BINDURA UNIVERSITY OF SCIENCE EDUCATION

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DEPARTMENT OF SCIENCE AND MATHEMATICS EDUCATION

Exploring the Integration of indigenous knowledge of fruits into an O level Biology curriculum in Zimbabwe by

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A project submitted to the Department of Science and Mathematics Education, Faculty of Science Education, Bindura University of Science Education, Bindura, Zimbabwe, in partial fulfillment of the requirements of the degree of Bachelor of Science Education Honours Degree -Biology

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Approval form

I, Dr. Vongai Mpofu, the undersigned certify that I have read this project entitled: **Exploring the integration of indigenous knowledge of fruits into an 'O' level Biology curriculum,** conducted by Tatenda Gracious Munokori **B1437706** in partial fulfillment of Bachelor of Science Education Honours Degree - Biology. I further approve its submission and recommends to Bindura University of Science Education for it to be examined.

Name of Supervisor: Dr. Vongai Mpofu

Signature of Supervisor: ……...

Date signed: January 2023

Declaration

I, Tatenda Gracious Munokori **B1437706** declare that this project is my own, supervised work. It is being submitted for the **Bachelor of Science Education Honours Degree - Biology** in the **Science and Mathematics Education Department, Faculty of Science Education** of the **Bindura University of Science Education.** It has not been submitted before for any degree in other University.

Signed…...……

……day of……2023

Abstract

Integrating indigenous knowledge in the science classroom is one approach of bringing about relevance of science learning to society. This study explored the integration of indigenous knowledge of fruits into an Ordinary level Biology curriculum in Zimbabwe. The study sought to address the problem that school science in Zimbabwe and in most colonized nations has remained largely western, that is disconnected from the cultural background of the learners, thereby not only affecting their performances, but also their interests in learning sciences and pursuing Science, Technology, Engineering and Mathematics (STEM) career. Consequently, this has largely contributed to the STEM skills gap Zimbabwe has been experiencing for more than thirty years. The purpose of this study is to describe the possibility of integrating indigenous knowledge of fruits and school biology through an exploratory case design at secondary school located in the Mutoko district of the Mashonaland East province, in Zimbabwe. Qualitative data were generated through document analysis and conversation with six Ordinary ('O') level learners participant. The school, class, and learners were purposively sampled. The qualitative content analysed data revealed three main findings/themes (1) a fragmented approach to the integration of indigenous knowledge of fruits; (2) exclusive approach to the integration of indigenous knowledge of fruits in the Biology component of the combined science curriculum; and (3) a five staged process for blending of Western and indigenous knowledge of fruits in the Biology component of the combined science curricula offered in Zimbabwe. The study concludes that though curriculum documents and classroom practices are largely IKF exclusive, the study gave an insight through the suggested five staged process integrated teaching and learning of IKF and EKF practically achievable. It proffers three main recommendations that the curriculum designers need to review that syllabus and textbook to incorporate indigenous knowledge in balanced and connected way (2) the teachers, learners and community need to collaborate in reviewing curriculum documents and teaching and (3) teachers should be professionally developed on how to integrate indigenous knowledge when teaching Biology.

Dedication

Dedication to my beloved brother, Amon Munokori and my mother Tsitsi Munokori who have been always there with their support.

Acknowledgement

I acknowledge with much humility the grace of the Almighty God for the guidance and strength to do this research. I have depended on the help and guidance from the firm, committed and loving supervisor, Dr Vongai Mpofu in correcting errors. I also appreciate her constructive comments and willingness to assist.

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List of Abbreviations

STEM	Science Technology Engineering and Mathematics
WSK	Western Scientific Knowledge
IKF	**I**ndigenous Knowledge of Fruits
IKI	Indigenous Knowledge Integrated
SKoF	Science Knowledge of Fruits
IKoF	Indigenous Knowledge of Fruits
EKF	Exotic Knowledge of Fruits
CACS	Culturally Aligning Classroom Science

CHAPTER 1: INTRODUCING THE STUDY

1.0 Introduction

The twenty first (21st) century economy is more and more demanding STEM competent workers (Mpofu & Vhurumuka 2017). This has driven Zimbabwe to introduce the competence based curriculum that emphasises on grounding Science, Technology, Engineering and Mathematics (STEM) of sciences on the philosophy of *Unhu/Ubuntu/Vumunhu* (Ministry of Primary and Secondary Education, 2015). *Unhu* is a social philosophy which embodies virtues that celebrate mutual social responsibility, mutual assistance, trust, sharing, unselfishness, self-reliance, caring and respect for others among other ethical values (Mandova, 2013).The directive to guide drive all teaching and learning in science implies integrating indigenous knowledge into the western science in teaching and learning. Thus, this chapter introduces and discusses the problem that motivated my undertaking of this study and elements related to it inclusive the background, research questions and objectives, significance, it's limitations, delimitations and assumptions. These elements forms the structure of the chapter, which concludes with a summary.

1.1 Background to the study

Before being colonized, African indigenous communities and others beyond Africa survived on their own forms of knowledge. Colonisation then bore a sad situation whereby indigenous knowledge was excluded from the curricula, thus Western education domination of school science remained a colonial legacy upon the nation's attainment of independence of many former colonies. The African education curricula have always been an integral part of the culture and history of indigenous (traditional) communities (Omolewa, 2007). In support of this scholars like Grange (2007), and Otulaja, Cameron & Msimanga (2011) argue that though colonialism has led to low appreciation of indigenous knowledge systems, among many people including the indigenous ones, acknowledge that most Western knowledge categories such as medicine, science,

climate and agriculture were extricated from indigenous knowledge. In African indigenous communities, Elders like fisherman, hunters, pastoralists and traditional doctors as expert in these knowledge domains orally pass this knowledge from generation to generation. . Such Experts are researchers in their indigenous ways of knowing wherein scientist develop western scientific knowledge.

Against this backdrop, it is no wonder that the integration of indigenous knowledge, which are others refer to as traditional or local knowledge into the science curriculum is now a well-recognized globally curriculum movement. In fact, worldwide, the inclusion/ integration of indigenous knowledge into the western oriented school science is becoming more and more vibrant. This comes from the recognition that reality is multiple so is science as both are culturally grounded (Mpofu 2016, Barnhardt, 2005, Aikenhead, 2009), Thus, indigenous knowledge integrated school science each is expected to understand the world and solve the problems in it through the indigenous knowledge and western science blended lenses (Bartlett, Marshall & Marshal, 2012). In other words this reform wishes learners to make sense of the world based on their experiences in it (van Glasersfield 2008), which in communities today are plural. Indigenous knowledge is an adaptable, dynamic system based on skills, abilities and problem -solving techniques that change over time depending on environmental conditions (Battiste 2005). This brings in the argument that indigenous knowledge and western science are both valuable knowledge systems whose integration in education is inevitable for socioeconomic transformation (Mpofu & Vhurumuka 2017).

Many studies are consistently showing that the exclusion of indigenous knowledge in the Western curricula has disadvantaged and is disadvantaging many learners with an indigenous background (Ogunniyi, 2005). In Zimbabwe, studies are providing enough evidence that indigenous knowledge integrated (IKI) teaching and learning science is marred with challenges, therefore is limited (Shizha, 2007, Mpofu 2016, Dziva et al, 2011), thus ignoring provision in legislation (revised constitution of Zimbabwe, 2013; policy 2007; CBC 2015). In support of lack IKI teaching and learning Zimbabwe Nherera,

(2000) noted that colonial legacies has continued to influence her education system since 1980". It can be drawn from this observation that Zimbabwean educators are still colonized and are in need of decolonization. This be attributed to the fact that most classroom practitioners (teachers and lecturers) in Zimbabwe and elsewhere in similar situation have received a teacher education qualification grounded in the Western scientific paradigm (Bode, 2013; Gomba, 2017; Shizha, 2007). As a result they have limited IKI science teaching know how. Arguably, the retention of western science teaching practices to Zimbabwean learners whose background is African, encounter language and understanding of western science content.

The reviewed 2015 curriculum framework not only revive the erosion of indigenous knowledge systems through making science teaching culturally relevant and responsive but also focus on the development of 21st century competencies through culturally responsive STEM education. This is made possible through underpinning all teaching on Unhu philosophy. However, despite this directive the science teaching has remained the same without adopting this new approach. Therefore the necessity of this study is to explore the integration of indigenous fruits into western biology curriculum.

