvious trends in the data. During this phase, researcher entered data into excel spreadsheet to help identify the trends. The third phase was grouping of data.

During this phase, the researcher coded and assembled codes into themes in order to compare them. These themes were reviewed, revised, and checked to determine whether they aligned with the codes. The Final codes were formed from the most descriptive wording for the topics. Topics related to each other were grouped in order to reduce the total list of categories. The researcher drew Lines between the categories to demarcate their relationships. The researcher then developed the categories of themes (informed by the research questions) in order to assist in the analysis and presentation of data. The next and fourth phase was presentation and display of data. At this phase, themes were interpreted and written up; the data was now written up as a narrative that tells a story using the themes identified in stage three. Lastly was the validation of the data phase. The researcher used methodological triangulation to check through the themes generated in order to see the synchronisation in order to validate the data coming from the transcribed interviews, observation and document analysed.

4.8 Trustworthiness of the study

In this section, an outline of how issues of study trustworthiness were addressed in the study is provided. Reliability and validity, which are used to ensure the rigor of research work in the positivist paradigm, are conceptualized as trustworthiness in the interpretive paradigm (Gunawan, 2015) and assert that the trustworthiness of a research study is central to evaluating what it is worth. Trustworthiness is concomitant to the qualitative research approach and refers to how qualitative researchers make sure that credibility, dependability, confirmability, and transferability are evident in their study (Agunis & Solarino, 2019). Gunawan (2015) adds that strategies for establishing credibility, transferability, dependability, and confirmability need to be put in place for the trustworthiness of qualitative research.

4.8.1 Credibility

Credibility is the degree to which the results of a qualitative study can be credible and believable (Saldana, 2016). Anney (2014) defines credibility as when the research findings agree with reality. To ensure the credibility of the results of this research, the researcher used multiple research methods, including semi-structured interviews, document analysis, and lesson observations to triangulate data.

This is supported by Agunis and Solarino (2019), who state that data credibility is attained through rectitude, depth, richness, and scope of the data, together with the extent of triangulation and degree of objectivity of the researcher. Moreover, Stahl and King ((2020) posit that the researchers need to record truthfully the phenomena under scrutiny. Thus, the researcher spent extended periods at the participating schools (prolonged engagement) to build rapport with the study participants and referred the data to the participants for cross checking (member-checking) (Saldana, 2016).

The researcher also had debriefing sessions with the supervisor and other critical friends and piloted the research instruments to identify and minimise researcher flaws, bias and preferences in the generation and interpretation of the data.

4.8.2 Transferability

Transferability is the extent to which the results of qualitative research can be applied to other contexts and settings (Gunawan, 2015). Because, this study adopted a single case study approach, the process of generalisation that appropriately matches it is “inferential generalisation” which is best illuminated as generalising from the context of the research study itself to other settings or contexts (Ritchie & Lewis, 2003). In this case, therefore, it is a prerequisite that the researcher files and justifies the methodological approach and describes, in detail, the critical processes and procedures that have helped the researcher to construct, shape, and connect meanings associated with those phenomena.

Further, throughout the study, the researcher was sensitive to potential biases by being conscious of the possibilities for multiple interpretations of reality. The researcher provided detailed information and justifications for the study’s methodological approach, data analysis and interpretations for ease of comparison by other researchers. The researcher also provided detailed, thick descriptions of data so that those interested in transferability would have a solid framework for comparison, as indicated (Creswell, 2018).

4.8.3 Dependability

When researchers talk of dependability, they will refer to data stability over time and conditions (Anney, 2014). Often, dependability is analogous to reliability, that is, the uniformity of observing the same findings under similar circumstances. Creswell (2018) argues that dependability is the extent to which the study could be repeated by other researchers and similar findings are found to be consistent. Therefore, dependability is an evaluation of the quality of the integrated data collection process, analysis and theory generation (Anney, 2014). In this study, the researcher took the following steps to achieve dependability.

One of the steps the researcher took to achieve dependability was to explain in detail the curriculum implementation theory by Rogan and Grayson (2003). The researcher dedicated the whole of chapter three to the theory explanation and how it informs the study. The researcher's next step in assuring dependability was using multiple methods of data collection and analysis (triangulation). Again, a considerable amount of time was spent in preparation for the interview guide, document analysis schedule, and class observation schedule to ensure that the instruments took the necessary information required to assess. Moreover, using the three instruments was significant for this study for triangulation purposes (confirming emerging findings). Furthermore, the researcher explained in detail how data was generated to allow for an audit trail if required. Closer to that, the researcher took data and tentative interpretations back to the people from whom they were derived and asked them if the results were plausible (member checks).

During the research, the researcher constantly interacted with peers (critical friends) who reviewed, read and reread every stage of the study and suggested changes where possible. Furthermore, the researcher worked together with the supervisors, who also made sure that all was done and in line with the research questions, theoretical framework, and methodology. In addition, the piloting of research instruments was done to ensure their effectiveness and to make modifications. Lastly, as stated by Robson and McCartan (2016), the researcher made sure that the research process was logical, well-documented, and audited to ensure dependability in this study.

4.8.4 Confirmability

Confirmability is the gradation of neutrality in the research study's findings (Diehl, Guion & McDonald (2011. It is equivalent to objectivity, that is, the extent to which a researcher is conscious of or accounts for individual subjectivity or bias. In other words, this means that the findings are based on participants' responses and not any potential bias or personal motivations of the researcher (Creswell, 2018). This implies that, as far as possible, the findings should be based on the experiences and ideas of the informants rather than the characteristics and preferences of the researcher (Stahl and King, 2020). In this research, confirmability was ensured by discussing the results with critical friends and other experienced researchers. Further, the researcher made sure that auditing was possible by other researchers by archiving all collected data in a well-organized and retrievable form so that they could be made available to them if the findings were challenged.

4.8.5 Piloting

To pilot a study is to have a feasibility study intended to assess coordination and gather information before a bigger study to improve the study's quality and efficiency (Ayesha & Khan, 2020). Crossman (2019) states that a pilot study is conducted after a larger piece of research to determine whether the methodology, sampling, instruments, and analysis are adequate and appropriate. Ayesha and Khan (2020) further give two reasons for using pilot study in social sciences: as a trial run done in preparation for a significant study and or as a pre-testing or trying run for a particular research instrument. In this study, piloting was done to try out the research instruments that were used for the study. The researcher used the semi-structured interview guide for teachers and an inspector. In addition, the classroom observation guide and document analysis guide were the other instruments used for the pilot study. For this study, piloting was carried out at one high school other than the two high schools selected for the main study since they possess similar characteristics.

During the piloting, one geography teacher and an education inspector took part in the study to test the semi-structured interview instrument. A form six lesson was also observed, while a lesson plan of a form five class was used to test the document analysis protocol. The researcher informed the participant that the study was a pilot study to test

research instruments. The interview process lasted for about 45 minutes for the teacher and the education inspector. During the pilot study, little adjustments were made to research instruments as some of the questions did not seem clear to participants. The researcher had to add some probing questions to the instruments. The pilot study gave a picture of the whole study and the suitability of the instruments to the main study.

Procedures in administering the research instrument in this study.

The study used three research instruments to gather data about integrating IK into CCE. These instruments included interviews with teachers and education inspectors, lesson observations, and document analysis. These instruments were designed by the researcher to help collect data about the study research question.

The key research question:

How is IK integrated into CCE in the Advanced Level Geography Curriculum in selected high schools in the Gwanda North District of Zimbabwe?

Sub- research questions

The following sub-research questions were set to help answer the main research question:

- What is IK integrated into CCE in the Advanced Level Geography Curriculum at the selected high schools?
- What pedagogical strategies are used by teachers in the integration of IK into CCE in the Advanced Level Geography Curriculum at selected high schools?
- What challenges are teachers facing in integrating IK into CCE in the Advanced Level Geography curriculum at the selected high schools?
- How is the integration of IK into CCE in the Advanced Level Geography Curriculum supported?
- What implementation framework could be used to improve IK integration into CCE in the Advanced Level Geography Curriculum?

The interviews

The researcher used two sets of interview guides: one for the teachers and the other one for the education inspector.

The teacher interviews

The interview guide for teachers had 18 semi-structured interviews questions. These questions pertained to the types of IK integrated into CCE in the Advanced Level Geography curriculum, the strategies the teachers used in the integration of IK into CCE, the pedagogical and assessment strategies used by the teachers. It also had questions on the support given to the integration of IK into CCE, including the challenges that were being faced. There were four teachers who were interviewed, two from school A and the other two teachers from school B. Each teacher was given an average of forty minutes. Before the interviews were held, the teachers were briefed about the purpose of the interview, that they had the right to withdraw from the interviews, confidentiality was assured. The teachers were presented with the consent forms. The teachers opted to use their offices as venues for the interviews. The researcher asked questions, and the teachers would respond. There were pauses during the interview to all the respondents to have deep thoughts and ask questions where issues were not clear. All the four respondents did not consent to their responses being audio recorded but allowed the researcher to take down the notes.

The education inspector interview.

The education inspector was briefed about the purpose of the interview, he was also informed that he had the right to withdraw from the interviews, confidentiality was assured. The education inspector was given the consent forms. The interview was carried out in the office of the inspector and was done in forty-three minutes. There were seventeen questions in the education inspector interview guide. These questions pertained to the types of IK in the Advanced Level Geography curriculum, the strategies the teachers used in the integration of IK into CCE, the pedagogical and assessment strategies used by the teachers. It also had questions on the support given to the integration of IK into CCE, including the challenges that were being faced.

The education inspector like teachers, did not consent to their responses being audio recorded but allowed the researcher to take down the notes.

Lesson Observations

The researcher observed eight advanced level geography lessons at the two schools through the participants permission. All the four teachers were informed about the purpose of the lesson observations and were given the informed consent forms. The researcher organised for lesson observation at the two schools. These lesson observations were held in two consecutive weeks. In the first week, the researcher observed two form of fives lessons at each school. At school A, the lessons were carried out in a normal classroom. And at School B, the lessons were carried out in a Science Laboratory. Each lesson was at least sixty minutes long. The researcher recorded all the classroom interaction on the observation guide sheet. In the second week, the researcher observed the two forms six classes at the two school. The observation guide had twenty areas to be observed. These included the objectives of the lessons, the content, classroom interaction activities, resources used and the assessment styles. Additionally, the data was recorded on the observation guide sheet.

Document Analysis

The researcher analysed ten documents that wee relevant to the integration of IK into CCE. Permission was sought from the authorities to analyse information from the different documents. These documents were the Primary documents (scheme books, and Lesson plans) and the Secondary documents (Nziramasanga, National Syllabus, Geography Syllabus, Curriculum Framework for Primary and Secondary Education 2015-2022 (MOPES, 2015), ZIMSEC Advanced Level Geography Question Papers.

Through the assistance of heads of schools, the researcher was helped to gain access to the teachers' documents. The researcher used the document analysis worksheet with thirty criteria for analysis. These criteria had leading statements on the types of IK in the Advanced Level Geography curriculum, the strategies the teachers used in the integration of IK into CCE, the pedagogical and assessment strategies used by the teachers.

It also had questions on the support given to the integration of IK into CCE, including the challenges that were being faced. All information observed were written on observation analysis sheet.

4.9 Ethical Considerations

In this section, the focus is on how ethical research issues were addresses during the study. Ethics are "what is or what is not legitimate to do, or what moral research procedure involves" (Neuman, 2006: 129). This study involved obtaining data from human participants. Water-Adms (2006) states that as long as the research involves other people, then it has ethical implications. In support of that, Bloom and Crabtree (2006) note that a problem for such research is how to balance probing for detail with respect for privacy, and for human dignity. It was therefore proper for the researcher in this study to abide by the rules and principles of ethical research. Therefore, as Lester et al (2020) put it, ethical considerations should not only be done during research planning but should be a central part of the entire research process. Accordingly, De Vos, Strydom, Fouche & Delport (2013) define ethical principles in research as a set of criterions that guide researchers on how they should interact with research participants. The following discussion highlights the diverse strategies that were used to guarantee that the study adhered to ethical research.

In this study, from the onset, the researcher was attentive to the fact it was his responsibility to ensure that the study was conducted, and the results disseminated in an ethical manner. Thus, before proceeding with data gathering, the researcher sought ethical clearance from the University of Fort Hare Hare's research Ethics Committee. After obtaining the ethical research certificate, written permission was obtained from the Ministry of Primary and Secondary Education in Zimbabwe, the Matabeleland South Provincial Education Director (P.E.D) the heads of schools and participating teachers from the selected schools. Permission was also sought to record the interviews, and to observe teachers' lessons. Also, this was after the participants were clearly briefed on what the research would entail, the procedures to be adopted, and the requirements from their side in terms of time and resources.

The researcher made it clear to the participants at the onset that the research was for academic purposes only, and that at the researcher was not going to make payments at the end of the study or provide financial assistance or benefits of any kind.

Before data were collected, the participants were given a Participant Information Sheet (Appendix 12) which served as an introduction and invitation to the research and described their involvement. It contained all information about how confidentiality and anonymity was to be maintained. Furthermore, all participants were requested to sign a Formal Consent Form (Appendix 13) and were accorded the option not to answer any question, and to withdraw from the study at any time during the research process.

Lastly, all data collected were kept anonymous and confidential, pseudonyms were used to safeguard the identity of the participants and schools that were involved in the study. In addition, transcripts did not include the participants' names or other personal details, and identifier codes were used on all data files. To protect data confidentiality, the list of participants and schools and their identifier codes, and the copies of the transcripts were stored separately in a locked cabinet. Soft copies of the transcripts had passwords and were backed up on a password protected laptop, external hard drive, computer disk and flash drive. All these were stored under lock and key in different places as an added measure of safety. Backups were also done on the internet, and these were also password protected.

Chapter Summary

This chapter explicitly unpacked the methodology and data tools were used to collect data (semi-structured interviews, lesson observation and document analysis). The inductive approach was used to analyse, describe, interpret and select codes to construct themes from the data that was collected. This was followed by coding the data into different themes. The interview field notes, and voice recording were used when transcribing data. The descriptions were done and supported by different scholars. Lastly, the chapter looked at how issues pertaining to the trustworthiness of the study and adherence to ethical research principles were addressed. In the next chapter presents the study's findings.

CHAPTER FIVE

PRESENTATION OF RESULTS

5.1 Introduction

The previous chapter (Chapter 4) outlined the research methodology adopted for this study. In this chapter, the presentation of results of the study based on the analysis of the data that were generated to answer the study's research questions was done. As indicated in Chapter 1, the purpose of the study was to investigate the integration of Indigenous Knowledge (IK) in climate change education (CCE), within the Advanced Level Geography curriculum at two high schools in Gwanda District, Matabeleland South Province in Zimbabwe. To generate the data on which the results are based, three research methods were used, namely structured interviews, lesson observations and document analysis. The interviewees were the Education Inspector, and four Advanced Level Geography teachers from the two participating schools. Eight Advanced Level Geography lesson observations were conducted, and ten different documents analysed **(see Section 4.7).**

Participants' Profiles

Since the study was basically qualitative in nature; the researcher had to be thorough on the knowledge about the participants in the interviews. This context helped the researcher to understand the perspectives and experiences shared during interviews or discussions. The biographic information on the participants is very significant in the study in order to identify participants experiences in the field based on age, teaching experience Inspectorate experience and qualification. This means that they are well informed and will be able to relevant and give rich results. Thus, indeed, the demographic information helped the researcher to identify themes within the data and get the rich results as expected. Additionally, the analysed data were collected from one purposefully selected Education Inspector and the four selected Advanced Level Geography teachers in the two schools. The total number of participants in this study was five.

Furthermore, the researcher promised the study participants that their views, identities, and those of their schools would remain completely anonymous. The following codes were used for the participants EI for the Education Inspector, T1 and T2 from the school A, and T3 and T4 from school B.

Biographic Information

The tables below illustrate the background information of the current study participants. The information was important because it shows how genders, races, educational qualifications, working experience, and schools were represented in the study.

Representation of the Education Inspector:

Table 5.1. Demographic characteristics of the Education Inspector.

Age	Gender	Race	Teaching Experience in years	Inspectorate experience	Highest Qualifications
50-59	M	African	30	12	M.Ed

All the participants in this study were Africans and this is common in most schools in Zimbabwe except for few private schools. The Education Inspector was in the age range of between 50 and 59. He had taught in schools, was also a head of schools, and subject inspector and lately has been an Education Inspector in the district. He had both educational qualification and administrative qualification. This then suggests that the results might be rich in information based on his vast experience in the teaching field.

Table 5.2. Representation of teachers

Teacher	Age	Gender	Race	Teaching experience in years	Qualification
T1	40-49	M	African	14	M.Ed

T2	40-49	M	African	23	B.Ed
T3	40-49	M	African	17	B.Ed
T4	30-39	M	African	11	M.Ed

T1 was a male teacher between 40-49 years. He held an M.Ed degree, a bachelors' degree and a diploma in education. T1 had been in the teaching field for 14 years. While **T2** was a male practitioner between 40 to 50 years. He had obtained a B.Ed degree and a diploma in education and had 23 years of teaching experience. **T3** was a male teacher aged between 40 and 49. He held a B.Ed degree and had been a teacher for 17 years. **T4** was also a male teacher aged between 30 and 39 years. This teacher had 11 years of teaching experience, and he holds an M.Ed All the four participants have been Geography examiners at national level. They had each been marking the subject for at least 8 years. The variations in experiences based on age enriched the analysis as the responses they would give were well informed. This then suggests that the results might be rich in information based on his vast experience in the teaching field.

The results presented here were founded on the major themes that emerged from the analysis of the data in response to the study's sub research questions, which were:

- What IK is integrated into CCE in the Advanced Level Geography curriculum at the selected high schools?
- What pedagogical strategies are used by teachers to integrate IK into CCE in the Advanced Level Geography curriculum at the selected high schools?
- How is the integration of IK in into CCE in Advanced Level Geography curriculum being supported?
- What challenges are faced by teachers in the integration of IK into CCE in the Advanced Level Geography curriculum at the selected high schools?

Details of the themes that emerged from the data are provided in the following sections.