1.2 Statement of the problem

Science has always known as a complex discipline which is difficult to teach and learn. Students ' performance in Zimbabwe and elsewhere has been consistently been low. One of the reasons cited in literature is that in many cases science taught in schools is disconnected to the cultural background of learners. All the aspect of western oriented curricula such as content, discipline language and language of instruction among others are largely foreign to learners of indigenous background. This makes science concepts difficult for learners to understand. The competence based curriculum introduced in 2015 has tried to address this problem by directing the STEM teaching of science to be underpinned on the philosophy of *Unhu*. *Unhu* is an indigenous philosophy, which if the teaching of concepts like biology draws from, makes learning more interesting, connected to home background and understandable. Notably, the school in indigenous communities can identify knowledge of the people of the community that can be integrated into the

teaching of sciences. However, studies like that of Mpofu (2016) and Shizha (2007) insights that teachers are challenged with IKI teaching of sciences like that of biology as their classroom practices have remained traditional western. The challenges could be attributed to the teacher's limited IKI teaching competencies. In an effort to contribute to solving this problem, this study seeks to explore how indigenous knowledge can be integrated into the teaching of Biology illustrating with the indigenous fruits. The study is focused through the following research questions.

1.3 Research questions (RQ)

RQ 1: What knowledge of fruits (KOF) can be drawn from curriculum documents?

RQ 2: What knowledge of fruits can be found in the community?

RQ 3: How can indigenous knowledge fruits (IKF) be taught within the nutrition topic taught at 'O' level?

1.4 Research objectives (RO)

By the end of the study the researcher should be able to:

RO 1: identify the KOF provided in the curriculum for 'O' level learners.

RO 2: document KOF extant in the locality of the school.

RO 3: establish the concepts of IKF which can be taught in the nutrition topic

1.5 Significance of the study

The study is valuable to learners, teachers, researchers as well as curriculum developers. The curriculum developers will be able to identify the loopholes in the syllabus concerning the topic Nutrition. The study will also help the curriculum developers to keep on directing teachers to teach topics contextualized to the equal environment of Zimbabwe. Also it becomes possible to point out the curriculum expectations and to know what is prevailing in the schools that is how teachers are teaching and how teachers are teaching and how is this connected to what literature is saying. Teachers will also benefit from this study in terms of getting insights into how to integrate indigenous knowledge into their respective

subject areas. Also the study will assist the learners to relate knowledge acquired through schooling to that in the community. By so doing learners gain their cultural identity. Learners will also build positive interests of learning foreign science or knowledge. The community as well will gain more confidence of their knowledge because it is being valued. Learners having an understanding of science may in their generation become equipped with life skills, creativity and innovation. This shows that the ideas the researcher has put forward can be used by education sector in general.

1.6 Assumption of the Study

This study was conducted based on that the integration of two knowledge systems (indigenous and Western science) will enhance effective teaching and learning process.

1.7 Delimitation of the Study

This study was delimited in terms of geographical location, methodology and key concepts. Geographically, this project was carried at Mutoko Central high school in Mashonaland East province of Zimbabwe. An exploratory case study design located in the qualitative methodology was adopted. A qualitative data was generate and processed to answer the RQs of this study. The conception of the study is built and bound on three key terms as discussed below:

1.7.1 Geographical location

The research was carried out with the participants selected from form 3 class at Mutoko Central High School. Mutoko is a district in Mashonaland East Province of Zimbabwe.

1.7.2 Methodology

This study adopted an exploratory case study design situated in qualitative paradigm.

1.7.3 Key concepts

Knowledge of fruits describes the valuable facts or information inclusive of subject matter, like the types and importance of fruits, how the knowledge is shared, come to be known and/or developed and the knowledge holders (Pierce, 2015).

This body of knowledge can either be described as either western/modern science or indigenous knowledge. Western science means the system of knowledge which relies on certain laws that have been established through the application of the scientific method to phenomena in the world around us (Aikenhead, 2009). Indigenous knowledge refers to the complex set of knowledge and technologies existing and developed around specific conditions of population and indigenous to a particular geographic area (Mosemege & Onwu, 2004). Thus the knowledge of fruits can either be a form of Western science and here referred to as SKoF or an indigenous form here referred to as IKoF.

1.8 Limitations

The researcher faced the challenge of limited access to literature relevant to the study because very little has been written in literature about the knowledge of indigenous fruits within the local context sources. I was also time constrained because the study was time framed within one semester. To overcome these constraints the researcher is going to acknowledge the use of international sources. In terms of time the research is going to be carried out in Mutoko District.

1.9 Summary of the Chapter

The identified problem under investigation is the integration of the prior knowledge of indigenous fruits into Biology concept taught in schools. In terms of structure, the study consist of five chapters. The first chapter is the introduction of the study. Chapter two is about the review of related literature. The third chapter is about research methodology, chapter four present findings and discussion and chapter five summarizes and concludes the study with recommendations.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This chapter discusses the literature related to this study.This chapter discusses the literature relevant to integration of indigenous fruits into an 'O' level Biology curriculum. The chapter was developed from the view of literature review as the summarising, synthesizing and/or critiquing reporting of literature searched for a study being undertaken (Patton, 2002; Cohen, Manion & Morrison, 2007)**.** In addition, reasons to review the literature inclusive of locating the study in previous research and making the problem understudy apparent (Merriam & Simpson, 2000) were considered. The literature reviewed is presented and discussed under three themes that relate to the research questions and objectives. These themes are (1) knowledge of fruits (2) indigenous knowledge of fruits and (3) knowledge of fruits and school science curriculum, which. Informed my choice of a culturally aligning classroom science model (Mpofu, 2016) as a conceptual framework. The chapter ends with a summary.

2.1 Knowledge of fruits

Globally, it is recognized that research is conducted to construct knowledge for solving problems. However, the term knowledge is complex to define and requires to be defined in accordance to how it is used in this study. Mercer (2010) describes knowledge from a learning perspective as information and skills (competencies) acquired through education or experience or awareness or familiarity gained by experience of a fact or situation. There are three kinds of knowledge namely physical (facts about the features of something), social (names and conventions made up by people) and logico- mathematics knowledge (the creation of relationships). Such knowledge are provided in form a curriculum. Where a curriculum here is viewed as what the learner at any level of education is expected to acquire in terms of concepts, skills, values and attitudes (competences/exit profiles). This perspective of knowledge relates to a western education system. Within this system, different subject curricula are designed from related knowledge developed by scientist in

discipline. For example, a biology curriculum is designed from the knowledge developed by biologist and the skills, values and attitude they hold.

Today, both the biology knowledge and curricula are largely western grounded. The description of knowledge or curricula as western, means that knowledge exist in many form. The other form of knowledge relevant for this study is indigenous knowledge. According to Mosemege and Onwu (2004) indigenous knowledge is an all-inclusive knowledge that covers technologies and practices that have been and are still being used by indigenous and local people for existence, survival and adaptation in a variety of environments. This gives an insight that indigenous ways of knowing rely heavily on many forms of intelligence, including interpersonal, physical and spiritual intelligence. It is characterized as holistic, meaning that it interlinks all the categories of western knowledge with spiritualism. Indigenous knowledge refers to the philosophies, indulgences and expertise developed by long resident societies in their interaction with their natural surroundings and other people (Dziva et al, 2011). In contrast, Western scientific knowledge (WSK) refers to a generalized body of laws and theories to explain a phenomenon or the scientific method (Aikenhead, 2009). WSK exist in different disciplines such as chemistry, Biology, and Botany. (Oggunnyi, 2007; Betiusta. 2002; Oddora-Hoppers, 2002). Such knowledge is developed through western approaches that is knowledge constructed is prediction or hypothesis based and tested.

Both Botany and biochemistry are variations of Biology. The botanical definition of fruit is a seed-bearing part of a flowering plant or tree that can be eaten as food. This aligns with Holmes, (2013) who defines a fruit as edible part of plants that contain the seeds and pulpy surrounding tissue, have a sweet or tart taste, generally consumed as breakfast beverages, breakfast lunch and side-dishes, snacks or desserts. Like knowledge, fruits fit into two different categories, 'indigenous fruits' and ' exotic fruits '. Indigenous fruits are those which are native to Africa, where they have originated and evolved over centuries (Pierce, 2015) whereas exotic fruits are that which are not native and that are cultivated

outside, available at their place of origin. (Beaulieu, 2003). Beaulieu, goes on to say exotic fruits are mostly tropical fruits and are unique in nature and different in taste.