5. 2 Types of Indigenous Knowledge integrated into Climate Change Education in the Advanced Level Geography Curriculum

The study investigated the types of IK that are integrated into CCE in the Advanced Level Geography curriculum at the two high schools that participated in the study. The analysis of the generated data revealed five different types of IK that were integrated into CCE in the Advanced Level Geography curriculum, namely:

- Beliefs about celestial bodies
- observation of vegetation condition
- beliefs about animals, birds and insects' behaviour
- nature conservation practices
- traditional sustainable farming practices.

Details related to each type of IK that was identified are provided below.

- ***Beliefs about celestial bodies***

The study exposed that at the two schools that were investigated, traditional beliefs about the sun, moon and stars were integrated into CCE during Advanced Level Geography lessons. For example, Teacher1 noted:

> *When facilitating a topic on Climatology to the form fives, specifically on weather conditions and rainfall, I usually refer my learners to our traditional beliefs about observation of the celestial objects like the sun, the moon and the stars. The approaching rains can be predicted by a pool of clouds that surrounds the moon. In contrast, when the moon is full, traditionally we do not expect rains in the following couple of days or even weeks*.

Teacher T2 had this to say:

> *When teaching the form five IKS and diseases, I describe to the learners the situation where the moon blocks the sun or the opposite (solar eclipse and the moon eclipse). It is believed that this scenario brings disease (blindness) to the community or worse bad omen, such as floods and drought*.

Teacher T3 explained:

> *In teaching form five learners on weather prediction, I have always referred to the intensity of the sun during the rainy season. Traditionally this can also be used to predict whether the rains are coming or not. I explain that we grew up knowing that the stronger the intensity of the sun, the higher chances of the rains. On the other hand, if the sun is less intense, traditionally, we expect no rains.*

The analysis of Document D1 (T2's notes) also revealed reference to the traditional use of the position of celestial bodies to predict changes in weather patterns. It was stated thus:

> *The terrestrial objects include: the sun, the moon and the stars. A mere look for example at the moon at night can reveal that rains are close. The approaching rains can be predicted by a pool of clouds that surrounds the moon.*

D3 (scheme book for T4's) had the following example: … *when it is full moon, there would be no rains.*

References were also made to celestial bodies and weather patterns in the assessment tasks that were set during the geography lessons at the two schools. For example, one assignment task that was given to learners during Lesson observation LO2 stated:

> *With reference to examples, assess the effectiveness of the use of terrestrial bodies in predicting weather.*

At school B, as part of the Continuous Assessment Learning Area (CALA) learners were asked to:

> *Compare and contrast the traditional and scientific methods of predicting weather in trying to adapt to CC effects.*

- ***Observations of Vegetation condition***

During the interviews teachers explained that they teach their learners about how traditional knowledge about the condition of vegetation is used to predict weather patterns and to test for the presence of underground water in each area, as part of CCE.

For example, Teacher T1 had this to say:

> *In my lessons on Climatology in form five on weather prediction, I usually refer to how people can foretell whether rains will be abundant in that particular year by observing the number of fruits some types of trees have. For example, if trees like "Muchakata" bear many fruits, it is a sign of drought*.

Teacher T4 stated:

> *In a weather forecasting lesson with the form five class, I refer them to the observation of vegetation. If trees show some new leaves, it is a clear sign that rains are approaching*.

The teachers also described how they integrate traditional methods of water surveying into their lessons on Hydrology (water quality and quantity).

T3 had the following to say:

> *Whenever I get into the form five class on the topic of hydrology, especially on water survey, I bring to the attention of learners the IK of dowsing. When surveying for water (dowsing), the elders use wet sticks of some certain trees, this would indicate where there is water and as such would dig a well. The elders know the different ways of surviving at the effects of climate change*.

Teacher T4 said:

> *When facilitating on hydrology to the forms five, when it comes to surveying underground water, I usually ask my learners to share the meaning of the presence of the different types of trees in the environment. There is much evidence that certain types of trees like the Fig tree, indicate abundance of underground water*

storage. This has been in use since time immemorial. The knowledge about the abundance of water where Fig trees are, helped our elders to adapt to the effects of climate change

Document analysis of the geography textbook (DA 4) revealed a picture of a man using sticks and copper wires as illustrations of traditional ways of dowsing.

- ***Beliefs about the behaviour of animals, birds and insects***

During the interviews, the geography teachers described how they incorporate traditional knowledge and beliefs about animal, bird and insect behaviour when teaching about CC to their learners.

Teacher T4 said:

In my interaction with forms five on climatology specifically rainfall prediction and on food security in form six under agriculture, I refer my learners to the traditional knowledge that has been in use by our forefathers that the observation of animals Antelope, Zebras and other mammals) leads to a better understanding of rainfall pattern for that period. For example, when such animals, reduce the number of calves they give birth to, shows scarcity of pasture resulting from less rains. In that regard, humans need to copy or be adequately prepared.

Similarly, Teacher T2 was quoted saying:

Under Climatology on rainfall prediction, I usually task my learners to ask their elders on the meaning of sounds made by certain birds, and equally the presence of certain birds. It is believed that the Secretary bird (Hwaya), is a secretive bird that only appears just before the rains. It also produces some sounds, if that happens, we know for sure that there will be heavy down pours in the area. This is equally so with the swallow birds that fly high in the sky during the day. It is believed to be a sign of impending rains.

Teacher T3 had this to say:

When teaching on Agriculture about planting season and on Climatology on rainfall prediction, I usually introduce my learners to the traditional knowledge of migratory

birds. These birds always visit our area, when there is rainfall, one would not see them during dry season. Moreover, they visit when the rains are above normal. So, this IK helps farmers on what crops to plant and when to plant.

Teacher T1 further explained that during lessons on food production with the form six, he brings learners' attention to the traditional beliefs about the behaviour of insects.

A mere look at insects specifically the ants, you would see them carrying and stocking food, this is a sign to the farmer, as it shows that the period coming has shortage of food. This is equally so when one looks at the white and flying ants, to the farmer their coming out of the holes signifies the onset of the rain season and so is time for planting

- ***Nature conservation practices***

The teachers also described several examples of traditional nature conservation practices that they refer to when teaching about CC during their Geography lessons. These included traditional farming methods, the use of taboos and sacred places as a form of nature conservation.

For example, Teacher T2 had this to say:

… in my lessons with the forms five and forms six on environmental management and conservation, I usually refer my learners to their totems. In most cases, animals in Zimbabwe are used as totems. These include among others the lion, elephant, zebra, buffalo, leopard, hyena, and crocodile. This leads to conservation of the animal that is said to be a totem. One is not allowed to eat their totem. Invariably, the animal referred to is conserved and sustained and that curtails the effects of climate change.

Teacher T3 said:

Our elders have always conserved the environment using Taboos. So, when interacting with my learners on the topic on environmental conservation with the forms five and forms six, I usually ask them to name the different taboos in the society. For example, on mountain Nyanga, one is not supposed to go further up the mountain, if that happens the person will just disappear. This taboo has been

in place since long back and has helped in conserving the Nyanga Mountain. This in a way reduces the effects of climate change.

T2 added that,

When teaching about conservation, I ask learners to identify abominable behaviours in their communities. Learners usually bring about sexual activities, religious activities (Christian baptism, tourism activities like photo shooting, disclosure of information of religious sites), desecration of sacred places which are contrary to local cultural beliefs are endangering our country's culture.

Discussions on traditional nature conservation practices was conducted during Lesson observations LO1 and LO3. Teachers also set questions related to traditional forms of nature conservation during their Geography lessons. During Lesson observation LO2 the teachers assigned learners to name examples of different taboos in their communities and their implications to environmental protection. Document (D6) contained the following question: *Distinguish between traditional and modern methods of conserving nature.*

An analysis of the teacher's notes used during the geography lessons (DA 4), revealed references to traditional methods of nature conservation under the topic on environmental management, which include beliefs about sacred places like the traditional "Njelele area" and traditional farming methods like nomadic pastoralism and shifting cultivation. The same document also included reference to the use of taboos as a form of indigenous nature conservation practice against the effects of climate change.

- ***Traditional sustainable farming practices***

Results from the study also revealed that the teachers discussed various traditional sustainable farming methods when teaching CC-related agricultural geography topics. These include shifting agriculture, bush fallowing, mixed farming, intercropping, transhumance and conservation farming.

Teacher T1 had this to say:

When teaching about the effect of climate change on Agriculture, food production and security to the forms six, I usually refer learners to the traditional ways of

farming. Our elders used shifting cultivation. This method was guided by wisdom. It helped them to conserve the environment, especially the soil. This would help in the conservation of conservation of the environment.

Teacher T3 also noted:

Our elders practiced mixed farming, intercropping and zero tillage in managing their environment. So, as I teach my learners on sustainable farming methods to combat the effects of climate change in food production, I refer to the use of these traditional methods.

In Document DA 3 under the chapter on Agriculture, there is mention of numerous traditional farming methods as examples of conservation farming. These include the digging of holes during the dry season to conserve water, and the use of manure to sustain crops during drought.

Furthermore, during lesson observations LO5 and LO6, T4 lectured to his learners on IK related conservation practices. The teacher informed the learners that traditionally farmers mix different crops in the for storage in the granaries. In the same lessons, Teacher T4 taught his learners that sweet potatoes, watermelons and other fresh vegetables were put in underground holes to maintain their freshness after harvesting.

5.3 Pedagogical strategies used by teachers in the integration of IK into CCE

To understand the pedagogical strategies used by teachers to integrate IK into CCE in the Advanced Level Geography curriculum, the researcher generated data through interviews, lesson observations and document analysis. The data that were generated were classified into the following themes:

- Teaching methods
- Setting assessment tasks on IK
- Seminars / Presentations on IK
- School excursions on IK
- Case studies on IK

Details on the above strategies are presented in the following sections.

Teaching methods

A major group of strategies used by the teachers to facilitate the integration of IK in CCE was identified as teaching methods. Data from the teacher interviews exposed the use of various teaching methods in the integration of IK into CCE during their Advanced Level Geography lessons. The teaching methods that were mentioned by the teachers were: the lecture method and research projects. Details about each of the teaching methods are given below.

Lecture method

Interviews with the teachers and the Education Inspector, document analysis and class observation showed that the lecture method was widely used in the integration of IK into CCE. The Education Inspector had this to say:

> *Zimbabwe like another developing countries lacks on the use of modern methods of teaching. This is albeit the recommendation by many educationists, teachers still feel that they are the bearers of information to the learners. While others feel that the lecture method allows the teacher to complete the syllabus well on time.*

All the teachers indicated that they used the lecture method when discussing CC issues during their lessons.

Teacher T1 had this to say about the lecture method:

> *The lecture method is my major teaching method. I sue t because when dealing with large classes of say 70 learners at a time, it would help me move fast. I will be able to teach exactly what I want within a short period of time, unlike these other methods where I end up not finishing what I would have prepared for.*

To sum up on the lecture method, T4 had this to say:

> *I can easily manage my time well with the lecture method. These other methods are not effective when we are targeting the large volumes of work that needs to be covered in the geography curriculum where IK and CCE fall under. Moreover, when I get into the class, I will be exam driven. So, it is better for me to use the lecture method as it is fast and convenient.*

Evidence from all the eight lessons that were observed showed the over reliance by teachers on the use of the lecture method when teaching

Research projects on IK

Research projects were also revealed as a common teaching strategy when integrating IK in CCE among all teachers who were interviewed. For example, teacher T2 had this to say about research projects:

> *These days, I use Continuous Assessment of Learning Areas (CALA). This CALA is an assessment tool employed by the Ministry of Primary and Secondary Education (MOPSE) to encourage research amongst learners particularly in emerging issues such as IK and CCE*.

To confirm with T2, T4 had this to say:

> *When it comes to IK and CCE, I usually guide my learner to do research projects. This allows learners to use their own background experiences. It also allows cooperation among learners while addressing challenging situations like IK and CCE in their natural settings. As an example, I would take learners to the local community affected by soil erosion then I go on to assess them to work in groups and use IK to conserve that soil.*

Data generated from the analysis of teachers' schemes of work revealed that teachers asked learners to conduct research projects on CCE related IK. For example, in teacher T3's scheme of work, learners were asked to individually research on how observations of celestial bodies could be used to predict weather and changes in weather patterns. The learners were tasked with writing a report on their findings. Another example of a research project on CCE related IK was set by teacher T4. This research project required learners to identify and describe one environmental problem in their communities, and to write a research report on traditional methods that can be used to address it.

Setting assessment tasks on Indigenous Knowledge

All the teachers that were interviewed exposed that they use both the formal and the informal assessment tasks to help their learners understand and appreciate the significant uses of IK in addressing CC concerns in their communities. As an example, teachers T4 and T3 commented thus:

> T4: *I have always asked my learners to identify the different totems used in their community after that they also name out the different animals there around. I would go on to ask them to explore how much reverence they give to these animals. Finally, would ask them check on how many animals are saved from extinction as a result of CC. in this way, I would have assessed my learners on identification skills, analytical skills, evaluation and application skill in IK and CCE.*

> T3: *Sometimes I asked my learners to use IK in predicting the amount of rainfall during a particular season. And the learners would bring a lot of knowledge ranging from observation of fruit trees, movement of birds, direction of wind etc*

Teachers' use of formal and informal assessment during lessons on IK and CC was also confirmed during some of the lessons that were observed during the study. For example, during lesson observation LO4, T4 asked the following question: *What are the traditional methods of predicting the occurrence of drought*? (8)

Also, during lesson observation LO1, T1 gave learners the following questions as a homework task:

> *Explain, using examples give four traditional ways of conserving farm produce as a measure to address food insecurity due to climate change in your area. (12)*

During Lesson observation (LO2), Teacher T3 gave the following questions as IK related assignment tasks:

> *Explain four traditional methods of agriculture in drought prone areas*. (12)

> *Evaluate the effectiveness of traditional methods of water surveying in your area.* (13).

Seminars and presentations.

Data from the teacher interviews showed that seminars and presentations were used to help learners understand and appreciate better the role of IK in CCE. This is evident in what teacher T2 said:

> *Towards examinations, it has been our tradition as Advanced Level geography teachers that we meet either at cluster level, district or even at provincial level to allow learners from various schools to interact, debate on issues and share ideas. This strategy has been a success for us especially in topical issues like* IK and CCE.

In support of what T2 said about seminars, T3 said the following:

> *Seminars are an interface among learners, teachers and all who are into the subject. We have been meeting as Geography teachers, where we would share ideas on the new trends in the subject. I remember in 2017, when we met at Midlands State University. The gathering was electric and helpful. We have also been organising such gatherings for learners so that they could exchange knowledge on topics like IK and CCE which are new within the curriculum.*

The Education Inspector also reiterated the geography teachers' use of seminars on IK as a teaching and learning tool in CCE during Geography lessons. This is what he said:

> *Schools usually come for permission to have seminars, and permission has been given especially looking at new learning and emerging issues in Geography like CCE and IK*.

School excursions

All the Geography teachers that were interviewed indicated that they use school excursions to help them integrate IK into CCE. For example, T4 had this to say about such excursions:

> *IK and CCE in Geography are outdoor subjects, therefore, the local environment plays a crucial role in place of the laboratory. I have always used excursions to*

allow my learners have a feel of what really happens out there. For instance, in Agriculture, population, hydrology and environmental conservation. Learners need to use all their senses, thus the need to have school excursions to the actual places where phenomena take place.

Corroborating with what T4 said about the use of excursion in the integration of IK in CCE, T2 had to say this:

Excursions are part of the geography curriculum meaning to say one cannot do without them. When I am teaching about resources conservation, I usually plan that my learners should visit the very places where these resources are conserved like going to the Nyanga mountains. I believe, during the visit to such places, learners have an experience on how the traditional people there have managed to conserve their resources. Thus, the element of IK into CCE.

However, some of the teachers said it is not always possible to organise such excursions due to various reasons. T3 explained that she could not take her learners on such an excursion last year because of the COVID-19 restrictions on movement of learners.

This is what T3 had to say:

I had pencilled for a trip with my learners to Binga, to get in touch with how the Tonga people manage their environment and understudy their farming activities. This did not come to pass because of COVID-19 restrictions. However, I want to note that excursions are essential in IK and CCE in Geography as they make learners have a direct experience of concepts under study and do give a hand on feel of the subject.

Similarly, T1 stated that the reason they sometimes failed to take learners for excursions was because of financial incapacitation within the school. The D7 books of teachers T1 and T2 showed that the two teachers had planned for a school excursion to a traditional shrine as part of a CCE lesson. However, in their teacher reflections they noted that the excursion did not take place because of the financial constraints at the school.

This is what T1 had to say:

> *I have always planned for excursions in my schemes with the intention of going for excursions. This sometimes has failed because the school would fail to avail resources citing financial challenges*.

Case studies

Case studies were mentioned as being used to integrate IK in CCE.

As evidence to the use of case studies, T2 had this to say:

> *To have a deeper understanding of traditional farming methods, I ask learners to have a thorough look at communities where these practices are done.*

As evidence of the use of case studies, T4, added that:

I have often referred to When it comes to floods adaptation strategies, people in Tsholotsho and Muzarabani. Agriculture, I use the Southeastern Low veld, etc.

The use of case studies was referred to as evidenced in the D7 books for T1 and T4.

5.4 Support given to the integration of Indigenous Knowledge into Climate Change Education in the Advanced Level Geography curriculum.

This research also aimed to investigate how the integration of IK into CCE in the Advanced Level Geography Curriculum at the two schools was being supported. Interviews with teachers and the Education Inspector were used to generate the necessary data. The data were categorised under three main themes, which were financial support, materials support, and professional development in IK integration. Details of each type of support provided are presented in the following sections.

Financial support for integrating Indigenous Knowledge into Climate Change Education

Participants who were interviewed during the study all complained about the insufficient or total lack of financial support to facilitate the integration of IK into CCE. Although the schools receive financial aid from the government, it is for general school purposes, rather than directed at supporting the integration of IK into CCE.

For example, the Education Inspector had this to say:

> *While the government of Zimbabwe through MOPSE render financial support inform of School Improvement Grant (SIG) to schools, these monies are not specifically for supporting the integration of IK into CCE. The monies are usually tied to the general development of school i.e., building the school, the purchase of resources and other materials for new curriculum. This is just general!*

Teacher T4 had this to say about the lack of financial support for IK integration at her school:

> *We receive some finances from the government the (community in form of fees), and other well-wishers. However, this money is hardly directed to IK and CCE. I would say, there is inadequate support in the integration of IK into CCE in our school.*

To sum up teachers' view about financial support for IK integration into lessons,

T2 had this to say:

> *Yes, monies come into the school through fees, SIG, and even projects, but this money is not specifically for IK into CCE. Although we may indirectly benefit from it, it is usually meant for other businesses within the school.*

Materials Support for integrating Indigenous Knowledge into Climate Change Education

During the interviews with the teachers and the Education Inspector, complaints were raised about the poor material support for integrating IK into CCE. This inadequate material support referred to the poor availability and provision of teaching and learning support materials, and Information Communication Technologies (ICTs).

The Education Inspector had this to say:

> *The Ministry (MOPSE) provides every school with the new curriculum documents and support material such as the Curriculum Framework for Primary and Secondary Education 2015-2022, TPS handbooks, circulars on culture huts*

construction at every school. All these support services are based on the Education Commission Inquiry which was done in 1999 and led by Nziramasanga. However, there are no support material directly linked to IK into CCE. So, I would say the integration of IK into CCE suffers from little to no support.

The teachers also complained about the lack of information on IK. They said they relied mostly on their textbooks for information on IK, and most times this information was inadequate. For example, Teachers T1 and T3 had this to say about the availability of teaching resources on IK:

Teacher T1:

I have always struggled to get information on IK. The books themselves are not enough. To add to that even if I go on internet, there is scanty information or even materials on IK. Furthermore, there are no video clips there in that I could use as referral points as I will be teaching on this topic.

Teacher T3 also added that:

the area of IK is still very new in the field of publication. There is shortage of information. I have never seen a pamphlet on IK nor posters. This makes the integration of the subject a major challenge.

The interviews with the teachers revealed that while the Zimbabwean government has donated computers to schools, there is inadequate internet coverage, which hinders teachers' access to online resources on IK. For example, Teacher T3 stated:

The school received 10 computers from the government through the Presidential school to aid the new areas through ICT. However, our internet at this school is not accessible to everyone but members of the administration only since the majority have no access to the passwords.

Teacher T4 also bemoaned the absence of internet coverage in schools. This is what he said:

> *Internet services is a major challenge within the school. It was going to be better if we had the intent coverage. Maybe we would be able to google on our own issues pertaining to IK into CCE. Now that there is no internet, we end up relying on hearsay.*

Professional development in Integrated Knowledge integration.

The study also showed that the teachers did not receive any professional development in integrating IK into CCE. The few workshops that are organised for teachers are on Geography topics in general rather than focusing on IK and CCE. The Education Inspector had the following to say:

> *Whilst the facilitation of the teaching and learning of Geography and other subjects in the new curriculum, the government sometimes organises (for example training workshops on syllabus interpretation and the use of CALA as an assessment tool), IK and CCE have so far not had such workshops. This remains a big challenge in its dissemination and integration.*

The teachers also commented on the lack of in-service training in IK integration. For example, Teacher T2 said:

> *We never had any training in IK into CCE. The last training, we had in Geography was to do with remote sensing and the use of CALA as an assessment tool. Maybe we do not have enough human arsenal in this field.*

Also, T4 had this to say:

> *the workshops were very few and short that as teachers we do not come with enough information on IK and CCE. While some of these workshops were not specifically on IK into CCE. They are always centered on the exams and have little to do with IK into CCE. I therefore call for more time on IK and CCE.*

5.5 Challenges faced by teachers when integrating Indigenous Knowledge into Climate Change Education in the Advanced Level Geography Curriculum.

One of the objectives of this study was to investigate the challenges faced by the teachers at the two selected schools in integrating IK into CCE in the Advanced Level Geography curriculum. To generate the necessary data, the researcher used interviews, document analysis and lesson observations. Evidence coming from the data that were generated, shows that during the integration of IK into CCE in the Advanced Level Geography Curriculum, teachers face several challenges. The data generated on the challenges was grouped into the following themes:

- Non-availability of clear policy on the integration of IK into CCE
- Teacher factors
- Lack of resources for IK integration.
- Use of ineffective teaching methods

Details of the above listed themes are provided in the sections that follow.

The non-availability of a clear policy on the integration of IK into CCE

All the interviewees agreed that there was lack of a clear policy to support and guide teachers on the integration of IK into CCE in the Advanced Level Geography Curriculum in Zimbabwe. They indicated that in the Advanced Level Geography Curriculum the guidelines for teachers were mostly on the teaching and assessment of various Geography topics, rather than on integrating IK into CCE. As an example, Teacher T2 had this to say:

> *There are only recommendations in the curriculum framework, Nziramasanga and even the Syllabus. However, I believe if it was a clear policy, then we would all be compelled to teach IK effectively.*

Similarly, Teacher T4 made the following comments about the lack of policy guidance for integrating IK into CCE:

> *The integration of IK into CCE lacks the legal basis. You find that the issue is found behind other policies (e.g., on culture, languages etc*). Moreover, *the constitution of Zimbabwe Amendment no20, Act 2013, Article 16 calls for educationists to*

uphold the cultural heritage. And it further calls for preservation of traditional knowledge (Article (33).

Teacher factors

Interviews with the teachers and the Education Inspector unpacked two challenges which fall under teacher factors. These were identified as lack of teacher training in IK, and the negative attitude by teachers towards IK.

Lack of teacher training in IK

All the teachers who were interviewed indicated they lacked both pre-service and in-service training in IK, which negatively affected their ability to effectively integrate IK into CCE during their lessons. For example, Teacher T1 had this to say about his pre-service training in IK:

> *I was trained in the 1980s, and during our time in college, there was no formal curriculum on IK and CCE. These issues were never taught to us, except the then topical issues on HIV and AIDS. We only got to know about IK and CCE in the early 2000, but then it was only a talk in the print media and none of these were formally taught to us. For me to then teach about these, it is really a challenge. In all as teachers, we lack training on IK and CCE.*

Teacher T1 further commented:

> *I am not a qualified teacher in IK. This should be a subject on its own. I am trained in Geography. They should bring a qualified teacher in IK or hire a spirit medium, while Teacher T4 said: These are contemporary issues which we never heard of when we were still in college. Therefore, we cannot effectively teach these topics*.

The Education Inspector also maintained the view that paucity of training of teachers in IK was a challenge hindering the smooth integration of IK into CCE in the Advanced Level Geography Curriculum. This was evident from the discussion with the him where he said:

My visit to schools, shows that teachers lack skills and are not very comfortable on the teaching of IK and CCE. I can attribute this to lack of training in the subject matter.

The data from the study further revealed that in-service training in IK was not provided to the teachers either. For example, teacher T3 commented thus:

Since the introduction of the new curriculum in 2015 with the introduction of IK into CCE into the Advanced Level Geography Curriculum, so far there has not been any in-service training for me to be able to effectively teach these areas. Instead, I must rely on internet information, which is very scanty and not related specifically to our curriculum.

Teacher T2 corroborated Teacher T3 by saying:

From 2015, with the advent of IK and CCE in the Advanced Level Geography curriculum, I thought I would be trained on what exactly to teach, but alas! Until today I have not been formally oriented to these issues, yet I am expected to effectively teach them. Hence learners must find information for themselves, and for us we source information from fellow teachers through our social groups. Thanks to WhatsApp.

Negative attitude by teachers towards IK

The second teacher factor that was identified as a challenge to the integration of IK into CCE at the two selected schools was the negative attitude some of the teachers had towards IK.

Teacher T1 demonstrated this negative attitude in the following excerpt:

I do not actually see sense in introducing IK into a syllabus which is supposed to produce a learner who is to link to a technologically globalised economy. Its tantamount to introducing stone age tools in this world of mechanised agriculture.

Well because they tell us to teach, I will teach only for learners to pass the exam, but not that the information suits the contemporary society.

A negative attitude towards IK was also evident during the interview with T3 when he said:

IK is a type of education which has strong links with African Traditional Religion (ATR). This religion is at odds with my Christian beliefs. For example, I believe that God the creator produces rain, but am asked to teach learners that spirit mediums can be rain makers through mukwerera. I do not believe in what I am asked to teach; hence I am only teaching for the sake of the syllabus requirements.

The negative attitude towards IK by teachers was also noted by the Education Inspector had this to say about the teachers:

When it comes to integrating IK into CCE by teachers, the implementers (teachers) are at a crossroads. They are heavily compromised. Thus, they have developed a negative perception on IK because of the western education that demonised our culture.

Some of the teachers placed the blame on their learners' lack of interest in traditional beliefs. T2 had the following to say about her learners and IK:

Most of my learners always question me about the validity of teaching them about IK into CCE in this computer world. They go further to ask where on Earth will they apply the information.

Teacher T4 was also of the view that learners do not care about IK:

All my learners are Christians. The clash of belief systems makes them shy away from IK, and even if you give them homework, they will always find some flimsy reasons for not doing it. For example, they tell me that they did not find an appropriate person to ask, as a way of shying away from doing the homework.

Lack of resources for Indigenous Knowledge integration into Climate Change Education

The study unveiled two major factors that fall within the category of lack of resources for effective IK integration into CCE. They were identified as the shortage financial resources, and the unavailability of educational materials on IK.

Lack of financial resources

During the interviews, the teachers identified their schools limited financial resources as one of the reasons that prevent them from carrying out activities that foster the integration of IK into CCE during their lessons. These activities include the purchase of resources on IK, and the sponsorship of in-service training as well as school excursions, or seminars, on IK and CCE.

As a testimony to the above, T2 had this to say:

> *I made requests to the administration for me to carry out a field trip to Njelele last year. But until now, the response is saying the school coffers are empty, and they always say they are running on a shoestring budget.*

Teacher T3 stated:

> *I requested, through my Head of Department (HOD), for the invitation of an exam marker in physical geography to orient us on IK but the administration is always promising me that if they get the money to transport and pay the examiner, they will give the green light to call the person. By the way it is six months since I made the request.*

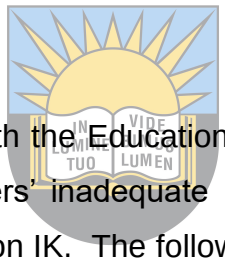
Lack of educational resources

Data generated from the study also revealed that schools are faced with a severe shortage of teaching and learning materials on IK. For instance, this was highlighted in the following excerpt by teacher T1:

Presently, the major textbooks am using at the Advanced Level Geography is R.J Small and David Waugh. These textbooks have nothing on IK. It is unfortunate that most of the textbooks we use are western textbooks, and they do not cover any aspect of IK.

To further underpin the lack of educational resources on IK teacher T4 had this to say: *I usually have challenges in teaching IK to my learners because I do not have formally published material resources on this topic.* The lack of teaching and learning materials on IK is further exacerbated by the schools' poor access to internet where IK related materials may be available. For example, teacher T2 had this to say:

Our school is connected to the internet but is not always available to us as teacher and learners. It is available to members of the administration, with their complicated passwords which are always changed frequently, and are a guarded secret.



In relation to ICTs, the interview with the Education Inspector revealed the shortage of ICT devices in schools and teachers' inadequate ICT skills as playing a role in their inability to access internet sources on IK. The following is what the Education Inspector had to say:

Some of our schools are connected to the internet, but the most challenging issue is the lack of adequate computers to access the internet by both teachers and learners. I have also noted that some of our teachers are analogue teachers in a digital world.

During the lessons that were observed during the study, none of the teachers used additional educational materials on IK such as posters, pamphlets or video clips. During lesson observation LO1 and LO3 for example, both teacher T1 and T3 were only lecturing, and did not use any educational material on IK and CCE.

Use of ineffective teaching methods for Indigenous Knowledge integration into Climate Change Education

In all the lessons observed during this study, the researcher noted that the teachers had overreliance on the use of the lecture method in the teaching of IK and CCE. The lessons were teacher dominated and did not make use of learner centered teaching methods such as the discovery method, hands on learning approaches, problem solving and design-based methods. The dominance of the lecture method during lessons on CC issues was also confirmed by the teachers, who gave several reasons why they rely mostly on lecturing when integrating IK into CCE. For example, Teacher T1 said:

> *When I teach on IK into CCE, I usually use the lecture method while here and there I ask questions. This I do because I feel it appeals to those leaners who learn by listening. This in all the has also allowed me to have maximum control of the and the learning experiences.*

Teacher T3 corroborated by saying:

> *The use of the lecture method allows me to present large amounts of information in a short space of time. Remember our learning is more for certification. The results count, so as a teacher I cannot waste time on no issues.*

Ineffective assessment of Indigenous Knowledge in national examinations

The teachers that were interviewed expressed concern with the way IK knowledge and skills are assessed in national Advanced Level Geography examinations in Zimbabwe. The teachers stated that questions that are specifically on IK are seldom set, and when they occur, they are mostly low order questions and carry only a few marks. Hence the teachers attach less importance to IK when teaching about CC issues during their Geography lessons. They instead concentrated on teaching core Geography topics such as climatology, hydrology or population studies. For example, Teacher T2 had this to say about the assessment of IK:

> *The 'O' Level questions have direct requirement for one to study IK, hence at 'O' Level, IK is given adequate coverage in the exams. However, we as Advanced*

Level Geography teachers do not attach much value to teaching IK because there are no direct questions on IK in the national exams.

Teacher T4 expressed similar sentiments in saying,

I only emphasise on IK during CALA, because there are no direct questions in IK in the national examinations. And for sure I know they are not there. Moreover, the CALA questions on IK are not compulsory to all. One can take it or select any other of their interest.

Chapter Summary

This chapter presented the results generated from the data that were collected during the interviews, lesson observations, and document analysis in response to the study's research questions. The results focused on the types of IK that teachers at the two schools are currently integrating into CCE during their Geography lessons, the pedagogical strategies they use, the support they enjoy facilitating this process and the challenges they face. The next chapter is a discussion of the study's results.

CHAPTER SIX

DISCUSSION OF RESULTS

6.1 Introduction

In the previous chapter, the study's findings regarding the integration of IK into CCE in the Advanced Level Geography Curriculum at two selected high schools in the Gwanda North District of Zimbabwe were presented. This chapter presented the discussion of the study's results. The discussion was guided by the study's theoretical framework and by the insights obtained from comparing the study's results with those from other similar studies that were accessed from literature. The discussion also explored the implications that the study's results had for effective integration of IK into CCE in the Advanced Level Geography Curriculum at high schools in Zimbabwe.

6.2 Types of Indigenous Knowledge Integrated into Climate Change Education in the Advanced Level Geography curriculum.

This section discussed the results of the types of IK integrated into CCE by the teachers who partook in the study. When integrating IK into CCE, teachers needed knowledge about the different types of IK that could or should be integrated into the different school subjects. Kugara, Kugedera, Sakadzo, Chivhenge and Museva (2021) identified eight major types of IK that related to CC in Zimbabwe. These eight types of IK included: plant and animal phenology for seasonal climatic forecasting, religious views: Taboos and myths, cultural beliefs on natural resources, indigenous ways of gathering medicinal plants, value of IK in disaster risk reduction, observation of weather systems and traditional agricultural adaptation strategies (Kugara, Kugedera, Sakadzo, Chivhenge and Museva, 2021). Studies across the globe have prescribed the use of various types of IK into education including CCE. These other types of IK that are integrated into education apart from the Kugara etal (2021) include: folk stories, artifacts, traditional games, traditional calendar, among others. The Ministry of Primary and Secondary education in

Zimbabwe is also calling for the heritage-based curriculum. The heritage-based curriculum is an educational approach that integrates the values, traditions, languages, and histories of a community into the curriculum. In line with the ministry's approach, one of the objectives of this study was to explore the types of IK integrated into CCE in the Advanced Level Geography Curriculum at the selected high schools.

An exploration of the different IK types that are integrated into CCE was found to be vital as it enhances the quality and relevance of education. Kugedera etal (2021) noted that traditional knowledge about production in trees helps learners to be able to investigate and envisage the onset of the dry season. The IK that relates to bird migration can also help learners understand how traditional agricultural communities prepare for the different seasons. IK that is based on traditional religious views on nature can teach learners about moral order on the usage and exploitation of natural resources, which contribute to biodiversity conservation knowledge. IK that relates to agricultural practices can improve learners' knowledge and understanding of the role of traditional agriculture strategies in mitigating the effects of CC. Schools need to tap into local knowledge and skills about biodiversity and resources management through a close watch of their vegetation to make CCE lessons relevant (Abar, Mashebe & Denuga, 2015). The knowledge about traditional farming practices when integrated in CCE allows learners to use their prior knowledge of various concepts and assists learners to apply them in real life situations (Abar, Mashebe & Denuga, 2015), which helps them link with their immediate environment (Ronoh, 2017). This approach would be in line with the heritage-based philosophy being advocated by the Zimbabwe education system.

Globally, several studies have reported on the integration of different types of IK into different school subjects. For example, in Namibia, Sheya (2014) noted that traditional knowledge about termite behaviour as a predictor of rainfall was integrated into the EE curriculum at some schools. IK about the observation of insects particularly termites was found to be common in the two schools that were sampled. This implies that among traditional communities in Southern Africa, there are common IK practices that point to the same belief system. This belief systems if are well documented and be found in books across the region, can be of benefit in CCE.

Sheya also revealed the use of traditional taboos when teaching about biodiversity conservation during EE lessons. Similarly, in South Africa, a study by Nnadozie (2009) described how Zulu traditional taboos formed part of the integration of IK in the teaching of grade 10 life sciences. While in the Philippines, among the Timor-Leste community, learners are taught about how traditional knowledge about the movement of the sun, moon, and can be used to predict storms, floods and drought during CCE (UNESCO, 2015). In the integration of IK into Geography lessons at schools in Uganda, Kagoda (2009) stated that traditional beliefs about the moon were included as part of weather forecasting knowledge.

However, while the study by Kugara at.al (2021) identified eight major types of IK in Zimbabwe that relate to CC. However, this study revealed only five main types of IK that the geography teachers at the two high schools integrate into CCE (Section 5.2: presentation of results), namely:

- Beliefs about celestial bodies
- observation of vegetation condition
- beliefs about animals, birds and insects' behaviour
- nature conservation practices
- traditional sustainable farming practices.