The construct knowledge of fruits describes the valuable facts or information inclusive of subject matter, like their types and importance of fruits, how the knowledge is shared, come to be known and/or developed and the knowledge holders. The important of fruits are to animals are well recognized worldwide. They are significant to people's lifestyles because they bare a good source of different nutrients which leads to good health. Accordingly, Slavin and Lloyd (2012) agree with many other scholars that 'By eating fruits a person is providing the body with key vitamins, antioxidants and dietary fiber' which give significant benefits for heart health, digestion, weight managed and skin health. For example grape fruit may help prevent diabetes and other chronic diseases. Health wise, indigenous fruits are of a great value for example the treatment of diabetes using baobab fruits (Liu, 2013). These fruits also have a medicinal value meaning some of the fruit seeds are good in producing medicines. Fruits can also reduce food insecurity as well as malnutrition and hidden hunger. Besides healthy benefits, fruits are also significant in high economic value. Akinnifesi et al (2007), postulates that indigenous fruits are sold in both urban and rural markets and provide a substantial income to the small-scale farmers. Accordingly, trading of fruits collected from the wild is a profitable enterprise. Not only indigenous fruits are associated with income generation but exotic fruits as well. Thus fruits are serving as source of income as well as nutritional sources for good healthy.

2.2 Indigenous knowledge of fruits

The phrase indigenous knowledge of fruits (IKF) describes the competencies (knowledge, values, skills, attitudes), development of knowledge, and sharing grounded in indigenous paradigms. A paradigm is a way of looking at or researching phenomena, a world view, a view of what counts as accepted or correct scientific knowledge, or way of working, an 'accepted model or pattern ' (Cohen et al 2007).The term indigenous relates to locality and context –specificity to explain why indigenous knowledge is often characterized as context –specific. Such knowledge is not static but evolves and changes it develops, influences and is influenced by both internal and external circumstances and interaction

with other knowledge systems (Dziva et al, 2011). This, implies that every community, in either the developed world or developing and underdeveloped countries, has its own forms of indigenous knowledge system (Nyong et al, 2007). The indigenous fruits and vegetables are connected to an ethnic group's heritage and culture by their knowledge of local plants (Schrecknberg et al, 2006). This conveys how indigenous people get to know about these fruits as well as being able to identify them. It has been documented by some scholars that indigenous people who live in the vicinity of natural resources observe the activities around them (Mugambiwa 2018). People in an indigenous set up observe nature and it's varying activities around them in many ways and they apply the knowledge that they possess about the environment and it is mainly passed orally. The relationship between humans and their environment which leads to symbiotic interdependence is also a solution to how do people know about the indigenous fruits. The symbiotic interdependence with the ecology enabled people to learn to observe how various natural artefacts from animals, birds and plants change, interact and behave over a period of time. Also indigenous knowledge is orally transmitted or through imitation and demonstration. Henceforth, basing on these facts it explicitly show how people get to know about the indigenous fruits.

The Zimbabwean fruits are utilized for different reasons. The major reasons for their utilization are to improve the nutritional status, broaden the food base, raise standards of living and provide opportunities for income generation. There are numerous ways of utilizing and processing indigenous fruits at household level or at large processing into juice and jam as well fermented beverages. In previous studies, it has been documented that in Zimbabwe there are many traditional beverages and /or wines made from indigenous fruits, which are produced through indigenous processes. The fermented beverages include *mukumbi, mudetemwa, mazhanje and Masawu wines.*

> Masawu wine is made by soaking, Mauritania (masawu) fruits for several hours and allow them to ferment at ambient temperature. A distillate called Kachasu is made from Masawu fruits that have been fermented for 4-7

days. Kachasu is a common name given to traditionally fermented and distilled alcoholic spirits which are poten

The above reference is expressing how one of the indigenous fruits is utilized as a way of commercialisation. This seen institutions of higher education embarking on production of fruit products as they implement STEM and Education 5.0 curriculum framework. For example Bindura University as an institution it practically producing Masawu products like yoghurts and juice.

In Zimbabwe as else, commercialisation of indigenous fruits has the potential to create employment, eradicate poverty as it improves income streams for the rural folk especially women and the youth who are economically marginalized. This uphold the sustainable development goals of quality education, good health and well-being, peace, justice and strong institutions, industry, innovation and infrastructure and many others. The Herald paper on 03 October 2022 mentioned the commercialisation of baobab fruit as one such initiative that could help in curbing the importation of aforementioned raw materials. It goes on to say, 'According to Dairboard, the baobab fruit was declared a superfood in the developed world in 2015. Another fruit is *mapfura*/ marula which is used to produce juices, alcoholic beverages, edible oils and stock feeds which are currently being sold locally with plans to export already underway. All these examples elucidates how the indigenous fruits are utilized. Utilization may be done by preservation which means that fruits can be preserved for future use. Preservation of fruits is done through drying. Dried fruits are believed to be unique and as tasty and nutritious as fresh fruits. They are sweeter as well because water has been removed, thereby concentrating the fruit's flavour. These type of fruits are advantageous as they add variety to human diet.

2.3 Knowledge of fruits and school science curriculum

As already discussed in the above sections, knowledge of fruits can be indigenous or Western knowledge. In general, science education stakeholders around the world are advocating for the integration of indigenous knowledge into the Western science. This is based on the argument that contextualizing science learning is most likely to make

learners understand and become interested in science. Research has consistently shown that most learner of indigenous background struggle with understanding of scientific concepts more the learners with western background (Shizha, 2007). This has been shown to lead to learners' loss of interest in science, which in turn results in many learners dropping out from science classes. In consequent creating a skills gap in STEM careers. All the science learning challenges are largely rooted in the fact that western science curricula are divorced from the indigenous learner's cultural backgrounds (Shava, 2005). To address these challenges, the Zimbabwean competence based curriculum framework (2015-2022) informs on integrating cultural knowledge into school science teaching. This is drawn from the framework's instruction to underpin all teaching and learning on the Unhu. Unhu is a social philosophy which embodies virtues that celebrate mutual social responsibility, mutual assistance, trust, sharing, unselfishness, self-reliance, caring and respect for others among other ethical values (Mandova, 2013).

In support of the indigenous knowledge integrated teaching of science, some Zimbabwean scholars argue that integrating indigenous knowledge into the school science not only transforms the relationship between school science educators and local communities, but also is a strategy for sustainable development (Dziva, Mpofu & Kushure, 2011). This support the competence based curriculum frameworks (2015-2022) drive to both STEM and indigenous teach science. In schools, aspects of local knowledge can be found, therefore schools are spaces where students and teachers have the opportunity to realize in practice how science and other forms of knowledge may connect and benefit each other. Moreover, integrating indigenous knowledge into the school curriculum capacitated the pupils with knowledge and skills to understand the world phenomenon in the different ways. Also, in most societies, indigenous people have developed enormous volumes of knowledge over centuries by directly interacting with the environment (Mpofu, 2016). An understanding of such indigenous knowledge within school education leads to a deeper understanding about the local area (Barnhardt, 2005). This makes the pupils value equally these two bodies of knowledge. Thus, it informs how relevant it is to integrate indigenous knowledge into school science curriculum. Research has shown that

teachers are barely teaching sciences from an indigenous knowledge integration approach, that is science teaching has remained western oriented despite the curriculum calls to integrate indigenous knowledge in the teaching and learning of science.

Despite the relevance of this integration, researchers are in agreement that the integration has got challenges associated with it. Most research reveal that teachers have a limited conception of indigenous knowledge and do not perceive indigenous knowledge as useful science content Dziva et al (2011). Since teachers replace parents and elders as the holders of knowledge in the school set up it becomes challenging for them to integrate the know-how of indigenous knowledge. In fact literature has revealed teacher resistance to indigenous knowledge and it's integration to school science curriculum as major challenge (Ogunniyi, 2007). The resistance is sometimes associated with the scenario that indigenous knowledge is looked down upon as primitive (Shizha, 2007). For example people has a belief that eating indigenous fruits is a sign of being poor or suffering which is wrong. Ogunniyi- (2007) also brought forward a statement which say:

> Teachers can help learners to integrate the indigenous knowledge but for them to do so they must be equipped with adequate knowledge and understanding regarding the two thought systems.

The reason why some teachers are not well equipped is that they have been schooled in Western Science especially the majority of teachers of the current generation in Zimbabwe (Mpofu, 2016). Other challenges highlighted by several authors include lack of documented teaching material and guidance on how to integrate indigenous knowledge in science teaching. Also there are students from a range of cultural backgrounds in classrooms - so whose indigenous knowledge should they teach?

2.4 Adapted CACS conceptual framework

Figure 1 below summarises a Cultural Aligning Classroom Science conceptual framework. The model, which for this study was adapted from Mpofu (2016) relates indigenous knowledge and western science through their integration in the school curricula. In other words, it summarizes how the integration of cultural (indigenous)

knowledge into the learning of science can be achieved. According to Khupe (2014) it is possible for western science to be culturally relevant. The CACS Conceptual framework guides on the teaching and learning process that aims at making school science relevant. This is supported by Lee (2003, p…) who asserts that “science learning may become particularly challenging when the cultural practices of the scientific community may or may not align with the cultural understandings of the students”. As such, exploring the worth and contribution of cultural knowledge systems and beliefs in science teaching will help learners understand it's worthiness and teachers will have a living laboratory to draw examples from for their teaching allowing for diversity, equity and fairness to the learners (Moyo, 2017).

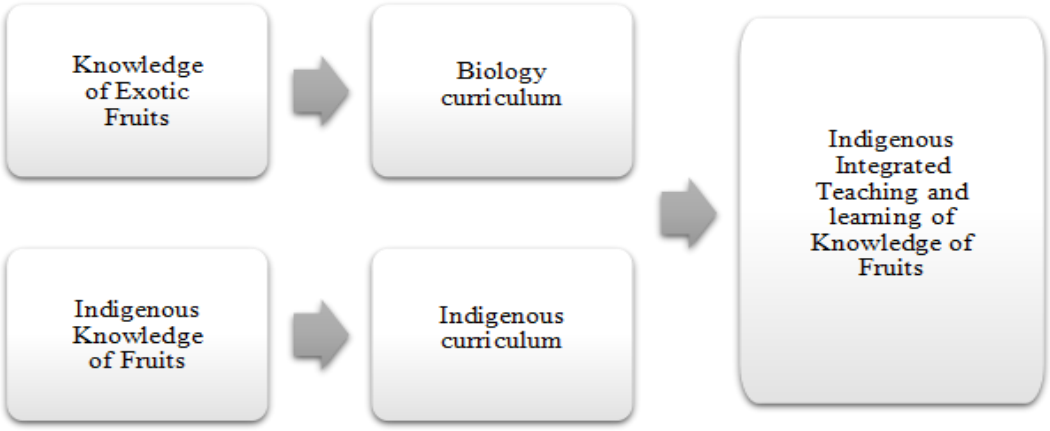

Figure 2-1: Adapted CACS conceptual framework (Mpofu, 2016)

As figure 1 above is showing, exotic and indigenous knowledge fruits (IKF and EKF) of are separate knowledge domain grounded in western and indigenous knowledge systems. A related curricula can be drawn from each of these systems of knowledge, IKF and EKF. However, the spaces between the shapes labelled IKF and EKF and that of their respective curricula show that they exist in isolation. To date the school science is disconnect from the cultural knowledge. However, CACS is expressing the integration of the knowledge of fruits from the community into that of the school science curriculum. The CACS conceptual framework now is advocating for a collaborative curriculum whereby

the teaching and learning process should consider the integration of indigenous knowledge of fruits into a Western biology curriculum.

2.5 Chapter summary

This chapter holds a discussion on related literature concerning the study. The discussion was guided by three themes which emerged from the RQs and ROs. Also the chapter reflects relevant information which will support the findings presented in chapter 4. CACS model was adopted as a conceptual framework to show how the two types of knowledge (IKF and EKF) can relate to each other in the teaching and learning process. Basing on these studies it implies that the current thinking is that school science should be integrated with cultural knowledge.

CHAPTER 3: RESEARCH METHODOLOGY

3.0 Introduction

The study aimed at investigating the integration between the indigenous knowledge of fruits and biology curriculum. This chapter focuses on the methods, design and research instruments the study employed. The discussion will centre on how to do the research and how the research was conducted in order to collect valid and reliable data for both the research questions and objectives of the study. This encapsulate a methodology in research. A research methodology is a stance that a researcher takes towards understanding or explaining the physical or social world (Rapley, 2007). Therefore in order to achieve these objectives as well as answering the research questions, this chapter represents and describes the components that make up this methodology. The structure of this chapter is a result of these components. They include the (1) Context of the study (2) Paradigm (3) Design (4) Research participation (5) Data and generation methods (6) Reporting on data generation.

3.1 Context of the study.

This section discusses the context of the study based on geographical location of the school and why this location. The study was carried out at Mutoko Central High School. The school is located in a rural area of Mutoko District in Mashonaland East Province of Zimbabwe. This location, Mutoko, was chosen to be an area of study because there is a variety of indigenous fruits which are found. These fruits come in different seasons which is a benefit to the people. The variety of fruits include Masawu (Ziziphus Mauritania), Mawuyu (Baobab fruit), mashuku (Sugar plums) matohwe (Snot apple) and chocolate berry (tsubvu). The fact that in Mutoko there's a variety of wild fruits makes it a suitable location to undertake the study. This also led to wide information about the investigation.

3.2 Paradigm

The paradigm guiding the study is called a Qualitative paradigm. This paradigm is a key research approach to educational researchers. According to Mohajan (2018) qualitative research is a systematic and subjective approach to highlight and elucidate daily life

experiences, and to further get appropriate meaning that are normally measured by quantitative research. The main characteristic of qualitative research is that it has the natural setting as the direct source of data. My aim was to understand experiences drawn from the context of real situations. In this case, context refers to a reality of considering the physical, intellectual, cultural and emotional settings. The qualitative research presents a researcher as the key instrument since data is generated by the researcher. This means that the primary collection instrument in a qualitative research is the researcher. The advantage of adopting this paradigm is that the researcher becomes self-engaged into the phenomena which leads to trustworthiness and credibility of the findings. Also qualitative research is humanistic, it's leads to a development of theory which makes it suitable for this study.

3.3 Exploratory case study

The study was an adopted and exploratory case study design. Exploratory research is qualitative in nature. It is a methodology approach that investigates a research that have not been studied in depth previously. It is characterized by low costs, being interactive as well as open ended. Generally there is no prior research done before or the existing ones do not answer the problem precisely enough. It enables the researcher to answer questions like what is the purpose of the study. What is the problem and what topics could be studied? Also it's not necessary to have a set of rules to carry out the research, it's just flexible. This design has its own advantages which makes it suitable for this study. As the research progresses the researcher can adapt to changes which shows the flexibility of the design. This design can assist other researchers to find out possible causes for the problem and further studies can be done in detail. Thus exploratory case study is such a research which explores the problem and not actually deriving a conclusion from it which helps the researcher to set a strong foundation for exploring his or her ideas.

3.4 Research participation

This section discusses participation components of this study. These are target population, sampling and participants or sample.

3.4.1 Target population

In this study, a total number 'O' level learners in the three form 3 classes constituted potential participants, that is the target population of the study (N=120). Creswell (2014) defines a target population as a group of individuals or a group of organizations with some common definite characteristics that a can identify to study. Thus, target population is the entirety of people from which a researcher select participants.

3.4.2 Sample

From the target population only 6 students participated in the study (n=6). The characteristics the participants which were considered relevant to the study summarized in the Table 3-1.

Table 3-1: Characteristics of Teacher participants

Participants	**Class**	**Gender**	**Ethnic group**
1	Form 3 Sciences	Male	Chitoko
2	Form 3 Sciences	Male	Chitoko
3	Form 3 Arts	Male	Chitoko
4	Form 3 Arts	Female	Chitoko
5	Form 3 Commercials	Female	Chitoko
6	From 3 Commercials	Male	Chitoko

Table 3-1 shows participants' class, ethnicity and gender which considered to be balanced and adequate .to generate qualitative data with. The pseudo names were used to uphold the ethical standard of confidentiality and protect the participant as provided in the confidentiality information (Appendix 2). As Table 3-1 is showing the study sample was constituted both boys and girls to show that knowledge holding has no gender

segregation. Thus, each participant's contribution was considered to be valuable regardless of class and gender.