Hence only a limited number of IK types are currently being integrated into CCE in the Advanced Level Geography curriculum at the two schools, which is contributing to partial and ineffective integration of IK into CCE at the schools that were investigated. The limited number of IK that was found to be integrated into the school curriculum may not be because of shortages of such information in the communities, but lack of documentation. Educationist are challenged to document this information as it is found to be of helpful in CCE.

The inclusion of more IK types into CCE would contribute to a universal and holistic approach to CCE. For example, this study found that folk stories were absent from the list of IK types that the teachers integrate into CCE in the Advanced Level Geography

curriculum. Yet several researchers have reported numerous advantages due to the integration of folk stories into different science subjects Ronoh (2017) noted that in South Africa and Kenya, communities advocated for the integration of folk stories into the school curriculum. They argued that in science subjects, such stories would make learning interesting, and learners would have a better understanding of abstract topics in Science and Mathematics (Ronoh, 2017). The use of folk stories when integrating IK into CCE in the geography curriculum in Zimbabwe would lead to lessons being interesting, unique and life-long and relevant.

A study in South Africa by Naido, shows that the inclusion of folk stories in Mathematics curriculum helped improve learner understanding of mathematics (Naido, 2021). Although these benefits were noted in mathematics, they can also be experienced in the geography curriculum on CCE. Another study that was done in South Africa was by Seehawer (2018) who recommended the use of folk stories to help learners understand Grade 10 Life sciences content. Lastly, Sheya (2014) observed that since the traditional practice of telling stories around the fireplace is fading away, folk stories now needed to be included into the school curriculum to enhance teaching and learning in classrooms. While folk stories have been found to be of great benefits in the teaching of CCE, in the two school that were sampled for this study, they were found to be upsent. It is recommended in this study that in the integration of IK into CCE, teachers need to engage folk stories to convey lessons. Furthermore, schools need to invite elders to share stories that highlight the relationship between the community and the land. IK is found in communities, and it is in oral form, hence, the use of oral stories becomes a base for the integration of IK into CCE in the geography curriculum.

Another type of IK that is common in many traditional communities in Africa is the use of artefacts. These artefacts have found their way into the school system in some countries. However, findings from this study did not reveal the use of artefacts as part of the IK integrated into CCE in the Advanced Level Geography Curriculum. In countries where artifacts have been integrated in the school subjects like in South Africa, Naido (2021) identified beadwork, weaving, decoration and construction as a type of IK that were relevant and present in the school curriculum. In Kenya also, Tsindoli, Ongeti and

Chang'ach (2018) reported that the use of traditional artefacts was common in the teaching of Mathematics in primary schools.

Such artefacts like beadwork were found useful in teaching learners on shapes, measurement, angles and estimation (Tsindoli, Ongeti & Chang'ach, 2018). Artefacts makes teaching and learning more realistic, relevant and concrete. There are several artefacts in Zimbabwe that can enhance learning such as clay pots, beads, sculptures, weaving and decoration. These artefacts can play a role in the various topics on IK integration into CCE. The study of these artefacts could help learners understand the change in climate as denoted by the variety of these exhibitions. In all, the integration of artifacts into CCE enriches the learning experience, making it more engaging, relatable, and impactful. They serve not only as educational tools but also as catalysts for awareness and action. The study recommends the incorporation of artefacts in the teaching and learning of CCE in high schools.

Another type of IK that was found missing in this study was traditional games. Such games form part of the culture in African communities and several researchers have recommended their inclusion into school subjects. For example, in Uganda, Kagoda (2009) recommended that the integration of IK into Geography should include native games. The inclusion of games in the integration of IK in Mathematics in Kenya was also noted by Tsindoli, Ongeti and Chang'ach (2018). A similar study that was carried out in Kenya by (Naido, 2021) reported that when teaching Mathematics, the use of games as class activities made the lessons more learner centered. In Zimbabwe, local communities have many games that can contribute to more effective integration of IK into CCE in the geography curriculum. Additionally, the inclusion of games into CCE lead to learner engagement, understanding, proactive mindset towards addressing environmental challenges. Games serve as powerful tools for raising awareness and inspiring action among learners of all ages. Their absence in the teaching of CCE in the two selected schools cause great concern. In Zimbabwe, local communities have many games that can contribute to more effective integration of IK into CCE in the geography curriculum.

Based on the discussion above, there is another type of IK that was commonly integrated into school curricula was the traditional calendar. Indigenous people have knowledge about the seasons which they used to navigate their lives. Sheya (2014) investigated the integration the traditional calendar into EE in Namibia's schools, was found to be more relevant and concrete when traditional calendar was used, learners could apply the knowledge they got to the western calendar and seasons (Sheya 2014). Traditional calendars are very important to the native people of Zimbabwe (Tanyanyiwa 2019). Tanyanyiwa (2019) recommended the inclusion of traditional calendar knowledge in the teaching of CC in Zimbabwean Secondary Schools especially in topics like Agriculture, and Climatology. This traditional calendar has the naming of seasons based on the weather patterns prevailing. So, if well studied and integrated well in CCE, can promote its effective implementation as learners could the link the names of the months to the climatic or weather events of the time. This information can also help the learners to then assess whether there has been shifts in climate from the time these months were named to the present days. Is there a connection between the name of the month and the weather patten? Lastly, incorporating traditional calendars in the teaching of IK into CCE provides a culturally rich, locally relevant framework for understanding environmental issues. This approach leads to a deeper connection to the natural world and encourages stewardship.

Every group of people have a language as their identity. The Ministry of Primary and Secondary Education in Zimbabwe recommends the application of native languages as medium of instruction in the early grades of primary schools (MoPSE, 2015). Ronoh (2017) noted that the use of Is-Xhosa for instruction at schools in the Eastern Cape in South Africa would help learners understand Science and Mathematics concepts better. In Namibia, the Ministry of Education has a policy that recommends the inclusion of the mother tongue instruction up to grade seven (Namibian Sun, 2014). The use of native languages in teaching improves the retention and comprehension of scientific concepts (Abar, Mashebe & Denuga, 2015). The teaching of climate change concepts in indigenous languages help to preserve linguistic heritage while promoting environmental awareness. The language classes should include vocabulary related to local plants, animals, and climate. However, it was observed during this study that when teaching on IK into CCE in geography, teachers used English as the medium of classroom interaction.

The use of English as the language of instruction, is found to be notable as the final examinations are in English. It is thus sustainable for the native educators to develop and write down vocabulary on IK and CCE.

Another type of IK that was common in many school curricula but was found to be absent among those that were integrated into CCE at the two selected schools were traditional health sciences practices. Indigenous people rely on various plants and animal species to meet their health care needs (Abar, Mashebe & Denuga, 2015). Traditional knowledge about health sciences has been reported to be included in the school curricula in Ghana and Nigeria (Abar, Mashebe & Denuga, 2015). Schools in both Kenya and South Africa have also been reported as integrating indigenous health sciences in the science curricula (Ronoh, 2017). The knowledge of the indigenous health sciences helps to improve understanding and relevance of Science and Mathematics among learners (Ronoh, 2017). Zimbabwe has many traditional medicines that can be engaged in the teaching and learning in CCE. During the COVID 19 period, the use of traditional medicines has been on the rise. However, more need to be integrated into the school curriculum. It should be noted that when such information becomes common and popularised in the while school system, then it shall not be looked down upon and this leads to sustainability.

6.3 Pedagogical strategies used by teachers to integrate Indigenous Knowledge into Climate Change Education

This section discussed the results of the pedagogical strategies used by the teachers during the integration of IK into CCE. In the teaching of IK and CCE, pedagogical strategies can be combined and adapted to create a dynamic and effective learning setting that meets the needs of all students and nurtures engagement, critical thinking, and teamwork.

6.3.1 Teaching Methods

Data generated during the study revealed that the lecture method was the most dominant teaching method used by the four teachers when integrating IK into CCE during their Geography lessons. Lecturing is viewed by many teachers as being the most convenient

teaching method when material and financial resources available in schools are limited (Sheya, 2014). The lecture method is also said to be suitable when presenting genuine information and when teaching a large class (Gitau, 2008). During this study, it was observed that very few material resources in terms of textbooks on IK in CCE are available. Hence the teachers were the major sources of information, which contributed to the overuse of the lecturer method as a teaching strategy. Most high schools in Zimbabwe are under resourced and overcrowded, hence the popularity of this teaching method among teachers (Tanyanyiwa, 2019). The lecturing method also allows for speedy coverage of content in the curriculum (Kagoda, 2009). Some geography topics such as Climatology, Agriculture and Biogeography are lengthy, as such the use of lecture method helps teachers to teach at a faster pace. Tanyanyiwa (2019) reported a similar dominance of the lecture method in the integration of IK into CCE at secondary schools in Zimbabwe.

The dominance of the lecture method at schools elsewhere in Africa has been reported on by other researchers. In Uganda for example, Kagoda (2009) reported that when integrating IK into Geography lessons at secondary schools, teachers largely employ the lecture method and are the major sources of knowledge. In Namibia, a study by Sheya (2014) also recorded overuse of the lecture method by teachers during the integration of IK into EE. Sheya (2014) believed the Namibian education system is still focused on terminal national examinations, as such teachers prefer the lecture method to meet their curriculum targets early enough. Ronoh (2017) described teacher centered teaching methods such as the lecturing method as being rampant at schools in South Africa and Kenya. The dominance of the lecturing method at Zimbabwe's schools is contrary to the recommendation by (MOPSE, 2015) that teachers use more learner centered teaching approaches.

The disadvantages of the lecture method of teaching, especially in science education are well documented in literature. The lecture method limits learners' participation in the lesson and as such fails to develop their power of reasoning (Thungu, 2008). Tanyanyiwa (2019) further argued that during lecturing, teachers act as Gatekeepers to knowledge. This limits learners' ability to take their own initiatives during lessons and being

responsible for their own learning. The lecture method also fails to consider the way learners communicate and think (Abah, Masheeb & Denuga, 2015).

Ronoh (2017) argued that the lecture method contradicts the constructivists theories of learning that children should actively construct their knowledge rather than observing and memorising ideas and facts spoken by teachers. It is thus pivotal that the integration of IK into CCE is done through learner centered teaching methods which allow for culturally inclusive and meaningful teaching and learning. The move away from teacher centered teaching approaches when integrating IK into school curricula would also help link learners to their communities. Such practices would make CCE learning lifelong rather than being segmented and confined to classroom teaching at schools (Naido, 2021). Despite the well documented advantages of active and participatory learner- centered teaching methods, this study revealed only limited use of such teaching methods during the incorporation of IK into CCE during Geography lessons.

The overreliance on the lecture method is associated with the old type of teachers who do not want to change to the new demands in the society. Hence the need for teacher in-service training on new pedagogies. This is in line with the Rogan and Grayson (2003) model on curriculum implementation: the need for teacher capacitation and continuous development. Lastly, while lectures can be a useful tool for introducing concepts, relying solely on this method in CCE hinders engagement, understanding, and the development of critical skills needed to tackle environmental issues effectively. More interactive and student-centered approaches are often more effective in conveying such complex topics.

The study recorded that only some of the teachers made use of research projects, Seminars, Case studies and School excursions as teaching methods when integrating IK into CCE. The use of Research projects as a teaching method is recommended by the Ministry of Primary and Secondary Education in Zimbabwe (MoPSE, 2015) as one of the learner-centered teaching methods that teachers should use in their classrooms. Research projects engage leaners in addressing real life problems connect teachers and learners to life in community that leads to knowledge generation (MoPSE, 2015). Kagoda (2009) further notes that research projects are a powerful teaching strategy for teaching Geography as they help link classroom knowledge with real world experiences. Research

projects develop social values like cooperation, learning by doing and links the learner to direct life experience (Ronoh, 2017).

Abah, Mashebe and Denuga (2015) posits that the use of research projects in the integrating IK into sciences helps learners develop hands on activities as well as collaboration with communities. The incorporation of projects into CCE enriches the learning experience, promotes engagement, and equips students with the skills and knowledge needed to tackle environmental challenges effectively. In the current curriculum, learners are assessed through projects (CALA). It has also been noted that this approach fosters a proactive attitude toward sustainability and community involvement however, many learners, parents and teachers are resisting this form of assessment. This resistance is common whenever curriculum change happens (Mogoshoa, 2021). There is thus need for intensive education to all curriculum stakeholders on the use of CALA and its benefits.

MoPSE (2015) identifies case study as one of the strategies that need to be used in schools because they give detailed information on a subject understudy. Nnandozie (2009) identified cases studies as useful in IK integration in the school curriculum in South Africa despite the expenses associated with their use. Furthermore, the use of case studies helps educators and learners have reliable and informed information derived from the context and makes learning socially relevant (Sheya, 2014). In Geography the use of case studies is a common practice. However, most rural school and those who have few resources would rarely visit case places. In such an event, the government is encouraged to set aside resources to help all the under resourced schools so that learners could all benefit from visiting places and having a hands-on feel of reality.

Since IK is in the community, and is shared by word of mouth, it is vital that those who want to explore it visit its sources. In most of the topics in Geography where IK is integrated, learners need to have a feel of what transpires by being physically there. The use of excursions is advocated for by the Ministry of Primary and Secondary Education in Zimbabwe. MOPES (2015) posit that learning should be participatory; hence learners must be hands on when it comes to CCE. Kagoda (2009) noted that in Uganda the use of excursions linked the school with its community.

The study also showed that many of the well-known active learning teaching methods such as games, community collaboration, and stories were not used at all by the teachers when integrating IK into CCE. Yet traditional games have been found to be supportive in assisting learners understand the content of various subjects such as Science and Mathematics content. The engagement of games as a teaching approach in mathematics and sciences helps the class to formulate activities together and allows for cooperation and appreciation of the activities (Stemn, 2017; Naido, 2021). Another benefit of using traditional games in mathematics and science is that the rules that are agreed on in games help learners to appreciate data handling procedures in research (Hand, 2021). As such, learning becomes more meaningful since aspects of learners' cultures are incorporated in the class (Naido, 2021). When games are used properly, they help learners grasp concepts that seem to be abstract when informed from the Western world view. These benefits of using traditional games would improve the integration of IK into CCE in the geography curriculum in Zimbabwe.

IK integration calls for the creation and use of a network between the school and the community as a teaching method. Sheya (2014) reported that in Namibia during the integration of IK into EE, the community played an important role by providing information that is not found in school textbooks. Such contextualisation of teaching allows learning to be relevant and directly applicable to learners' daily lives (Seehawer, 2019). It was advocated by Kagoda (2009) that community collaboration allows link the community to the school, and allows for development of observational, investigative, deliberative, and evaluative skills as well as putting into practice the values learnt (2021) reported that when artefacts and other activities from the community were incorporated into the school system, it encouraged interactive mathematics learning. This same strategy of having synergies with the community on matters of IK integration into CCE in geography leads to its improved implementation. Integrating IK into CCE through community connections enriches the learning experience, promotes cultural understanding, and empowers students to engage meaningfully with environmental issues. It was noted that, when community visits were made in the two schools, only teachers and learners were involved. It is crucial that these community visits be led by elders. This collaboration is essential for

fostering sustainable practices and building resilient communities. It also links schools and the community.

The use of stories is another example by which IK can be integrated into CCE. researchers like Tsindoli, Ongeti and Chang'ach, (2018) believe that the use of stories in the teaching of IK helps a lot in transmitting this knowledge. Hewson, Javun and Haltman (2000), identified the use of stories as paramount in IK integration in science curriculum. Nnandozie (2009) also noted that during the integration of IK into Grade 10 Life Science lessons, stories helped learners to use their imagination to understand the content being taught. In Seleti (2015) it was revealed that stories can play a major role in IK integration by making learning more relevant and contextual especially in. When used in class, such stories can bridge the gap between home and the school as such end up motivating learners to participate more in class thereby an improved IK integration into CCE. IK are not found in the communities in written form, hence the need to interact through stories.

6.3.2 Assessment strategies

Results from this study indicated that the teachers considered summative assessment especially the end of year examinations to be more important than the formative assessment. Formative assessment strategies enhance understanding of climate change topics, promote engagement, collaboration, and critical thinking among learners. However, teachers did not make use of many formative assessment strategies that are commonly used in science education such as scaffolding, in class discussions, clicker questions, one-minute reflection writing assignments and surveys (Trumbull, 2013). Through the incorporation of diverse methods, educators can create a dynamic learning environment that addresses the complexities of climate issues.

MoPSE (2015) it is stressed that both formative and summative assessment should be integral parts of the teaching and learning processes at Zimbabwe's schools, and should be verbally or written, done individually or in groups, and continuous or terminal. South Africa's Department of Basic Education (DoBE (2011) also calls for both formative and summative types of assessment to cater for learners' cognitive, affective and

psychomotor domains. About IK integration into CCE or EE, formative assessment helps teachers to identify gaps in the content knowledge that is being taught and enables the teacher to take appropriate action. It also assists the teacher to change, modify or discard teaching methods in favour of other new methods of teaching (MoPES, 2015). Using formative assessment, the teachers can adjust their questioning techniques, can change the work assigned as written work. Furthermore, formative assessment helps teachers to make decisions on type of grouping strategies to be used to promote teaching and learning (DoBE, 2011). Lastly, through formative assessment the teacher can prepare extension and remedial work for relevant pupils (Trumbul, 2013). In line with the Rogan and Grayson (2003)'s curriculum implementation framework, teachers in the two schools sampled, need in-service training on new assessment strategies. This would help towards effective integration of IK into CCE in schools in Zimbabwe.

At regional level, a study by Sheya (2014) in Namibia, noted that many teachers do not set assessment tasks on IK since such questions were rarely set in the final national examinations. In Zimbabwe, Tanyanyiwa (2019) noted that secondary school teachers did not take formative assessment of learners in IK seriously and focused instead on other nationally examined topics. In South Africa also, a study by Knight (2015) that investigated teachers' experiences with the integration of IK into the Life Sciences curriculum in South Africa, it was reported that assessment tasks are sometimes non-formal, and that some teachers did not take IK integration seriously. There is a general agreement on the failure and hesitance by teachers to employ formative assessment by teachers in schools, albeit its relevance especially on issues about IK and CCE. Teachers need re-education, reorientation and alignment towards the new progressive assessment strategies.