3.4.1 Purposive sampling of participants

The selection of the school, classes and learners was purposive sampling. Purposive sampling is a sampling technique in which the researcher relies on his or her own judgement when choosing members of population to participate in the study (Saunders, Lewis, & Thornhill, 2012). Their selection was based on the following criterion; be a form 3 student, be a resident in the locality of the school, voluntary consent (willingly to participate) as well as parental approval that is the parents to agree.

3.5 Gaining field access and ethical consideration

This study was ethically conducted. Research ethics entails the application of moral rules and professional codes of research conduct to fieldwork (Antoniadou & Dooly, 2017).Ethics considered were inclusive of human participants' right to confidentiality, protection, voluntary and informed (see **Appendix 2**). Additionally, authority to do research with students at White head high school was to uphold ethical obligations.

Research authority started with obtaining an introductory letter from the Department of Science and Mathematics Education **(see Appendix 1**). The application to conduct this research letter (see appendix 2) wrote to White head high schools will be accompanied by this this introductory letter. The authority given to do this study is shown in **Appendix 3.** The evidence that the participants agreed to partake in this study is illustrated by the completed voluntary consent form shown in **appendix 4.**

3.6 Data and generation methods

Data relevant to answering research questions (RQs) asked in chapter one was generated as summarized in Table 3.2. These RQs are re-stated for easy reference as: (1)What knowledge of fruits (KOF) can be drawn from curriculum documents, (2) What knowledge of fruits can be found in the community, and (3) How can indigenous knowledge fruits (IKF) be taught within the nutrition topic taught at 'O' level?

Table 3-2: Data generation Matrix

RQ	Source	Generation method	Tools	Recording	Type	Analysis
1	Curriculum documents	Document analysis	Document analysis guide	Writing or field notes	Text data	QCA
2	Students	Conversation	Conversation guide	Writing or field notes	Text data	QCA
3	Students and curriculum documents	Conversation	Conversation guide	Writing or field notes	Text data	QCA

Elements of data collection shown in Table 3.1 above are discussed in detail in the ensuing sections.

3.6.1 Data sources

The data were generated from students and curriculum documents as shown in the table above. The characteristics of students participants as sources of data are as detailed in the research participation section above. The curriculum documents sources included the 'O' level Biology syllabus, Competence base curriculum for primary and secondary education in Zimbabwe and the main the textbook. Students as data sources for questions 2 and 3 were the suitable participants because they not only connect the school with the community, but also barn and bread in the community. Students therefore hold prior knowledge found in the community for integrating into the school curriculum and at the same time they are expected to use competencies (knowledge, skills, values and attitudes) acquired at school to to solve community problems. The fact that curriculum documents provide the basis for teaching, learning and assessing in a particular subject area makes them suitable to be one of the fee data sources. They provide a foundation for further development and implementation as well in areas such as learning resources and assessment of learners.

3.6.2 Methods of generating data

In this study, data was generated through two different methods- conversation and document analysis. The use of these two methods gave sufficient triangulation, which is key to generating credible data. In qualitative research, triangulation refers to the use of multiple methods or data sources in qualitative research to develop a comprehensive understanding of phenomena (Moran-Ellis et Al, 2006) whilst credibility entails validity and reliability of data. Validity and reliability are concepts used to evaluate quality of a research. The following section discusses these methods in detail. This elaborates that the researchers are able to compare two or more sources of data in the same category. By so doing it increases the credibility and validity of research findings as the method enables the researcher to validate the findings and ensure accuracy.

3.6.2.1 Conversation with students

This method was used in this study to generate data with students because characteristics supported this exploratory investigation. Conversation is a suitable method for generating data with human participants such as students, particularly when the data relates to their community and identity. Conversations are an interview type.. .They conversations as any other forms of interviews enable researcher and participants to sharing of knowledge. However, conversations unlike interviews, removes researcher authority on participants and promote co-researching and co-participation. Thus, conversations means to 'allows [research] practitioners to talk freely about the impressions they have each received from among the various things they have seen and heard, so that they may have their wisdom while exchanging opinions vigorously and without restrictions '(Rapley, 2009). From this definition a conversation is the spoken exchange of ideas, opinions, observations or feelings between people. Conversation is not a competition but it is a dialectical process as the participants share knowledge, views, understanding and feelings. Also participants in conversations can come close to one another, "to what they know, desire, imagine and believe in". A person cannot be conversing alone but with others therefore the characteristics of a conversation is that it is an activity that is done by people together. These characteristics enable to provide

relevant information which should answer my questions. Learners interacting or discussing together sharing some ideas and after discussion they write chemical bonding concept down their answers as a group and submit their work for marking. I have chosen it because choose it to promote interaction among learners so as to create the opportunity for fast learners to help the slow learners to grasp the concept to foster reflective thinking the act of explaining and defending ideas to one's peers is thought of force students to take critical positions on their own ideas and writing. The main disadvantages are that during group discussions some of the learners do not want to contribute with answers and do not want to interact with others, I will minimize this by ensuring that every group member participate during discussion.

3.6.2.2 Document analysis

The document analysis method was used to generate data from the curriculum documents (the syllabus, CBC 2015 and the main reference textbook). These documents were examined in the context of how they were used by the participants (students). A document is something that we can read and which relates to some aspect of the social world. Document analysis is a qualitative research technique used by researchers. Bowen, 2009 defines document analysis as a form of qualitative research in which documents are interpreted by the researcher to give voice and meaning around an assessment topic. This technique involves evaluating documents and is a well-recognised effective method for generated data from readily available sources.

3.6.3 Development of data generation tools

The tools used for data collection shown in the table 3.1 were self-developed and checked for correctness (validity and reliability). The reason behind establishing validity and reliability in this research is essentially to ensure that data is plausible enough to give authentic findings. Validity refers to the accuracy of a measure [that is] whether the results really do represent what they are supposed to measure, reliability refers to the extent to which the same answers can be obtained using the same instruments more than one time

(Cohen et al, 2007). This reliability and validity are concepts used to evaluate the quality of research.

3.6.3.1 Development of document analysis guide

The document analysis guide in appendix 6 was self-developed. The guide was self-developed because the motive behind document analysis is to present accurate and reliable data. Also it was self-developed in order to select appropriate pieces for the study. The development process was informed by literature review and research questions 1 and 3. The development process involved 3 steps. In step 1, i have read my literature review particularly on the nutrition concepts. Step 2 was to list the resources that is to find and decide on the curriculum documents to use. The choice of the documents was based on this criterion; a curriculum document, a biology document and having nutrition concepts. In step 3 as the last step, the guide items were drawn from the research questions for example question 3 and 4 because there are some questions which are being answered by document analysis.

3.6.3.2 Development of a conversation guide

Conversation guide was self-developed as well. This is because the guide should outline issues that a researcher feels are good enough and they are meaningful to answer the research questions. The development process also was informed by literature review and research questions. The process was done in 3 steps. In step 1, i find the essential questions in which the information to answer those questions is acquired through conversations with participants. Research questions 2 and 3 are being answered through conversations. In step 2 the guide was developed with the aid of the document analysis guide. This is because the two guides mist speak the same language as the study uses a technique of triangulation (different sources developing a comprehensive understanding of the phenomena). The last step was to generate the guide items from the questions in document analysis guide.

3.6.3.3 Validating Research tools

In terms of validity, I gave this guide to my supervisor and to other educated colleagues to cross check for me to ensure that it is valid. After that I accepted changes by removing unnecessary stuff as well as adding relevant information which was missing. Therefore this guide is valid in doing this research thereby discussing the problem under investigation.

3.6.4 Data collection Procedure

Data was generated through a three-stage process which summarized in figure 3-1 below.