The over reliance on summative assessment in EE has been reported by other researchers. For example, Ronoh (2017) noted that in Science and Mathematics education in both Kenya and South Africa teachers over rely on summative assessment. However, a study in Tanzania by Hardma et al (2012) deemed summative assessment as being unfit for the integration of IK into CCE. These researchers argued that summative

assessment only promotes memorisation in learners. In MoPSE (2015), it is pointed out that relying on summative assessment in the competency-based curriculum that is followed in Zimbabwe's schools is unsuitable because the product (learners) remains theoretical and will be lacking the practical skills that are needed to be solving real-life challenges.

6.4 Support for the integration of Indigenous Knowledge into Climate Change Education

This study revealed three types of support that the teachers indicated they receive for the integration of IK into CCE during their Geography lessons namely, financial, material and professional development support. Each type of identified support is discussed in more intensified manner in the following sections.

- *Financial support*

One of the major recommendations by COP28 on CCE in school was funding (UN DESA, 2023). Thus, the education budget takes a major slice of the national budget in many countries across the globe, including Zimbabwe. Schools in Zimbabwe receive financial support in form of government grants, private donations and fees collected from learners. Support to school in form of financial resources helps them to construct the physical infrastructure (internet facilities, and electricity as examples) in schools which are key constituents to the establishment of quality education (UNESCO, 2019). Financial support helps schools to purchase learning support materials which are also critical for successful implementation of any education programme (Loubser & Simalumba, 2016). Also, financial support is necessary for professional development support of teachers. For example, the trainers who come to schools, need to be transported to and from the schools and to be given allowances for them to do carry out their duties effectively (Melope, 2014).

Nevertheless, the four teachers who participated in the study complained about the lack of enough financial support to their schools which hindered the integration of IK into the school curriculum, including that of CCE. Teachers complained that they failed to conduct field studies, had short ineffective in-service training and lacked adequate learning

support material all because the funds which were coming into the schools were not directly meant for the integration of IK into CCE. Numerous similar studies have reported inadequate funding for the integration of IK into school curricula. For example, Sheya (2014) reported how low financial contributions from communities surrounding schools in Namibia hindered the integration of IK into EE. In South Africa, Hewson, Javu and Hortman (2000) noted inadequate financial support from the government as a challenge for effective integration of IK into the Science curriculum. In Kenya also, a study by Owuor (2007) revealed a similar shortage of financial support from the government for IK integration into school curricula. With limited financial support, schools may be tempted to solicit for donations. however, Owuor (2007) cautioned that the lack of financial support may lead schools to seek support from foreign donors who may in the end dictate curriculum policy that may work against the effective integration of IK into school curricula. There is need for proper and enough funding for the effective integration of IK into the Advanced Level geography curriculum in Zimbabwe. This would align with the COP28 recommendation on funding CCE in schools across the globe.

- *Material support*

In this study, the term material support, was used to denote those physical teaching and learning resources that facilitate and enhance the application of official curriculum policy in schools. In terms of effective integration of IK into CCE, such resources include textbooks, pamphlets, computers, artefacts, posters and models. In Canada for example, there is huge support given to schools in the integration of IK into the school curricula. As an example, there was an online tool for the Aboriginal perspective, this tool is used by teachers in class (Korteweg & Fiddler, 2018). This study however revealed a severe shortage of teaching and learning materials for-integrating IK into CCE.

The shortage of teaching and learning resources to support the integration of IK into school curricula in Africa has been reported by various researchers. For example, Risiro (2019) observed the lack of documented resources on the integration of IK in the teaching of weather and climate in Geography in Manicaland in Zimbabwe. Another study in Zimbabwe by Tanyanyiwa (2019) found that most teachers had challenges in the integration of IK in teaching CC in secondary schools because of the shortage of material resources like textbooks and other IK related publications.

Similarly, Manyanhaire and Chitura (2015) concluded that the lack of teaching and learning resources have slowed the integration of IK into the curriculum in Zimbabwe's schools. The lack of support in material resources is not peculiar to Zimbabwe alone but also occurs in other developing countries. For example, complaints about inadequate resources on IK in schools were also noted in both Kenya and South African schools by Ronoh (2017). The lack of material support has negative implications in the integration ok IK into CCE in the geography curriculum in Zimbabwe. For effective IK integration into CCE, there is need for these resources. Such a scenario where there is adequate material support has been reported in Canada, and the Philippines (Korteweg & Fiddler, 2018) and their IK integration in the curriculum is at an advanced state.

- *Professional development support.*

Professional development for teachers is necessary as it helps to equip them with both the content and pedagogical strategies for the implementation of new subject areas (Kalimaposo & Mleya, 2014). Teachers tend to teach what they were trained in colleges, hence when changes are done to the curriculum, teachers may become resistant to them unless effective and relevant in-service training is provide (Marom, 2019). In Canada and the Philippines, there is continuous professional development given to teachers on IK. Whilst this is in place, in the same countries they still call for more professional development (Kortewweg & Fiddler, 2018).

This study revealed that there was shortage of adequate professional development support for teachers when it came to IK integration into CCE during Geography lessons. The teachers further revealed that the few workshops that were conducted had nothing to do with IK or CCE. In addition, the workshops were said to be very short, general and examination oriented. The paucity of effective professional development for teachers in Africa in IK integration into school subjects including EE or CCE has been commented on by various researchers. For example, Marom, (2019) posits that the integration of IK in the school curriculum needed professional development in terms of personnel. He further argued that there was need for in-service training to prepare teachers for the curriculum change from being western dominated to the inclusion of IK.

The need for in-service training programme in EE for teachers was also recommended by Sheya (2014) to address the teachers' use of ineffective EE pedagogical strategies in schools in Namibia. The lack of professional development support on IK integration into CCE or in any other curriculum change in schools is a major cause of concern to curriculum policy makers and implementers worldwide (UNICEF, 2019) It demotivates the teachers who are the major curriculum implementers at schools as they lack the necessary IK knowledge, pedagogical skills, and attitudes. According to Reid (2019), teachers lacked the knowledge about CCE and IK. As a result of this challenge, the integration of IK into school subjects including CCE is failing to take root at many schools worldwide, including those in Zimbabwe. An example of Canada would work as yardstick towards an effective IK integration in CCE framework in the Zimbabwean geography curriculum.

6.5 Challenges faced by teachers when integrating Indigenous Knowledge into Climate Change Education

The integration of IK into CCE is a relatively new practice in Zimbabwe's schools. It is thus facing several challenges. Data generated from the two schools under study revealed that when integrating IK into CCE, teachers face the following challenges:

- Lack of clear policy on the integration of IK into CCE,
- Teacher factors,
- Lack of resources for IK integration,
- Use of ineffective teaching methods for integrating IK into CCE and,
- Ineffective assessment of IK in national examinations.

These results are discussed in detail in the following sections.

6.5.1 Lack of clear policy on integrating Indigenous Knowledge into Climate Change Education

Effective curriculum implementation depends on clear and relevant policies and guidelines that are easily accessible to teachers (UNESCO, 2017). A detailed and relevant curriculum implementation policy helps inform the teachers on executing the changes' demands (Mogoshoa, 2021).

A clear policy also helps demystify the change that comes with the new demands of the curriculum (Viennet & Pont, 2017) and enhances the confidence of the stakeholders (parents, teachers, policymakers, and donors) in the curriculum change (Mogoshoa, 2021). Policy support plays a pivotal role in the formulation, dissemination and implementation of the new ideals of the curriculum (Rogan & Grayson, 2003).

However, data from this study revealed the nonappearance of a clear policy on the integration of IK into CCE for schools in Zimbabwe. A similar study in Zimbabwe that looked at IK integration in schools by Risiro (2019) bemoaned the lack of a clear policy to direct how the implementation ought to be done. Researchers have reported similar results elsewhere in Africa, such as Kenya, South Africa, and Canada. Ronoh (2017) blamed the ineffective integration of IK into the school curriculum in Kenya and South Africa on inarticulate and discrete integration policies.

A study by Mosimege (2005) in South Africa, noted that although the school curriculum policy supported IK integration, it was not explicit on how this should be done. For example, there was no reference to the strategies for teaching and assessment that should be used by teachers. What is common from these studies is that although many countries including Zimbabwe are signatories to international conventions on IK integration into school subjects, they still face the challenge of formulating local policies to guide their teachers on how this can be effectively done, especially under poorly resourced education contexts.

In contrast, in countries such as Canada, Nepal, Australia and Namibia there are effective and clear IK integration policies in place to guide teachers in the process (Marom, 2019). Sherpa (2017) stated that a very clear policy on the integration of IK into CCE exists in Nepal, which has given teachers a framework on how to integrate IK into CCE, thus boosting their confidence in the process. Australia also has a clear policy on the insertion of IK into the school curriculum, and teachers are encouraged to be trained in the Aboriginal cultures to be adequately informed when implementing IK integration into the school curriculum (Moichela, 2017).

Sheya (2014) reported that in Namibia that the integration of IK in EE was hindered by inadequate resources rather than lack of the necessary integration policy.Zimbabwe needs to follow the footprints of these countries like Canada, Nepal, Australia, Namibia whose policies are clear on the integration of IK into their curricula. A clear policy on integrating IK into CCE enriches learning experiences and leads to sustainability. Eventually, by valuing diverse perspectives, schools can better prepare students to address the complexities of climate change.

6.5.2 Teacher factors

Teachers are major actors in the interface between the learner and the curriculum (Allen & Penuel, 2015). However, there are teacher related factors that may interfere with this interaction. This study revealed two key teacher related challenges, namely the lack of teacher training in IK, and the negative attitude by the teachers towards IK.

- *Lack of teacher training in Indigenous Knowledge.*

The study exposed that majority of the teachers who partook in in the research, lacked training in IK integration in CCE. Similar results were reported by Risiro (2019) who concluded that lack of the necessary training hindered teachers' ability to integrate IK in the teaching of weather and climate topics in schools in the Province of Manicaland in Zimbabwe. In his study, Risiro (2019) posts that teacher were unwilling to include IK in their lessons as they lacked the prerequisite training. This hesitance to include IK in their lessons is because teachers only implement what they were taught in colleges and universities (Tanyanyiwa, 2019). Another study which was done in Zimbabwe by Mandikonza (2019) also noted that although teachers know about IK, they fail to integrate it into their teaching because of lack of the necessary preservice and in-service training. The reason for the lack of training has been blamed on the western oriented education system in Zimbabwe. The lack of training in IK integration for teachers was also noted by (Tanyanyiwa, 2019) who stated that most serving members in the teaching fraternity in Zimbabwe were trained under the colonial system that did not appreciate IK.

There is thus need for in-service training for teachers to allow effective integration of IK into CCE in the geography curriculum in schools.

The lack of initial teacher training in IK integration has also been observed in other African countries, and beyond. For example, in South Africa, Kaya and Seleti (2013) noted that there was shortage of personnel at the University of Northwest who had proper training on the teaching and supervision of IK in education. Another study that revealed the lack of initial teacher training in IK integration in South Africa was by Nnandozie (2006). In Kenya Owuor (2007) and Ongeti and Chang'ah (2018) lamented that the country was struggling to incorporate IK into the formal education because of the absence of initial teacher training in IK. The lack of teacher training on IK integration into CCE has derailed its proper implementation.

- *Negative attitude by teachers towards Indigenous Knowledge*

The attitude of teachers towards any curriculum change plays a chief role in its successful implementation in the classroom. This study revealed that the teachers who participated in this study had a negative attitude towards IK. Teachers indicated that they saw no value of IK being in the school curriculum, this is due to their Christian beliefs, and western oriented education which placed a low opinion on indigenous beliefs and practices. Some teachers avoid the teaching about IK during EE lessons citing the reason that IK was burdensome to access (Tanyanyiwa, 2019). This is evidence enough that there is need for documentation of this information. Also, teacher should be open enough for holders of the knowledge to come into classrooms and relay this information.

This study revealed that teachers were guilt-ridden and perturbed when teaching IK into CCE. These observations were common across Africa. For example, a study by Aabah etal (2015) noted that in Africa the integration of IK into the teaching of sciences is derailed by teachers who are at a crossroads in trying to mediate between different cultural systems which view the world differently. In Kenya, Owuor (2007) avers that the integration of IK into education suffers from the dilemmas between policy makers and teachers who might not have a common perspective on the value of IK into education. Kaya and Seleti (2013) reported that teachers in South Africa had a negative attitude on the introduction of IK in South Africa's science education in schools. The same negative attitude towards IK was noted in Namibia by Sheya (2014). Sheya noted that teachers saw no value in IK as they considered themselves modern and scientific in their approaches to life.

There is need to really educate teachers to value the need for the IK integration into CCE. Lessons can be learnt from Indonesia, where it was reported by Handayani, Wilujeng and Prasetyo, (2019) that many teachers who had undergone some training on IK had developed a more positive attitude towards its introduction in schools. When teachers fully engage in the integration of IK into CCE, just like in Australia, elders from local communities can now be more involved in the education of their children (Jacobs, 2017). The same study also reported as a result of teachers' positive attitude towards IK, good rapport exists between teachers in Canada and their communities.

6.5.3 Lack of resources for Indigenous Knowledge integration into Climate Change Education

The lack of financial and material resources towards education in Zimbabwe has been described as viral since the decline of the economy in the mid1990s (Mandikodza, 2019). Many schools in Zimbabwe have suffered from inadequate government funding, and lack of educational materials such as textbooks, ICT and science equipment. As a result of these inadequacies, the implementation of sciences especially in rural areas has been a major challenge (Tanyanyiwa, 2019). As an example, the implementation of IK into CCE in the Manicaland province of Zimbabwe has been basically oral without any major reference points (Risiro 2019).

In developing countries, the education system is under resourced and the shift towards the integration of IK into schools' subjects make the situation even worse. In Tanzania for example, Theodory (2014) reported similar challenges. In South Africa, Ronoh (2017) and Seehawer (2018) blamed poor resources in schools for the ineffective integration of IK into the school curriculum. The Rogan and Grayson (2003) framework bemoaned the lack of financial, material and professional support resources for the implementation of new curriculum particularly in developing countries. The findings from this study are in line with previous findings and also with the theoretical framework. The integration of IK into CCE needs to be seriously resourced and supported for its effective implementation.

Lessons on the effective integration of IK into CCE can be derived from other counties where governments have made strides towards the provision of adequate financial resources to support the implementation of the national curriculum and more specifically the sciences subjects. In Mexico for example, the government allocates funds to train the indigenous teachers in designing their school curricula and to make sure that their languages and culture are placed on same level with Spanish (Mendoza-Zuany, 2019). This can also be done in Zimbabwe to promote the native teachers. If this is done well, then there will be effective integration of IK into CCE. It is also noted that in Mexico, funds were allocated for the recognition and inclusion of elders and parents from the community as sources of IK for schools.

This provision is missing in the Zimbabwe education system and hence spoils the effective implementation of IK into CCE. The same lessons on funding the inclusion of the community-elders and parents is widely practiced in Australia. Unlike in Mexico, in Australia, this inclusion goes further to the crafting of texts to be used in class (National Curriculum Board, 2009). Lessons from Indonesia show that when funds are availed and the community becomes engaged, there is increased awareness of IK, and eagerness amongst the teachers, learners, and communities for IK integration into education (Handayani, Wilujeng & Prasetyo, 2018). Overall, the inclusion of elders and parents enriches CCE, nurturing a more comprehensive and effective approach that respects and utilises Indigenous wisdom. Hence the integration of IK into CCE in Zimbabwe needs adequate funding and borrowing of ideas from countries that have successfully implemented it.

6.5.4 Use of ineffective teaching methods

Another challenge that was revealed from this study was the over use of the lecture method by teachers when integrating IK into CCE during their Geography lessons. The use of active learning and participatory methods of teaching such as discovery method, hands on learning, problem solving, and design-based methods was found to be limited. Similarly, another study in Zimbabwe by Tanyanyiwa (2019) also revealed the dominance of the lecture method in high schools. This shows that many teachers in Zimbabwe have not yet moved from traditional teaching methods like the lecture.

Ministry of Primary and Secondary Education recommends the use of progressive and participatory methodologies during classroom interaction (MoPSE, 2015). However, findings from this study were contrary to these recommendations that teachers should use teaching methods that enhance active learning, rather than those that focus on information delivery and regard learners as empty vessels. It was revealed from this study that teachers used mainly the lecture method when integrating IK into CCE. There is also a confirmation of these findings from a study in Manicaland province of Zimbabwe, where it was noted that there was overuse of the lecture method in the integration of IK into Geography (Risiro,2019). Risiro (2019) bemoaned the overreliance on the lecture method by teachers and he attributed this to lack of resources, and lack of the necessary training for teachers. Teachers use the lecture method because it allows them to deliver subject content in a fast manner thereby finishing the syllabus on time. The integration of IK into CCE calls for behavioural change. However, the lecture method has been found to be mostly inappropriate for behavioural change as it made learners to be merely recipients of information (Tsindoli, 2018). Furthermore, the lecture method fails to promote interest, creativity and imagination among learners (Aabah, Mashebe, & Denuga, 2015). There is need for a paradigm shift from the lecture method to progressive methods across Africa (Abar, Mashebe & Denuga (2015). This shift accordingly poses a major challenge to teachers who act as mediators between the Western educational philosophy and the IK but who continue preferring the use of traditional ineffective teaching strategies.

Namibia, however, has something to note about progressive teaching methods in IK integration into CCE (Sheya, 2014). In Namibia, learner-centered teaching is increasingly becoming popular among teachers. This teaching approach enhances learners to think independently, offers challenging and meaningful tasks to nourish learners and promotes the use of learners' existing knowledge (Sheya, 2014). Furthermore, Handayani, Wilujeng and Prasetyo, (2018) noted that the active teaching method helps in linking the community to the school, making learning lifelong and allows the use of real-life experiences and use of visual media. As such, learning becomes more meaningful, more participatory and life-long (Stemn, 2017). Such a framework has been found workable in

Canada and Nepal and need to be adopted in Zimbabwe for the integration of IK into CCE.

6.5.5 Ineffective Assessment of Indigenous Knowledge in National Examinations

Zimbabwe's high school curriculum framework emphasises the importance of assessing learners on skills, attitudes, attributes and values gained rather than on their ability to memorise information (MoPSE, 2015). Findings from this study showed that teachers were not happy with the way IK competencies were assessed in the national Advanced Level Geography examinations in Zimbabwe. The teachers stated that the questions to do with IK were rarely set, and when set they are mostly of the low order types on CC. The use of low order questioning is not beneficial to learners especially regarding IK as these types of questions focus on recalling rather than interpretation and application (Abar, Mashebe and Denuga, 2015), which are very important in CCE. The study revealed the exitance of major challenges in assessing IK and CCE in geography in the selected two schools. These assessment problems included: how to assess, the types of questions to set, especially in the national examinations which are centralised (Risiro, 2019). These challenges are a result of centralisation of the national examination (Sheya, 2014). This challenge is not peculiar to Zimbabwe alone but also even in Namibia. When it comes to IK assessment, teachers tend to stick to what they consider to be relevant important for the national examination, rather than what is important to learners' lived life experiences. The avoidance of setting questions on IK in CCE are because such questions not included in the national examinations (Sheya, 2014). However, it can also be concluded that the ineffective assessment of IK stems from lack of training in IK among teachers (Jacobs, 2015). Also, the community elders and parents need to be engaged on learner assessment and their observations included in the final grade for the learner (Rogan &Grayson, 2003). in the developed countries like Canada, Nepal, Thailand and Australia, steps are being taken to involve communities in learner assessment. In these countries, learners go into the community and perform tasks which are then assessed by community elders (Handayani, Wilujeng & Prasetyo, 2018).

In Zimbabwe, the new curriculum uses Continuous Assessment Learning Area (CALA) as an assessment tool, this needs to be overemphasised in the integration of IK into CCE. When assessment is done with the community, learning becomes more relevant as it

brings the community back into education hence allowing relevant long-life learning (Seehaver, 2018). It is thus worth noting that there should be IK assessment tools developed in schools. Learners can be asked to go into the community and collect information about traditional ways of predicting rainfall and floods and conserving forests and other resources. The involvement of parents, elders, and the whole community in the assessment of learners can lead to the effective implementation of IK into CCE in Zimbabwe.

7. Chapter Summary

This chapter presented a discussion of the study's findings, guided by the study's theoretical framework and comparisons of the results with those from other similar studies conducted in Zimbabwe and elsewhere in the world. The discussion also explored the implications that the study's results have for the effective integration of IK into CCE in the Advanced Level Geography curriculum at high schools in Zimbabwe. The findings revealed that learners, parents, and teachers are resisting to be assessed through projects (CALA) as indicated in the current curriculum. This resistance is common whenever curriculum change happens. The findings further revealed that the shortages of material resources in terms of textbooks on IK in CCE IK limited the number of IK that was found to be integrated into the school curriculum, and educationists are challenged to document this information as it is found to be helpful in CCE. It is concluded that there is a need for more IK to be integrated into CCE and the development of transformative pedagogies that allow the use of IK. The next chapter looks at the conclusions and recommendations of the study.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

In the previous chapter discussion of the study's findings and their implications for the effective integration of IK into CCE in the Advanced Level Geography Curriculum in Zimbabwe was done. The purpose of this study was to explore the integration of IK into CCE in the Advanced Level Geography curriculum at high schools in Zimbabwe. This chapter aims to: provide an overview of the study: the study's aim, research questions, theoretical framework, and research methodology, give the summary of the study's results on types of IK integrated into CCE, the pedagogical strategies used by teachers, the support given to the integration of IK into CCE, and the problems confronted by teachers when integrating IK into CCE in the Advanced Level Geography curriculum. Topresent and discuss the study's contribution towards new knowledge by proposing a model for effective IK integration into CCE and lastly, to make recommendations based on the results of the study. It also proposes areas for further study in the area of IK integration into CCE.

7.2 Background to the study

Globally, humanity is facing the challenges brought about by the changing climate. Strategies are being developed and put in place to counter the adversaries of climate change. Educationists believe that there should be CCE in schools. CCE is an educational programme that is premeditated for the purpose of creating public awareness on CC, empowering people to address CC, live sustainably and improve their adaptation capacity to CC risks at individual and community level (UNESCO, 2012). UNESCO has made two main recommendations: that CCE be integrated into all levels of formal education, and that indigenous knowledge (IK) be integrated into CCE to improve its

quality and relevance where it is being implemented (UNESCO, 2019). However, the integration of IK into CCE is faced with a lot of misconceptions.

There are debates in education, including CCE, on how IK can be effectively integrated to improve teaching and learning (Dei, 2011; O'Donoghue, Shava, & Ngcoza, 2016). However, for a long time, the importance of IK in enhancing education quality and relevance has been neglected (UNESCO, 2017). The integration of IK into CCE provides a vital foundation for community-based CC adaptation strategies (Theodory, 2014). Despite the widely acknowledgement of the benefits of integrating IK into school curricula, research into how far this is being implemented is limited (Lotz-Sisitka & Urquhart, 2014).

The current secondary education curriculum in Zimbabwe has made CCE a cross-cutting theme in all subjects. However, several challenges have been identified in the way CCE is currently being implemented in Zimbabwean schools, notably the lack of locally relevant educational materials to support its implementation (Manjengwa, Matema, Mataruke, Tirivanhu, Tamanikwa & Feresu, 2014), and failure to integrate indigenous knowledge (IK) into the CCE curricula (Government of Zimbabwe, 2014). It is with these concerns in mind that this study investigated the integration of IK into CCE in the Advanced Level Geography curriculum with the aim of designing a framework for its effective implementation in Zimbabwe's schools.

7.3 Aim of the research

This study explored the integration of IK into CCE in the Advanced Level Geography curriculum with the aim of designing a framework for its effective implementation in Zimbabwe's schools.

7.4 Theoretical framework

The Rogan and Grayson (2003) curriculum implementation theory) was adopted for this study. Rogan and Grayson (2003) advanced that in the analysis of curriculum implementation, three major constructs need to be considered: profile of implementation (PoI), capacity to support innovation (CtI), and outside influences (OI).

The Rogan and Grayson (2003) framework was modified to make it the more relevant to the integration of IK into CCE into the Advanced Level Geography curriculum (see Fig. 3.1).

The construct 'Profile of Implementation' (PoI) which entails responsibility to ascertain the extent to which the recommended curriculum is being transformed into reality (classroom interaction). This sub-construct assisted the researcher to generate data on, the types of IK integrated into CCE, and the teaching strategies used by teachers in the integration of IK into CCE into during these lessons.

The second sub-construct under PoI is that of 'Science practical work. Within the confines of this research, the Rogan and Grayson (2003) sub-constructs of 'science practical work' was substituted with that of 'IK and practical work' (Figure 3.1). 'IK and practical work' were used to refer to the real-life practical activities that learners engage during the integration of IK into CCE during the Advanced Level Geography lessons.

The third sub-construct of PoI is that of 'Science and Society'. In this research, the sub-construct 'Science and Society' was replaced by that of 'IK and Society' (Fig 3.1) and was used to generate data on how knowledge and skills acquired through the integration of IK into CCE were applied outside the schooling context and vice versa.

The fourth sub-construct under PoI is that of 'assessment.' In this study, this sub-construct was used to explore and generate data on assessment practices used by teachers during the integration of IK into CCE during the Advanced Level Geography lessons at the selected schools. The construct 'Capacity to support Innovation' (CtI) refers to the fundamentals that have influence on the execution of new ideas and practices in the new curriculum. For effective curriculum implementation, teachers needed to have the indispensable apparatus, classrooms, textbooks, and other important resources (Rogan & Grayson, 2003). The CtI has four sub-constructs (physical resources, teacher factors, learner factors, institution ethos and management) (Rogan & Grayson, 2003).

In this study, the construct CtI helped the researcher to determine the factors within schools that support or hinder the integration of IK into CCE into the Advanced Level Geography curriculum at the schools that were investigated.

The construct 'Outside Influence' (OI) is used cater for the organisations outside the school that act together with the school in order to facilitate curriculum innovations (Rogan & Grayson, 2003). These organisations include government department, donors, NGOs, and unions. In this study, the construct 'outside influence' assisted the researcher in analysing the type of external support that is being offered to schools to enhance the integration of IK into CCE in the Advanced Level Geography curriculum. In this study this construct was used to generate data on the kind of the out-side support (policy documents and professional advice and training) that have a bearing on the integration of IK into CCE in the Advanced Level Geography curriculum.

According to Rogan and Grayson (2003) the sub-construct of 'professional development is used to bring up the up to date keeping of the trends, skills, technologies, and other characteristics of the teacher's field to bring about the expected curriculum changes. In this construct, physical resources were used to examine their influence on the integration of IK into CCE in the Advanced Level Geography curriculum. The sub-construct on change forces was used to generate data on the leading global and national initiatives or narratives that have a bearing on the integration of IK into CCE in the Advanced Level Geography curriculum. Lastly, Monitoring was used to generate data on organisations that are responsible for monitoring the integration of IK into CCE in schools and the roles they play in the process.

7.5 Research questions

In this study, the main research question was:

> How is IK integrated into CCE in the Advanced Level Geography curriculum at selected high schools in the Gwanda North District of Zimbabwe?

The following sub-research questions helped answer the main research question:

1. What IK is integrated into CCE in the Advanced Level Geography curriculum at the selected high schools?
2. Which pedagogical strategies are used by teachers to integrate IK into CCE in the Advanced Level Geography curriculum at the selected high schools?
3. What challenges are faced by teachers in the integration of IK into CCE in the Advanced Level Geography curriculum at the selected high schools?
4. How is the integration of IK in into CCE in Advanced Level Geography curriculum being supported?
5. What implementation framework can be used to improve the integration of IK into CCE in the Advanced Level Geography curriculum?

7.6 Research Methodology

7.6.1 Research paradigm

This study was informed by the interpretivism paradigm. Under this paradigm, the researcher perceived reality as being multiple and relative. Through interpretivist ontology, the researcher gained a deeper appreciation and insight into the experiences of teachers in the integration of IK into CCE, within the Advanced Level Geography curriculum in Zimbabwe. The researcher in this study adopted the interpretivist epistemology as he believed that understanding obtained in this research is socially constructed rather than objectively proven from the perspective of individuals who are partaking in it (Cohen et al., 2011).

7.6.2 Research approach

This research was guided by the interpretivist paradigm**;** hence the qualitative approach was adopted. This approach allowed the researcher to study phenomena in their natural setting. The researcher needed to observe ordinary day-to-day experiences of the subject of the research study (Bloom and Crabtree, 2006). The use of the face-to-face interfaces was conceivable to obtain comprehensive information on participants' experiences, interpretations, the challenges, and the support in the integration of IK in CCE in the Advanced Level Geography curriculum in selected high Schools in Zimbabwe.

7.6.3 Research Design

This study adopted a case study design. The case study design was used as it allowed the study participants to speak for themselves about the integration of IK in CCE in the Advanced Level Geography curriculum. Moreover, Cohen, Manion and Manson (2007) argue that case study allows the use of several different research methods, which contributes to the generation of rich data about the issues that are being investigated.

7.6.3 Research methods

The study used interpretivist research methods, namely same-structured interviews, lesson observations and document analysis to help generate thick descriptions of the participants' meanings and experiences regarding the integration of IK into CCE, within the Advanced Level Geography curriculum in Zimbabwe. The researcher made use of face-to-face semi- structured interviews to gather data. Semi-structured interviews were used because they allowed the researcher to ask both closed and open questions about the integration of IK in CCE within the Advanced Level Geography Curriculum in Zimbabwe. Semi-structured interviews permitted participants to put forward their views and opinions and to elaborate on their understanding, experiences and practices, thus generating more in-depth information on the integration of IK in CCE within the Advanced Level Geography Curriculum in Zimbabwe. One District Inspector for Geography, and four Advanced Level Geography teachers were interviewed. The inspector interview sought information on support and monitoring policies and practices regarding the integration of IK in CCE, while interviews of the teacher's solicited information about the strategies used, the challenges faced, and the support given to enhance the integration of IK into CCE during the Advanced Level Geography lessons.

The researcher also conducted non-participatory lesson observations. Lesson observations enabled the researcher to focus on observing and recording what was taking place during the geography lessons about the integration of IK. Four Advanced Level Geography lessons were observed at each school. The researcher gathered information on the teaching strategies, the resources used, and the assessment tasks set by the teachers on the integration of IK in CCE in class. As a third research method for this study, the researcher used document analysis. For the purposes of this study, the documents

that were analysed included the school syllabus, the scheme books, teachers' lesson notes and assessment tasks, curriculum policy statement, the National Syllabus, teaching guides, publications and textbooks that schools use in the Advanced Level Geography curriculum, or the integration of IK into school subjects.

7.6.4 Selection of participants

Convenient and purposeful sampling were used to select the study sites and the participants. Two high schools were conveniently selected out of the six high schools within Gwanda North District.

The two schools were coded School A, and School B for anonymity reasons. The participants who were purposefully selected were four Advanced Level Geography teachers (two from each school), and the Gwanda North District Education Inspector for Geography (coded (R1). The participating teachers were coded T1, T2, T3, and T4.

7.6.5 Data analysis

An inductive approach to data analysis was adopted in this study. This approach was suitable for this study because it permitted research findings originated from the recurrent, principal or significant themes intrinsic in raw data (David, 2003). This approach was iterative and required the researcher flexibility. Themes and insights would evolve as the researcher engaged with the data.

7.6.6 Trustworthiness of the study

To guarantee credibility in the findings in this research, the researcher used multiple research methods (semi-structured interviews, document analysis and lesson observations) to triangulate da

The researcher also spent extended periods of time at the participating schools to build rapport with the study participants and referred the data to the participants for cross checking. The researcher also had debriefing sessions with the supervisor and other critical friends and piloted the research instruments. For transferability purposes, the

researcher was thoughtful of possible predispositions by being conscious of the possibilities for multiple interpretations of reality.

Thus, the researcher presented detailed information and justifications for the study's choices of methodological approach, data analysis and interpretations for ease of comparison by other researchers. The researcher also provided rich, thick description of data so that those interested in transferability would have a solid framework for comparison (Creswell, 2018).

To achieve dependability, the researcher explained in detail the curriculum implementation theory by Rogan and Grayson (2003). The researcher also employed multiple methods of data collection and analysis (triangulation). Again, a substantial amount of time was spent in preparation for interviews guide, document analysis schedule and the class observation schedule. Furthermore, the researcher expounded in detail how data was collected to allow for an audit trail if called for. The researcher used member checks, was in constant interaction critical friends and was working together with the supervisors Again, piloting of research instruments was done to ensure the effectiveness and to make modification. Lastly, as stated by Rossouw (2003) to ascertain dependability, in this study, the researcher made sure that the research process was rational, well documented and checked.

In this research, confirmability was safeguarded by discussing the results with critical friends and other qualified researchers. Further, the researcher made auditing achievable by other researchers, through archiving all gathered data in a well-organised and retrievable form so that they can be made accessible to them if the findings were questioned.

In this study piloting was done for the purpose of trying out the research instruments that were employed for the study. The researcher used the semi-structured interview guide for teachers and inspector. In addition, classroom observation guide and document analysis guide were the other instruments used for the pilot study.

Pilot study was done at one high school besides the two high schools chosen for the main study since they possess similar characteristics. Resulting from the pilot study, the researcher adjusted the research instruments accordingly.

7.7 Summary of the main findings

7.7.1 Types of Indigenous Knowledge that are integrated into Climate Change Education in the Advanced Level Geography curriculum.

The study investigated the types of IK that are integrated into CCE in the Advanced Level Geography curriculum at the two high schools that took part in the study. The analysis of the generated data revealed five different types of IK that are currently integrated into CCE in the Advanced Level Geography curriculum, namely: Beliefs about celestial bodies, observation of vegetation condition, beliefs about animals, birds and insects' behaviour, nature conservation practices and traditional sustainable farming practices. A summary of the revealed types of IK are provided below.

The study exposed that at the two schools that were investigated, traditional beliefs about the sun, moon and stars were integrated into CCE during Advanced Level Geography lessons. Through interviews, teachers explained that they teach their learners about how traditional knowledge about the condition of vegetation is used to predict weather patterns and to test for the presence of underground water in each area, as part of CCE.

It was further brought out that the geography teachers incorporate traditional knowledge and beliefs about animal, bird and insect behaviour when teaching about CC to their learners. The teachers also described several examples of traditional nature conservation practices that they refer to when teaching about CC during their Geography lessons. These included traditional farming methods, the use of taboos and sacred places as a form of nature conservation. Discussions on traditional nature conservation practices was conducted during Lesson observations. Teachers also set questions related to traditional forms of nature conservation during their Geography lessons. It was also observed during Lesson that teachers assigned learners to name examples of different taboos in their communities and their implications to environmental protection.

An analysis of the teacher's notes used during the geography lessons (DA 4), revealed references to traditional methods of nature conservation under the topic on environmental management, which include beliefs about sacred places like the traditional "Njelele area" and traditional farming methods like nomadic pastoralism and shifting cultivation.
The same document also referred to the use of taboos as a form of indigenous nature conservation practice against the effects of climate change.

The results from the study also revealed that teachers discuss various traditional sustainable farming methods when teaching about CC related Agricultural geography topics. These include shifting agriculture, bush fallowing, mixed farming, intercropping, transhumance and conservation farming. In addition, document analysis shows that under the chapter on Agriculture, there is reference to traditional farming methods of the digging of holes during the dry season to conserve water, and the use of manure to sustain crops during drought. Lastly, teacher informed the learners that traditionally farmers mix different crops in the for storage in the granaries. Learners were also informed that sweet potatoes, watermelons and other fresh vegetables were put in underground holes to maintain their freshness after harvesting.

7.7.2 Pedagogical strategies used by teachers in the integration of Indigenous Knowledge into Climate Change Education

Data pertaining to the pedagogical strategies used by teachers to integrate IK into CCE in the Advanced Level Geography curriculum were, placed into two groups: Teaching methods and assessment tasks on IK. Data revealed that the teachers mostly relied on the lecture method to facilitate the integration of IK into CCE. The use of the lecture method was due to limited material resources and a result of large classes. There was also use of research projects by teachers especially the use of CALA as a directive from MoPSE. This allowed learners to have hands on activities. The second pedagogical strategy that was used by teachers were seminars and presentations. Data from the teacher interviews, and document analysis showed that seminars and presentations were used to help learners understand and appreciate better the role of IK in CCE.

The third pedagogical strategy that was found to be common among the teachers in the integration of IK into CCE was the use of school excursions. All the Geography teachers that were interviewed indicated that they use school excursions to help them integrate IK into CCE.