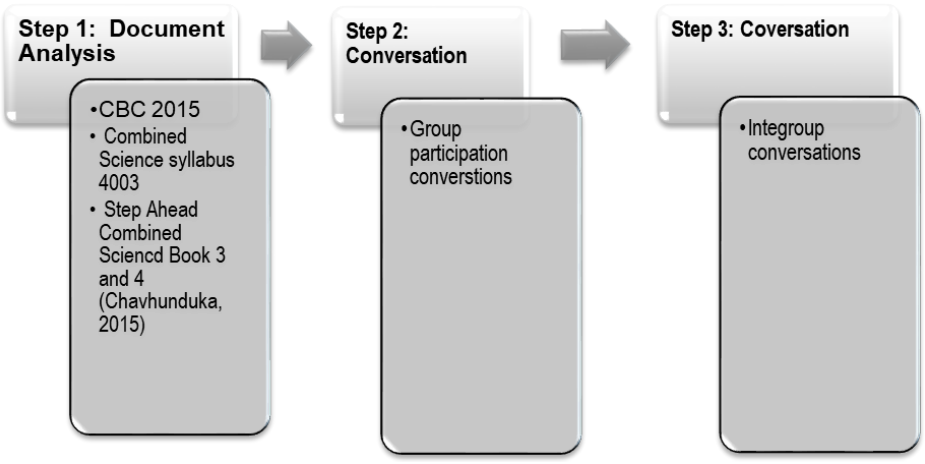

Figure 3-1: Data generation process.

3.6.4.1 Step 1: Document analysis

In step 1, the curriculum documents were analysed. These documents are the Curriculum Based Competence 2015, Biology syllabus and the G.C.E O level Biology Matters textbook. This document analysis was done because these documents are the relevant sources to answer the research question 1 and 3.

3.6.4.2 Step 2: Conversation (participants only)

What was done in step 2 is a conversation cycle. This conversation cycle was done in three ways resulting in pre- and post- conversation. This means that it's individual

followed by group conversation. First self-conversation was done that is participants responding to the questions on the conversation guide individually. Secondly it was paired conversation whereby the participants work in pairs generating comparative notes using the outcome of self-conversation. The last part of the conversation cycle is whole group conversation whereby the researcher joined the group of participants in order to make field notes. Conversation was done in two sessions. Session 1 was conversation within the participants in two groups of threes producing hand written transcripts. The second session was the whole group conversation (researcher and participants) the researcher making field notes. The conversation was based on the items developed on the conversation guide which attended to the RQs. Some of the researcher field notes are given below.

3.6.4.3 Step 3: Conversation (researcher and participants).

In step 3, it is also whole group conversation; the researcher and the participants. At this stage this is where the comparison of data generated in step 1 and step 2 is done thereby writing field notes. The comparison is done as a way to answer research question 2 and 3.

3.6.5 Nature of data collected

By nature, data are either qualitative or quantitative. Data represent measurements of quantities or of variables. Data is defined as any information that has been collected, observed, generated or created to validate original research findings (Bauer, 2008). This means that data are factual material to validate scientific findings. Since the paradigm guiding this study is a qualitative paradigm, the type of data for the study is Qualitative data. Qualitative data is made up of words, descriptions, images, objects and sometimes symbols. Qualitative data methods focus on gaining insights, reasoning and motivations, hence they go deeper in terms of research. From the data generation matrix it shows that data is in the form of text data.

3.6.6 Analysis of data

Data analysis is a complicated process that involves getting insights into or information about the problem understudy from the collected data. .According to Saunders (2012) research data analysis is a process used by researchers for reducing data to a story and interpreting it to derive insights. This process reduces large data chunks into smaller fragments, which makes sense. Marshall and Rossman (2006), also describe data analysis as a messy, ambiguous, and time-consuming, but a creative and fascinating process through which a mass of collected data is being brought to order, structure and meaning. Data analysis organizes and, summarizes information in data into categories that stories solutions to the problem which is being studied. Data was qualitative content analysed through a four stage process as presented below.

3.6.6.1 Data preparation

Data generated through document analysis and conversation with participants was recorded in form of participant written discussions and researcher field notes. The hand written field notes were typed and constituted qualitative text data. The data was then tabulated in line with the eight classroom practice aspects of content, and purpose, pedagogy, teaching and learning roles, language and assessment and RQs as illustrated in Tables 3-3 and 3,4 below.

Table 3-3: Example of Document Analysis Data

Document	**Indigenous**	**Western scientific**	**Blended-** RR/V/C
CBC	Data Observation As shown in Fig 3 cross-cutting themes like heritage studies and the constitution of Zimbabwe [Preservation of	Data except The learning area should allow the learners to identify their pathways…. STEM pathway would study additional Mathematics, Physics, Chemistry, Biology and Geography Fig 3	This gives a reflection that the inclusion of indigenous type of knowledge tend to be fragmented henceforth the content is more of Western oriented.

	traditional knowledge The State must take measures to preserve, protect and promote indigenous knowledge systems, including knowledge of the medicinal and other properties of animal and plant life possessed by local communities and people](field notes, source CBC 2015, pg 33, date--31/12/22). Inference The term heritage and the IK Constitutional clause suggests the inclusion of content related to indigenous fruits. Section 33 of the constitution says, the state must take measures to protect, preserve and promote indigenous knowledge systems. Therefore this suggest inclusion indigenous content but with examples of content.	From Fig 3 pg 33 some of the cross cutting issues are digital literacy, enterprise skills and financial literacy are largely Western scientific content (CBC 2015, pg 33) Inference As illustrated above, the term STEM means a combination science, technology, engineering and maths. The learning areas under STEM pathway as indicated in the data are related to Western science education. The CBC document is much emphasizing on the teaching and learning of pure sciences. Thus the type of knowledge is pure western scientific education.	
Syllabus	**<u>Observation</u>**	The syllabus covers science concepts such as observing, measuring,	Given that the indigenous knowledge is

	Commission and omission (No topics about indigenous knowledge)- Omission retains status quo and commission entails a decision to do so do something- This relate to keeping the western science content.(field notes, source -Combined science syllabus 2015, date 31/12/22). **Inference** Basing on the above, the expression...no topics about indigenous content informs that indigenous content is excluded. This means that there is no specific indigenous type of content in which the syllabus interpreters mist deal with during the course of teaching and learning.	presentation, interpretation of data and analysis. There are seven topics in the Biology section which are Laboratory rules and safety, Cells and levels of organisation, Nutrition, Respiratory system, Transport systems, Reproduction in plants and animals as well as Health and diseases. **inferences** The excerpts above explicitly (overtly, openly) suggests (guides, instructs, informs, directs) the teaching and learning of exotic fruits content. All the stated topics explicitly show that the whole concept of Biology is grounded in foreign science. Therefore it reflects a Western science scope.	missing, it means that Western scientific content is dominating in the documents
Textbook	**Data Excerpt** You're eating plan should also be culturally … including foodstuffs that are easy to	**Nutrition** is the study of how food affects the health and survival of an organism. A balanced diet contains the proper properties of carbohydrates, fats,	Given that teaching and learning of knowledge related to indigenous fruits can only be inferred in the text book as compared

	access to make it possible to maintain the plan. **Inference** By implication, the term culturally and phrase foodstuffs that are easy to access in the excerpt above, makes reference to Indigenous knowledge. Since no specific IK content is provided syllabus, teachers the expected establish the content for themselves. expressed in the t.	proteins, vitamins, minerals and water necessary to maintain good health. To be healthy does not mean that you must give up some foods and eat only fruit and vegetables. Fruit and vegetables: Three to five servings per day. A food pyramid on page 15 fig 2.1 show some fruits which are bananas, grapes, watermelon, oranges and apples. The components of a balanced diet contain the nutrients you need in sufficient quantities. Each nutrient has a specific role to play in ensuring that your body functions properly and stays healthy. Naturally occurring sugars are found in fruits, milk products and honey, beet sugar and sugar cane. Examples of given fruits from fig 2.2 pg 16 include grapes and bananas. Also from fig 2.3 one of the examples of foods rich in fats is an avocado which is a fruit as well. Minerals are found in foodstuffs such as fresh fruits and vegetables, dairy products, meat and vegetables. From fig 2.6 there are some examples of fruits rich in fibre as a nutrient which are	to that of exotic knowledge of fruits which is explicit, the content to be taught is largely western.

		bananas, apples, oranges and pears. **<u>Inference</u>** The excerpt above explicitly (overtly, openly) suggests (guides, instructs, informs, directs) the teaching and learning of exotic fruits content.	

Table 3-4: Example of Conversation data

Qn	**Group 1**	**Group 2**	**Whole group**
1	Nutrition is the study of how food is affecting our health and survival. Munharaunda matigere umu, tinorarama ne chikafu chinobva musango, kumhuka nemukurima. Urwu ndirwo ruzivo rwedu runokosha rwatinowana kubva kuvakuru vedu Indigenous knowledge is the knowledge that we know without using	Nutrition is the study of how food is affecting the health and survival of an organism. Zvokudya tinozviwana nenzira dzakasiyana sekuvhima, kuredza hove, kurima nekutsvaka michero yemusango.Balanced diet eg carbohydrates, proteins, lipids, vitamins. Ini ndinokosherwa neruzivo rwandinowana kumba kupfuura zvandinodzidza kuchikoro, vamwe munoti kudii? That knowledge is for free,	Both indigenous knowledge and scientific knowledge is found in learners. Indigenous knowledge is existing knowledge in learners they get from their homes. Learners are much knowledgeable about indigenous knowledge. They know indigenous concepts like history, language, cultural practices, and healing skills. There are unique ways of learning in a community whereby people connect through

	scientific means to gather the knowledge. Zvisiri zvokudya chete, vakuru vedu vanotidzidzisa tsika nemagariro anoumba munhu nokut munhu unhu, unhu munhu Nhai vasikana nevakomana, zvidzidzo zvedu izvi zvakambobva kup? Ruzivo rwatinowana munharaunda muzvidzidzo zvedu haruwanikwi. Chimbofunga kuwanda kwaakaita michero yemusango , zvakaipei tikadzidza nezvayo. They are not considering indigenous knowledge, they are considering scientific knowledge nowadays. To a greater extent Western Biology	easy to learn and understand. Indigenous knowledge is the knowledge that we have besides scientific knowledge. We learn through different activities like rain making ceremony, bira, rituals (kurova guva), kurapa tichishandisa mishonga yechivanhu, nhimbe. But most of us are now ignoring this type of knowledge. Students are not taking the concept serious and valuing the indigenous knowledge. To a greater extent the Western biology concepts are considered. People are paying more attention to do the Western biology concept. Our own new	stories, knowledge is shared through art and objects, rituals. People practice hunting and gathering, fishing and farming.

	concepts are being considered as they are used regularly in health matters based on DNA tests.	curriculum is mainly focusing on Western biology concept.	

3.6.6.2 Data familiarization

Data familiarization is the process of becoming familiar with the data through reading and re-reading text data from document analysis data (field notes) and conversation data (student written responses and researcher field notes). All the data was generated in text form. Familiarization commenced during field work and it constitutes the activities and process of generating data.

3.6.6.3 Coding

Coding is a process of labelling and organizing qualitative data to identify different themes and the relationship between them (Gibbs, 2007). Coding was informed by a conceptual framework, research questions data and classroom aspects. The conceptual framework and research questions provided deductive directions or deductive coding themes and codes.

3.6.6.4 Categorisation of codes into themes

The codes assigned to units of analysis assigned into themes drawn from the RQs which are: knowledge of fruits in the 'O' level Biology curriculum, (2) knowledge of fruits in the locality of the school and knowledge of fruits, (3) integration into the nutrition topic taught at 'O' level. The study recommend that indigenous knowledge should be integrated into the school science.

3.7 Presentation and discussion of findings

The processed data (information) forms research findings which are presented and discussed in the ensuing Chapter four. The findings from are presented in form of

descriptive text accompanied with data excerpts. The choice of using descriptive text was based on its ability to clearly classify different data in thematic form.

3.8 Research Rigor and Trustworthiness

I was informed by Lincoln and Guba's (1985) framed of research rigor and trustworthiness (Table 5) to enhance the validity and reliability of my research processes and findings. According to Lincoln and Guba, (1985) the rigor and trustworthiness the findings of any qualitative study is a measure of the trust or confidence in the data from which they are drawn from, the analysis processes, and consistency in the methods used over time, accurate representation of the participants studied.

Table 5: Framework for qualitative research rigor and trustworthiness

Elements	**Description**	**How achieved examples**
Credibility	The confidence that can be placed in the truth of the research findings and its process. It establishes whether or not the research process and findings are plausible. In case of findings it evaluates the originality of data, correctness of interpretation from the participants' point of view.	− Prolonged Engagement in field − Triangulation – Member checks − Persistent Observation
Transferability	the degree to which the findings of a qualitative research can be transferred to other contexts with other participants – it is the interpretive equivalent of generalizability	− Provide thick description −

Dependability	the stability of findings over time and involves participants evaluating the findings and the interpretation and recommendations of the study	− audit trial − Peer Examination − Member checks
Confirmability	the degree to which the study findings could be confirmed or corroborated by other researcher	− audit trial − reflexive journal − triangulation

Adpted from Lincoln and Guba (1985)

The rigor and trustworthiness of this study is evident throughout this chapter and others and their connections.For instance, my use of two methods of data generation with two groups of participants enhance the trustworthiness of both the data, information drawn from it through triangulation. Many qualitative research scholars agree with Patton (2002) that triangulation entails to the generation of of data through multiple methods and/or generating of from many data sources in order to study a phenomenon in depth and understand it comprehensively. In fact it can be also be viewed as a strategy for assessing and evaluating the validity of qualitative research findings to through the convergence of information dawn from different sources and/or with more than one method. As proposed by Denzin (1970, p.301) they are four forms of triangulation (1) data triangulation (includes matters such as periods of time, space and people) (2) investigator triangulation, (the use of several researchers in a study) (3) theory triangulation (encourages several theoretical schemes) to enable interpretation of a phenomenon and (4) methodological triangulation (promotes the use of several data collection methods such as interviews and observations). In this study, I mainly used the data and methods form of triangulation (see Table 3.2).

3.9 Chapter summary

This chapter, which is ending with this summary discussed the research methodology that I adopted in this study. The methodology aspects of paradigms, the research design which was used (Exploratory Case study), contexts, how the participants were sampled, methods and procedures of data collection as well as its analysis to solve the problem understudy. The chapter also highlight how ethics were taken into consideration. The next chapter focuses on data presentation and discussion on the findings concerning the study.

CHAPTER 4: RESEARCH FINDINGS AND DISCUSSION

4.0 Introduction

The research or study aimed at exploring how indigenous knowledge of fruits can be integrated into an “O” level Biology curriculum in Zimbabwe. This chapter, therefore is presenting the findings of the study, which are answering the three research questions that were presented in Chapter one. In other words, these findings are to a large extent providing the solutions to the problem which has been stated in Chapter One. The chapter is organized into three themes, which speak to the research questions and research objectives. The findings discussed under each theme- (1) knowledge of fruits in the 'O' level Biology curriculum, (2) knowledge of fruits in the locality of the school, and (3) knowledge of indigenous (KIF) integration into the nutrition topic taught at 'O' level emerged from the generated data.

4.1 Findings and discussion

The findings are based on themes that emerged from the collected data in line with the research questions. Within each theme, findings are presented and discussed in relation to eight aspects of classroom science practices of Mpofu and Mutseekwa (2023). These aspects provided the sub-themes (sub-heading). The sub-themes are (1) philosophy, (2) context, (3) content, (4) purpose, (5) pedagogy, (6) teaching and learning roles and responsibilities, (7) language and (8) assessment.

4.1.1 Knowledge of Fruits in the 'O' level Biology curriculum

Under this theme, the analysis of documents revealed a fragmented approach to the integration of indigenous knowledge of fruits in the Biology component of the combined science curricula offered in Zimbabwe. This is elaborated under the following section.

4.1.1.1 Philosophy

The curriculum documents reveals that is limited inclusion of indigenous philosophy into that of Western science. In other words, the documents are encouraging teachers to teach science in the tradition of Western science education philosophy (No integration).

The indigenous knowledge philosophy tend to be fragmented. It's just bits and pieces not being fully considered. Therefore the inclusion of indigenous type of philosophy is limited. The finding emerge from data as in following excerpts:

Excerpt 1

> Zimbabwean rootedness in the foregoing beliefs and values reflects pan-Africanist philosophy even in the face of globalisation (Mandova, 2013).Unhu/Ubuntu/Vumunhu epitomizes universal human inter-dependence, solidarity, humanness and sense of community in African societies (CBC 2015, p 22).
>
> This is a document that outlines the underpinning national philosophy, principles, learning areas, the description and expectations of Ministry of Primary and Secondary education (MOPSE)..... One of the factors that influence the drafting of a school syllabus is community influences (Combined science syllabus, pg 5 Unit 1).
>
> Your eating plan should also be culturally … including foodstuffs that are easy to access to make it possible to maintain the plan. Naturally occurring sugars are found in fruits, milk products and honey, beet sugar and sugar cane (Combined science book 4, pg 15 Unit 2)
>
> The establishment and consolidation of firm grounding in Science and Technology disciplines (STEM). The teachers possesses intercultural understanding, life skills, health education, economic and entrepreneurial education, media education, ICT and e-learning. This relate to keeping the Western philosophy of science education. Evidence eg language, forms of assessment (field notes, source CBC, pg 22, and 31/12/22).