However, it was also noted that it is not always possible to organise such excursions due to various reasons like the COVID-19 restrictions on movement of learners and insufficient funding. financial within the school. Data from interviews and document analysis revealed the use of case studies as another pedagogical strategy used to integrate IK in CCE in schools. This strategy allowed learners to have vivid and detailed information about IK into CCE.

Lastly, teachers also used the assessment as one other pedagogical strategy during the integration of IK into CCE. All the teachers that were interviewed revealed that they use both formal and informal assessment tasks to help their learners understand and appreciate the role of IK in addressing CC issues in their communities. Teachers also revealed their heavy reliance on summative assessment, although the questions on IK were not common in the national examinations.

7.7.3 Support provided to the integration of Indigenous Knowledge into Climate Change Education

The data on support were categorised under three main themes, which were financial support, materials support, and professional development support in IK integration.–All the participants who were interviewed for the period of the study complained about the insufficient or total lack of financial support to facilitate the integration of IK into CCE. Although the schools receive financial aid from the government, it is for general school purposes, rather than directed at supporting the integration of IK into CCE.During the interviews with the teachers and the Education Inspector, complaints were raised about the poor material support for integrating IK into CCE. This inadequate material support referred to the poor provision of teaching and learning support materials, and Information Communication Technologies (ICTs).

The teachers also complained about the lack of information on IK. They said they relied mostly on their textbooks for information on IK, and most times this information was inadequate. The interviews with the teachers revealed that while the Zimbabwean government has donated computers to schools, there is inadequate internet coverage, which hinders teachers' access to online resources on IK.

The study also revealed that the teachers did not receive any professional development in integrating IK into CCE. Data revealed that teachers did not receive pre-service training nor in-service training on IK integration into IK. The few workshops that were organised for teachers were on Geography topics in general rather than focusing on IK and CCE.

7.7.4 Challenges faced by teachers when integrating Indigenous Knowledge integration into Climate Change Education in the Advanced Level Geography Curriculum.

The data generated on the challenges was grouped into the following themes: Lack of a clear policy on the integration of IK into CCE, teacher factors, resources inadequacy for IK integration, and the use of ineffective teaching methods. All the interviewees agreed that there was paucity of a clear policy to support and guide teachers on the integration of IK into CCE in the Advanced Level Geography Curriculum in Zimbabwe. it was also revealed that teachers lacked training in IK.

All teachers interviewed indicated that they lacked both pre-service and in-service training in IK, which negatively affected their ability to effectively integrate IK into CCE during their lessons. The second teacher factor that was identified as a problem to the integration of IK into CCE at the two selected schools was the negative attitude some of the teachers had towards IK. Some of the teachers placed the blame on their learners' lack of interest in traditional beliefs. The study unveiled two major factors that fall within the category of lack of resources for effective IK integration into CCE, which are: financial resources, and the unavailability of educational materials on IK. During the interviews, the teachers

identified their schools limited financial resources as one of the reasons that prevent them from carrying out activities that foster the integration of IK into CCE during their lessons. These activities include the purchase of resources on IK, and the sponsorship of in-service training as well as school excursions, or seminars, on IK and CCE. Data from the study also revealed that schools are faced with a severe shortage of teaching and learning materials on IK. In relation to ICTs, the interview with the Education Inspector revealed the shortage of ICT devices in schools and teachers' inadequate ICT skills as playing a role in their inability to access internet sources on IK. During all the lessons that were observed throughout the study, the researcher noted the overreliance on the use of the lecture method in the teaching of IK and CCE. The lessons were teacher dominated and did not make use of learner centered teaching methods such as the discovery method, hands-on learning approaches, problem solving and design-based methods. The dominance of the lecture method during lessons on CC issues was also confirmed by the teachers, who gave several reasons why they rely mostly on lecturing when integrating IK into CCE.

The teachers that were interviewed expressed concern with the way IK knowledge and skills are assessed in national Advanced Level Geography examinations in Zimbabwe. The teachers stated that questions that are specifically on IK are seldom set, and when they occur, they are mostly low order questions and carry only a few marks. Hence the teachers attach less importance to IK when teaching about CCE issues during their Geography lessons. They instead concentrated on teaching core Geography topics such as Climatology, Hydrology or Population studies.

7.8 1 Study Delimitation

The research examined the integration of IK into CCE in only one subject, Advanced level Geography. The study involved form five and form six classes and took place in Gwanda North District of Matabeleland, South Province, and involved two high schools. In addition, one district Geography inspector and four Advanced Level Geography teachers from these schools participated in the study.

7.8 2 Limitations of the study

The study had three main limitations.

The first limitation related to the small sample sizes that were involved. The study investigated only two high schools in Gwanda North district, four Geography teachers, and one District Geography inspector. A larger sample size would have contributed to more comprehensive results. However, the aim of the study was to provide in-depth information from a case study, rather than data for generalisation for the whole of the Gwanda North district. Nevertheless, rich descriptions of the research process and results were provided, as well as an audit trail so that the study could be replicated by other researchers elsewhere for generalisation.

The second limitation was that only the geography teachers and the Geography District Inspector were involved as study participants. The inclusion of learners would have contributed to more data being generated, and less data bias. However, due to COVID-19 this was not possible as learners were not attending schools regularly. This shortcoming was addressed by using purposeful sampling which ensured that although they were few, only those participants who were very knowledgeable about the integration of IK into CCE were selected.

The third limitation in the study was that due to COVID-19 restrictions, only a short time was spent at the two schools to generate the necessary data. This might have had a bearing on the quantity and quality of data that was generated to answer the study's research question. To address this short coming, the researcher made use of different research methods (triangulation) which helped to ensure dependability (confirming emerging findings).

7.9 Study conclusions

The study found the integration of IK into CCE during the Advanced Level Geography lessons at the two schools to be incomplete and ineffective. Several factors were

identified as major reasons to the incompleteness and ineffectiveness of the integration of IK in schools.

There has been insufficient knowledge by teachers on the types of IK to be integrated because of lack of professional training. Hence teachers lack the effective pedagogical strategies for the integration of IK into CCE. This insufficient knowledge led to few types of IK being integrated into CCE.Teachers also exhibited a lack of effective pedagogical strategies for the integration of IK into CCE and lack of effective assessment strategies. The community was not effectively involved in the integration of IK into CCE, let alone assessment. Lastly, there is poor support in terms of professional, material and financial.

7.10 Study's recommendations

From the findings of the study, the following recommendations are proposed:

- ✓ The study found that at the two schools, only a few types of IK were being integrated into CCE. It is thus recommended that the community be involved in the provision of types of IK.
- ✓ The study exposed that teacher were mostly relying on ineffective teaching and assessment methods to integrate IK into CCE. Hence, this study recommends that initial teacher training courses include modules on IK types, and on teaching and assessment approaches that enhance the acquisition of knowledge and skills on IK and CCE. Additionally, the community must be fully engaged in the integration of IK into CCE in schools.
- ✓ The study revealed that professional development workshops on IK were not provided to the teachers. It is thus recommended that the ministry provides workshops on IK, and how to integrate it in CCE in schools.
- ✓ Evidence from this study has it that there is lack of a clear policy on the integration of IK into CCE. Therefore, this study recommends that the Ministry of Primary and Secondary Education, which is responsible for making curriculum policies should promulgate clear guidelines in the policy on IK into CCE integration.
- ✓ The study also noticed that the integration of IK into CCE was besieged by poor financial support in terms of excursions. This study recommends that schools have

fund raising projects. The funds raised from these projects would allow learners to visit IK resource centres.

- ✓ The study also revealed a serious inadequacy of teaching and learning materials. This shortage derails the effective integration of IK into CCE in schools. This study therefore recommends that researchers and authors publish materials that can enhance this effective integration of IK into CCE.
- ✓ The results from this study also showed inadequate ICT tools and gadgets in schools, and this fails the effective integration of IK into CCE. This research thus recommends that government through MoPSE supplies schools with ICT tools and gadgets as to speedy the integration of IK into CCE in schools.
- ✓ The study also showed that the national examination board rarely examines learners on IK into CCE, this then demotivates teachers on the integration of IK into CCE. This study thus recommends that ZIMSEC adds questions that have the integration of IK in the final examination papers. And also, to engage with the community in assessing learners for the effective integration of IK into CCE in Zimbabwe.

7.11 Contribution Towards New Knowledge from the Study

The researcher offers a real-world, comprehensive and straightforward model to guide the Ministry of Primary and Secondary Education, curriculum policy planners, and curriculum implementers such as District Subject Inspectors and teachers at in high schools in Zimbabwe on how to effectively integrate IK into CCE in the Advanced Level Geography curriculum.

The model is based on first-hand findings of this study that provided insight into current practices at the two selected schools about the types of IK integrated, pedagogical strategies used, support provided, and the challenges faced when integrating IK into CCE during Advanced Level Geography lessons. The model is called integration model for IK into CCE, (Figure 7).

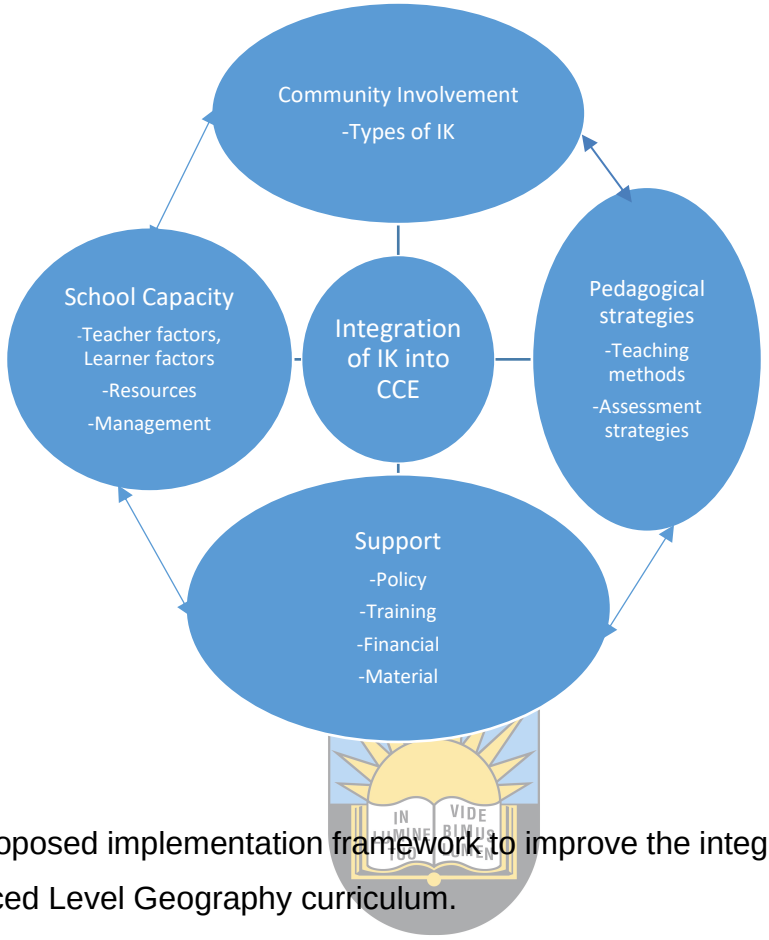


Figure 7.1 Proposed implementation framework to improve the integration of IK into CCE in the Advanced Level Geography curriculum.

The proposed framework is depicted on Fig. 7 . The model is guided by the study's findings and the reviewed literature. The model consists of four constructs. These four constructs are pedagogical strategies, school capacity, support for IK into CCE and community involvement. These four constructs have their own sub-constructs as indicated on Fig. 7. All the four constructs are interrelated and are dependent on each other to achieve the goal of improving the integration of IK into CCE in the Advanced Level Geography Curriculum. Each of the four main constructs and their related sub-constructs are described in detail in the following sections.

7.11.1The Pedagogical Strategies (PS) construct

The construct Pedagogical Strategies (PS) entails an undertaking to ascertain the extent to which the prescribed curriculum is being transformed into reality (classroom

interaction). These are educational actions, tactics that are used by teachers in the integration of IK into CCE in schools. This construct consists of two sub-constructs namely: Teaching methods and Assessment strategies. The study concluded that more appropriate pedagogical strategies need to be put in place for the effective IK integration into CCE. The proposed pedagogical strategies are differentiated into teaching strategies and, assessment. Teaching strategies need to be revised in the schools to integrate IK into CCE. While there is no one strategy that is found from the study as the most appropriate, the researcher suggests the use of IK integration model that promotes active learning and participatory teaching methods and that help to link the school and the community. The community should be involved in teaching of IK. These community members include the parents and elders. These groups of people have the knowledge, and the skills needed, hence should be involved. This fosters a more inclusive and effective approach that respects and utilizes Indigenous wisdom.

Assessment is key to learning; hence effective and appropriate assessment methods should be used to enhance learning during the integration of IK into CCE. The model proposes such as assessment should include formative and summative assessments strategies to promote behavioural change and action taking by learners, rather than mere recall of IK and CCE facts. During the formative assessment, parents and elders from the community should take part. The inclusion of elders and parents enriches CCE for sustainability. The model proposes are continuous process of monitoring both at home and in schools. This would lead to life-long learning as learners would be assessed in their communities, and at school. Naturally, this would give a holistic assessment kit. The product of such and assessment kit would fit in the community.

7.11.2 The Community Involvement (CI) construct

The construct Community Involvement (CI) refers to the engagement of the surrounding community in issues of IK and CCE. The CI has one major sub-construct namely types of IK. The study found that there were five types of IK integrated into CCE (Beliefs about celestial bodies, observation of vegetation condition, beliefs about animals, birds and insect behaviour, nature conservation practices and traditional farming practice). From these results, it was noticed that there were limited types of IK integrated into CCE in

schools. There was a need for inclusion of more types of IK into CCE. This research proposes the use of folk stories, artefacts, games, traditional calendar, indigenous languages and health sciences related IK. The addition of these types of IK into CCE in schools can lead to creation of more interest in learners for IK and CCE. IK is implanted in the community; hence the construct community involvement calls for a serious engagement with the community. Elders, parents, chiefs, headmen should be actively involved.

The different types of IK that were lacking during the integration of IK into CCE in the two school, are present in the different communities in Zimbabwe. For example, when artefacts from the community are identified and used in the teaching of CCE and Geography, then learning becomes realistic, relevant and concrete to learners. This would lead to lifelong learning. Furthermore, the use of games as a type of IK in CCE in schools, leads to better assessment of learners as well as making learning locally relevant. Language is the identification of any group of people, hence for the integration of IK into CCE in the Advanced Level Geography in schools, there is need for the recognition and identification of the learners' culture, especially their native languages. Indigenous language is an important component of IK and as such their inclusion in formal education is necessary for effective integration of IK into CCE in schools. The community being the source of these types of IK, if well engaged into the school, the integration of IK into CCE becomes effective and realistic. The construct community involvement is cog in the effective integration of IK into CCE in Zimbabwe and beyond.

7.11.3 The Support for Indigenous Knowledge into Climate Change Education (SIKCCE) construct

The support for IK into CCE (SIKCCE) construct refers to the any help from within and outside the school for the integration of IK into CCE. In this study, this construct has got four sub-constructs namely: Policy, Training, Financial and Material support. The finding from this study revealed lack of adequate support for the integration of IK into CCE at the two schools. The study highlighted the need for more appropriate support from the different stakeholders for effective IK integration into CCE. There is need for policy support, pre-service and in-service training of teachers, financial and material support for the effective integration of IK into CCE.

7.11.4 The School Capacity (CP) construct

The school capacity construct refers to ability of the school to promote or hinder the effective integration of IK into CCE. The construct CP consists of for sub-constructs namely: Teacher factors, Learner factors, Resources and Management. The findings from this study revealed that in schools, there are such factors as teacher factors (attitude and training), learner factors (attitudes and competencies), schools' resources (financial and material), and the management of different schools that hinder the effective integration of IK into CCE. This proposed model suggests the promotion of school capacity to have effective integration of IK into CCE.

7.12 Model Rationale

The study revealed that the current integration of IK into CCE in the Advanced Level Geography curriculum was beset with numerous challenges which made it ineffective and irrelevant to CC mitigation and learners' contexts. This proposed model attempts to address these and other shortcomings that the study has identified so that the integration of IK into CCE in the Advanced Level Geography Curriculum in Zimbabwe becomes more practical, participatory, comprehensive, effective and contextual.

7.13 Guiding Principles

The proposed model operates on a four-construct approach. Each of the constructs does not exist independently. It assumes that for the integration of IK into CCE into the Advanced Level Geography Curriculum to be successful all the four constructs must be in place and linked. The four constructs all feed into the effective integration of IK into CCE. As an example, teachers need knowledge about the types of IK, which they get from involvement of the community, then there is need for the pedagogical strategies for teachers, then the capacity of the school to promote IK integration into CCE and the support from within and outside the school. All the four constructs are linked together and play equal roles.

7.4 Areas for future research

From the findings of this study, the researcher proposes the following as needing further study in the area of IK integration into CCE:

- ✓ This study focused on two high schools in the Gwanda North District of Zimbabwe. However, there is a need for a study that covers more high schools in the Gwanda North District, and in the rest of the districts in Zimbabwe, and beyond. The study only investigated IK integration into CCE in the Advanced Level Geography. There is need to study IK integration in other subject such a Mathematics, Physics, Chemistry, Agriculture, Biology, arts and commercial subjects in high schools.
- ✓ This study used qualitative approach. A mixed method approach that combines both quantitative and qualitative data would help to broaden and strengthen the validity and reliability of the findings on IK integration into the school subjects.
- ✓ This study focused on teachers. There is thus the need for a study that investigates learners' views and experiences of IK integration into CCE in the Advanced Level Geography curriculum.

Chapter Summary

This last chapter provided an overview of the study in order to present a summary of the key aspects of the study, including the background, aim, research questions, theoretical framework, key findings, and conclusions. The findings revealed several challenges in the integration of IK into CCE in the Advanced Level Geography curriculum at the two selected schools. Thus, the chapter presented a list of recommendations based on the study's major findings. Lastly, the chapter proposed and described the model to guide the effective integration of IK into CCE in the Advanced Level Geography curriculum in Zimbabwe.

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APPENDIX 1

EDUCATION INSPECTOR INTERVIEW GUIDE

District:

Date:

Time:

1. In what ways do teachers integrate IK in CCE?
2. How is the local environment used in the teaching of IK in CCE?
3. How is the assessment of IK concepts in CCE?
4. Tell me about any other resources that are used to integrate IK in CCE.
5. Tell me about the difficulties faced in the teaching of IK in CCE.
6. In the context of modern science, how would you view the use of IK?
7. How do you find the use of other languages in the teaching of IK in CCE?
8. With the diverse backgrounds of learners, how easy is it to integrate IK in CCE?
9. What challenges are faced using current textbooks in the integration of IK in CCE?
10. What challenges are brought about through the engagement of local community in the integration of IK in CCE?
11. How often do you supervise teacher regarding the integration of IK in CCE?
12. What type of training do you give to teachers regarding the integration of IK in CCE?
13. How does the local community influence the integration of IK in CCE?
14. What is being done by the government and NGOs in the integration of IK in CCE?
15. How else do you want teachers to be supported on the integration ok IK in CCE?
16. How can teachers be made competent in the integration of IK in CCE?
17. What would you like happening in the integration of IK in CCE?

APPENDIX 2

TEACHER INTERVIEW SCHEDULE

School:

Date:

Time:

1. Tell me about your opinions and views regarding IK
2. Tell me about your opinions and views regarding the integration of IK into CCE in the Advanced Level Geography Curriculum
3. Tell me about your experiences with integrating IK into School subjects
4. Tell me about your experiences regarding the integration of IK into CCE
5. What teaching strategies do you use to help you integrate IK into CCE in the Advanced Level Geography Curriculum?
6. What resources do you use to help you integrate IK into CCE in the Advanced Level Geography Curriculum?
7. How do you assess IK during your CCE lessons?
8. How do you use the local environment in the teaching of IK in CCE?
9. What practical activities do you employ to help you integrate IK into CCE in the Advanced Level Geography Curriculum?
10. Tell me about any other resources that you use to help you integrate IK in CCE.
11. Tell me about support you receive from the district / ministry regarding the integration of IK in CCE.
12. What other organisations support the integration of IK into CCE in the Advanced Level Geography Curriculum?
13. What type of training have you received regarding the integration of IK in CCE?
14. How is the local community involved or contribute to the integration of IK in CCE?
15. Tell me about the physical resources regarding the integration of IK into CCE in the Advanced Level Geography Curriculum.
16. What other support would you wish to be included regarding the integration of IK in CCE?

17. What would you say are the major challenges to the integration of IK into CCE in the Advanced Level Geography Curriculum?
18. What do you think needs to be done to enhance the integration on IK in CCE in the Geography curriculum?

APPENDIX 3

DOCUMENT ANALYSIS WORKSHEET

Document Name ----------

Author(s) ----------

Date of publication----------

Criteria	**Comments**
Total number of pages	
Number of pages on CCE	
Number of pages on IK	
Number of illustrations / pictures on CCE	
Number of illustrations / pictures on IK	
Number of questions on CCE	
Number of questions on IK	
Number of tasks on CCE	
Number of tasks on IK	

% Of questions on CCE	
% Of questions on IK	
% Of tasks on CCE	
% Of tasks on IK	
Proportion of questions on IK in CCE section	
Proportion of questions on IK in CCE	
Proportion of exercises on IK / CCE	
Proportion of questions of field work activities on IK / CCE	
Proportion of IK / CCE plan	
Proportion of test on IK/CCE	
Proportion of field trips on IK or CCE	

Proportion of link with community on IK / CCE	
Proportion of problem-solving exercises on IK / CCE	
Marks allocated for IK / CCE questions	
% Of questions on IK in CCE topics	
Tasks on IK in CCE topics	
Policy on IK / CCE	
Proportion on IK / CCE content	
Proportion of sources of IK / CCE	
Proportion of IK / CCE strategies	
Reference to IK / CCE support institutions, individuals or materials	

APPENDIX 4

LESSON OBSERVATION GUIDE

Date…… Time……

School Code: …… Number in Class……

Lesson duration…… Teacher Code: ……

1. Lesson Topic

2. How is the topic related to IK / CCE?

3. Lesson objectives

4. How are the lesson objectives related to IK / CCE?

6. Core Content

6. How is the content related to IK / CCE?

7. Classroom interaction on the integration of IK in CCE

8. How is IK integrated in CCE in the Class?

9. Teacher activities

10. How has the teacher been engaged?

11. Learner activities

12. In what ways have learners been engaged?

13. Teaching Strategies on IK integrated into CCE

14. How is IK integrated into CCE?

15. Resources to support IK integration in CCE

16. What resources are used to support IK integration in CCE?

17. Challenges observed in the integration of IK integration in CCE

19. What challenges are there in relation to IK and CCE?

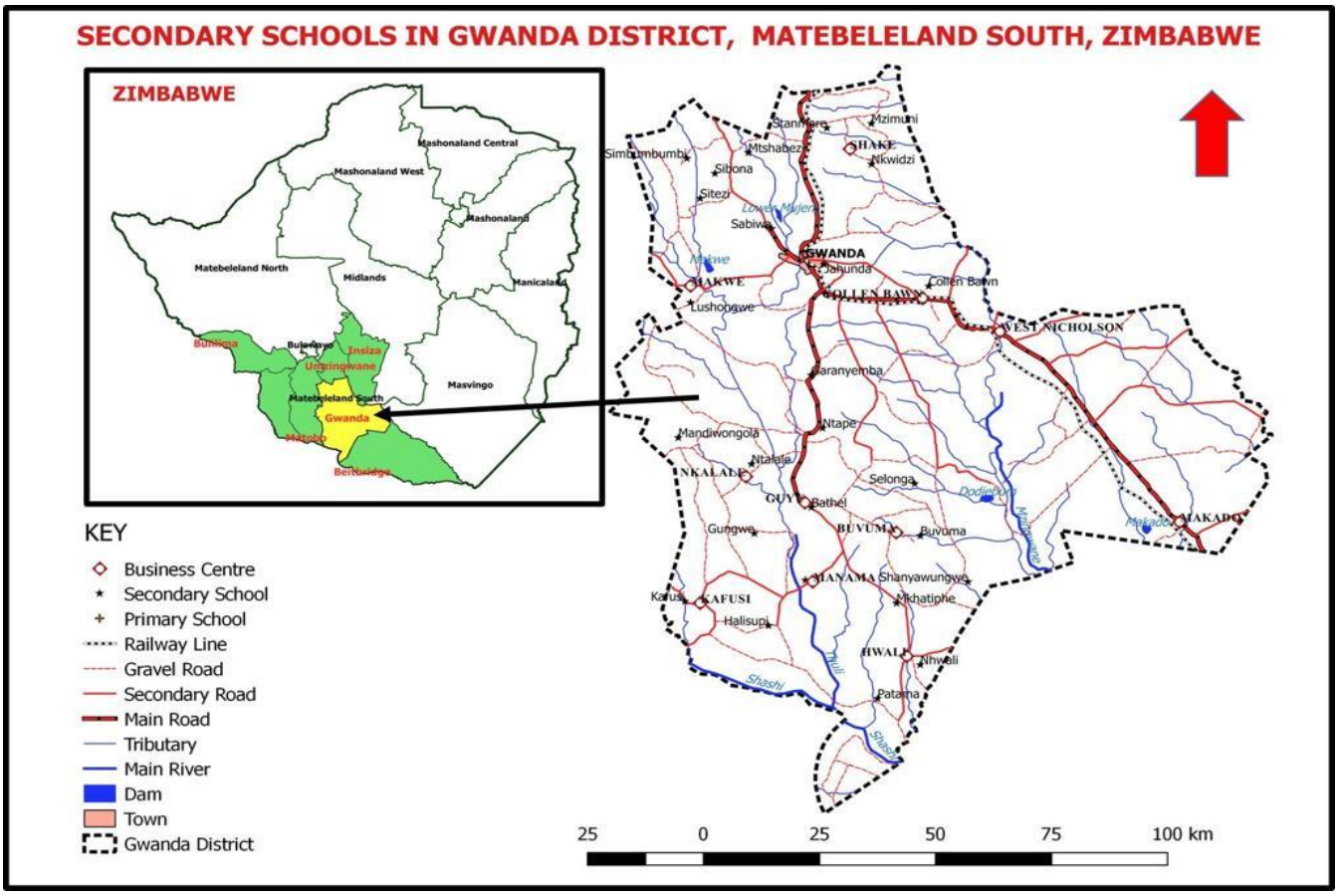
20. Assessment on IK and CCE

21. How has IK and CCE been assessed?

22. Personal reflections on IK, CCE and Geography

APPENDIX 5

A MAP SHOWING SECONDARY SCHOOLS IN GWANDA DISTRICT, MATABELELAND SOUTH, ZIMBABWE



APPENDIX 6

LETTER TO THE PROVINCE TO CONDUCT RESEARCH

Joshua Mqabuko Nkomo Polytechnic.

P. Bag 5832

Gwanda

Zimbabwe

13 January 2022

Ministry of Primary and Secondary Education

Matabeleland South Province

Gwanda

Zimbabwe

Dear Sir/ Madam

REF: REQUEST TO CONDUCT ACADEMIC RESEARCH IN YOUR PROVINCE

The above matter refers:

I am part-time PhD student studying with University of Forth Hare in the Faculty of Education. The purpose of this letter is to inform you of my research interest and gaining your permission to gather data from your schools.

The focus of my research is, "*THE INTEGRATION OF INDEGIONOUS KNOWLEDGE INTO CLIMATE CHANGE EDUCATION: A CASE OF THE ADVANCED LEVEL GEOGRAPHY CURRICULUM IN ZIMBABWE*."

I hope to carry out interviews with the district school inspector and teachers, observe teachers' classroom interaction, and analyse the relevant documents. Your attention is brought to the fact that this is an academic research and information obtained abides by the research ethical issues.

I, therefore, ask for your permission to access two sampled schools in your province.

Yours faithfully

Machaya Trust.

APPENDIX 7

LETTER TO THE DISTRICT TO CONDUCT RESEARCH

Joshua Mqabuko Nkomo Polytechnic.

P. Bag 5832

Gwanda

Zimbabwe

13 January 2022

Ministry of Primary and Secondary Education

Gwanda District

Matabeleland South Province

Gwanda

Zimbabwe

Dear Sir/ Madam

REF: REQUEST TO CONDUCT ACADEMIC RESEARCH IN YOUR DISTRICT

The above matter refers:

I am part-time PhD student studying with University of Forth Hare in the Faculty of Education. The purpose of this letter is to inform you of my research interest and gaining your permission to gather data from your schools.

The focus of my research is, "*THE INTEGRATION OF INDEGIONOUS KNOWLEDGE INTO CLIMATE CHANGE EDUCATION: A CASE OF THE ADVANCED LEVEL GEOGRAPHY CURRICULUM IN ZIMBABWE*."

I hope to carry out interviews with the district school's inspector and teachers, observe teachers' classroom interaction, and analyse the relevant documents. Your attention is brought to the fact that this is an academic research and information obtained abides by the research ethical issues.

I, therefore, ask for your permission to access two sampled schools in your district.

Yours faithfully

Machaya Trust.

APPENDIX 8

ETHICAL CLEARANCE LETTER

University of Fort Hare
Together in Excellence

ETHICS CLEARANCE
REC-270710-028-RA Level 01

Project Number:	LIN021SMAC01
Project title:	**The integration of indigenous knowledge into climate change education: A case of the Advanced Level Geography curriculum in Zimbabwe.**
Qualification:	Doctor of Philosophy in Education
Student name:	Trust Machaya
Registration number	201609925
Supervisor:	Dr M Linake
Department:	Education
Co-supervisor:	N/A

On behalf of the University of Fort Hare's Research Ethics Committee (UREC) I hereby grant ethics approval for LIN021SMAC01. This approval is valid for 12 months from the date of approval. Renewal of approval must be applied for BEFORE termination of this approval period. Renewal is subject to receipt of a satisfactory progress report. The approval covers the undertakings contained in the above-mentioned project and research instrument(s). The research may commence as from the 13/01/22, using the reference number indicated above.

Note that should any other instruments be required or amendments become necessary, these require separate authorisation.

Please note that UREC must be informed immediately of

- Any material changes in the conditions or undertakings mentioned in the document;
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research.

The student must report to the UREC in the prescribed format, where applicable, annually, and at the end of the project, in respect of ethical compliance.

UREC retains the right to

- Withdraw or amend this approval if
    - Any unethical principal or practices are revealed or suspected;
    - Relevant information has been withheld or misrepresented;
    - Regulatory changes of whatsoever nature so require;
    - The conditions contained in the Certificate have not been adhered to.

- Request access to any information or data at any time during the course or after completion of the project.

Your compliance with Department of Health 2015 guidelines and any other applicable regulatory instruments and with UREC ethics requirements as contained in UREC policies and standard operating procedures, is implied.

UREC wishes you well in your research.

Yours sincerely

Dr N Taole-Mjimba
Chairperson: University Research Ethics Committee
13 January 2022

APPENDIX 9

PERMISSION FROM SCHOOL A

GWANDA HIGH SCHOOL

Tel: (0284) 22930
Fax (0284) 22034
(0284) 22035
P.O. Box 40
All Correspondence to be addressed to the School Director

24 July 2021

Mr. Machaya

Joshua Mqabuko Nomo Polytechnic

P. Bag 5832

Gwanda

Ref: Permission to carry out a research on the title: **The Integration of Indigenous Knowledge into Climate Change Education: A Case of the Advanced Level Geography Curriculum in Zimbabwe.**

The above matter refers:

You have been granted permission to carry out a research on the tittle: *The Integration of Indigenous Knowledge into Climate Change Education: A Case of the Advanced Level Geography Curriculum in Zimbabwe.*

At the end of your research, you will be requested to submit a copy of your findings to the school so that it can be useful and of benefit to the institution.

The Head

A Maposa

THE HEAD
GWANDA HIGH SCHOOL
2021 -07- 24
P.O. BOX 40, GWANDA
TEL: 0284-22930, FAX: 0284-22034

TOGETHER WE CAN MAKE BIG THINGS HAPPEN
Discipline, Dedication and Determination

APPENDIX 10

PERMISSION FROM MINISTRY OF PRIMARY AND SECONDARY EDUCATION

All communications should be addressed to "The Provincial Education Director. Ministry of Primary and Secondary Education "
Telephone: 0284/23009/11
Fax: 024/23383

The Provincial Education Director
Ministry of Primary and Secondary Education
P. Bag 5824
Gwanda
Zimbabwe

15July 2021

MACHAYA TRUST
JOSHUA MQABUKO NKOMO POLYTECHNIC
P.BAG 5832
GWANDA

RE: PERMISSION TO CARRY OUT A RESEARCH ON THE TITLE "THE INTEGRATION OF INDEGINOUS KNOWLEDGE INTO CLIMATE CHANGE EDUCATION:A CASE OF THE ADVANCED LEVEL GEOGRAPHY CURRICULUM IN ZIMBABWE".

The above mater refers:

You have been granted authority to carry out a research on the title, **"THE INTERGRATION OF INDEGINOUS KNOWLEDGE INTO CLIMATE CHANGE EDUCATION:A CASE OF THE ADVANCED LEVEL GEOGRAPHY CURRICULUM IN ZIMBABWE ."**

At the end of your research you will be requested to submit a copy of your findings to the Ministry of Primary and Secondary Education (Gwanda District) so that it can be useful and of benefit to the Ministry.

MIN. OF PRIMARY & SECONDARY EDUCATION (MAT. SOUTH PROV.)
H.R. OFFICER SERVICES LEGAL & DISCP.
15 JUL 2022
P. BAG 5824 GWANDA
ZIMBABWE TEL: 0284/23009

NKALA S
FOR PROVINCIAL EDUCATION DIRECTOR

APPENDIX 11

PERMISSION FROM SCHOOL B

COLLEEN BAWN HIGH SCHOOL

BOX 20 COLLEEN BAWN, ZIMBABWE

CONTACTS: 0712974004/0776111570

EMAIL: colleenbawnhigh@gmail.com

20 July 2021

Mr Trust Machaya

JOSHUA MQABUKO NKOMO POLYTECHNIC

P. BAG 5832

GWANDA

RE: PERMISSION TO CARRY OUT A RESEARCH AT OUR SCHOOL, TITTLED 'THE INTERGRATION OF INDEGINOUS KNOWLEDGE INTO CLIMATE CHANGE STUDY: A CASE STUDY OF THE ADVANCED LEVEL GEOGRAPHY CURRICULUM IN ZIMBABWE'

With reference to the above matter, we hereby notify you that you have been granted permission to carry out educational research at our school titled '**THE INTERGRATION OF INDEGINOUS KNOWLEDGE INTO CLIMATE CHANGE STUDY: A CASE STUDY OF THE ADVANCED LEVEL GEOGRAPHY CURRICULUM IN ZIMBABWE'**

The school has already sensitised the students and members of stuff, however, you are requested to submit a copy of your findings at the Deputy Head's office for record keeping and future use.

Yours faithfully

.....

[Head]

[School's stamp]

THE HEAD
COLLEEN BAWN HIGH SCHOOL
20 JUL 2021
P.O. BOX 20
COLLEEN BAWN

APPENDIX 12

TURNITIN REPORT

Thesis

by Trust Machaya

Submission date: 30-Nov-2022 03:14PM (UTC+0200)

Submission ID: 1967201980

File name: Machaya_Thesis_All_Chapters._final_one.docx (601.58K)

Word count: 66000

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University of Fort Hare

Together in Excellence

14 CLIMATE CHANGE

ADVANCED LEVEL GEOGRAPHY

CURRICULUM IN ZIMBABWE

By MACHAYA TRUST: 7 : 201609925

Philosophy in

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Appendix 13

Editor's Letter

15 January 2023

Dear Editorial Staff

This is to certify that the Directorate Language Services at the University of South Africa language edited the thesis, "The integration of the indigenous knowledge into Climate change education: A case study of the advanced level Geography curriculum in Zimbabwe, University of Fort Hare by Machaya Trust.

The onus is, however, on the authors to make the changes suggested and to attend to the queries. Please note that we do not accept responsibility for content errors.

Direct any queries regarding the editing of this thesis to me .

Kind regards

UNISA university of south africa

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