It can be drawn from Ex 1 above that the mention of Unhu philosophy is weak as compared that of western, the latter philosophy is dominating. This finding is supported by other researchers such as Dziva, Mpofu & Kushure (2011) reveal that teachers have a limited conception of indigenous knowledge and do not perceive indigenous knowledge as useful science content. Hence unhu philosophy was mentioned but it is being suppressed.

4.1.1.2 Context

The curriculum documents show implicit inclusion of the indigenous context into that of a Western scientific environment. Of course the integration of the two types of knowledge is found but there is no specific deep content of the indigenous type of an environment. This gives a perspective that Western science is dominating in the document. The following excerpts are an evidence of these findings.

Excerpt 2

> The learning environment should promote various things like independence and inter-dependence, a learner-centred learning, motivation and self-esteem as well as the values, needs and interests of learners and the **society**. The **learner-centred classroom environment** must encourage self-confidence in learners as well as valuing the effort in the learner's work. Concerning the needs of **learners, teachers** take into account the needs of learners beyond the **classroom to enable learners to understand, adapt and participate in the dynamic of a changing society** (CBC 2015, pg 48-49).

in Except 2 above, It can be drawn from the bolded text that the curriculum documents are guiding on teaching science in the school settings. However, the emphasis on society suggests that teaching of nutrition concepts can also be done in the community and natural environment.

4.1.2 Content

In the CBC (competence based curriculum), it reflects that the inclusion of indigenous type of content tend to be fragmented thereby giving content which is more of Western oriented. Also in the syllabus the indigenous knowledge is missing. The teaching and learning of knowledge related to indigenous fruits can only be inferred in the textbook as compared to that of exotic knowledge of fruits which is explicit, thus the content to be taught is largely western. The finding emerge from the data as in the following excerpts.

Excerpt 3

The State must take measures to preserve, protect and promote indigenous knowledge systems, including knowledge of the medicinal and other properties of animal and plant life possessed by local communities and people](*field notes, source CBC 2015, pg 33, date--31/12/22).*

The learning area should allow the learners to identify their pathways…. STEM pathway would study additional Mathematics, Physics, Chemistry, Biology and Geography
Fig 3
From Fig 3 pg 33 some of the cross cutting issues are digital literacy, enterprise skills and financial literacy are largely Western scientific content (CBC 2015, pg 33)

Nutrition is the study of how food affects the health and survival of an organism. A balanced diet contains the proper properties of carbohydrates, fats, proteins, vitamins, minerals and water necessary to maintain good health. To be healthy does not mean that you must give up some foods and eat only fruit and vegetables. Fruit and vegetables: Three to five servings per day. A food pyramid on page 15 fig 2.1 show some fruits which are bananas, grapes, watermelon, oranges and apples. The components of a balanced diet contain the nutrients you need in sufficient quantities. Each nutrient has a specific role to play in ensuring that your body functions properly and stays healthy. Naturally occurring sugars are found in fruits, milk products and honey, beet sugar and sugar cane.

The excerpt above reflects that the nutrition concepts are largely western concepts. The given examples of fruits are exotic fruits, the learning areas are western content which gives a reflection that the indigenous knowledge of fruits is overtly missing in the school science curriculum. Therefore there is need to integrate the knowledge of exotic and indigenous fruits.This finding is research supported. Indigenous fruits are those which are native to Africa, where they have originated and evolved over centuries (Pierce, 2015) whereas exotic fruits are that which are not native and that are cultivated outside, available at their place of origin. (Beaulieu, 2003).

4.1.2.1 Purpose

The documents (syllabus and textbook) reveal that the indigenous kind of an objective is excluded which makes reference to a Western oriented knowledge. In the CBC the indigenous knowledge tend to be blotted. It is not fully developed meaning to say there is no much content specifically to it which can be taught. Therefore the slight inclusion of indigenous knowledge gives a conclusion that it is largely western contextualized. These findings were drawn from the data excerpts that followed.

Excerpt 4

> The goal of an appreciation for lifelong learning, visual and performing arts and civic education centers for indigenous knowledge. Establishment and consolidation of firm grounding in Science and Technology disciplines (STEM). Demonstration of communication, problem -solving, technological, management and leadership skills. (CBC 2015, pg 22 -23).
>
> The syllabus aims to develop learners' basic scientific skills in physics, chemistry and biology such as handling of apparatus chemicals, plant and animals specimens safely and confidently. Evidence eg topics, methods of teaching and learning (*field notes, source Combined Science syllabus,pg 4, date-- 31/12/22).*

The finding is directly showing that the curriculum documents keeps in possession of Western scientific knowledge. Though the CBC is appreciating the inclusion of indigenous knowledge it is not practiced on the ground because the syllabus interpreters are focusing on Western perspective which is found in the syllabus. Shizha (2005) revealed that teacher resistance to indigenous knowledge and it's integration to school science curriculum is a major challenge. Henceforth indigenous kind of objectives are not considered in the education system.

4.1.2.2 Pedagogy

In all the analysed curriculum documents, the indigenous pedagogical issues can only be inferred as compared to scientific strategies which are explicitly informing the methods of

teaching and learning to be used. Henceforth Western pedagogy is being used to achieve set objectives in schools expressing how restricted is the indigenous perspective. The following excerpts appears in the data to come up with the given findings.

Excerpt 5

> The curriculum framework stresses learner-centred approaches expressing the view that learners are active agents. As active agents they bring their own knowledge, ideas and past experiences. The centrality of the learner in the teaching and learning process leads to meaningful learning which is problem solving based, practicals, challenging and fun. Also it is an interactive pedagogy (classroom interaction and participation). An example of an approach that characterizes the learner- centred method is inquiry based learning. Inquiry -based learning is an approach that aims at nurturing thinking, reflection and problem -solving among learners.
>
> The methods should be learner centred and problem solving approaches for example giving room for group discussions in a lesson is a learner centred approach. Evidence eg language, teacher as a facilitator of learning (field notes, source - Combined Science syllabus, pg 13, date -31/12/22).

The pedagogy being used in schools is a bit balanced meaning to say it accommodate both indigenous and Western strategies of teaching and learning. From the excerpt, phrases like ' ...being their own knowledge, ideas and past experiences, classroom interaction and participation, learner centred and problem -solving approaches can be applied in either indigenous or Western education. Previous studies have shown the integration. Mercer (2010) describes knowledge from a learning perspective as information and skills acquired through education or experience or awareness of familiarity gained by experience of a fact or situation. Thus the teaching and learning strategies are considering both indigenous and Western perspectives.

4.1.2.3 Teaching and learning roles and responsibilities

Analysed curriculum documents are not directly informing the indigenous teaching and learning responsibilities. This type of knowledge is indirectly expressed which means it's

blotted. The Western science is dominating thereby proving that the teaching and learning roles and responsibilities are largely western oriented and indigenous views are limited. Some of the data excerpts below show where these findings were drawn.

Excerpt 6

> The teacher integrate the cross-cutting issues such as life skills, heritage studies, guidance and counselling as indicated in Fig 3 pg 33. The teacher is there to build better communication with the learners, parents and stakeholders as well. As a mentor of learning the teacher is expected to possess intercultural understanding eg life skills. The teacher is interested and able to engage in team work and participates in communities of practice. The learner is also aware of learning objectives and expected learning outcomes (learner competency). The teacher reinforces connections between learning areas and disciplines and promotes integrated learning. In the context of interactive pedagogy the teacher use various methods to adapt to the learner's situation and needs (CBC *2015, pg 44-45).*
>
> The teacher supervises class activities. Classroom management is facilitated by the teacher which is the process of planning, organizing, leading and controlling class activities to facilitate effective and efficient learning (*Combined science syllabus, pg 14 Unit 6).*

It can be drawn from the excerpt that the indigenous teaching and learning roles can only be inferred in the curriculum documents. The data shows that the teacher is the one who facilitates the learning process mostly, the indigenous ideas are bit marginalized. Hence there is no integration of the two types of knowledge (IK and WK). This finding can be explained from findings of previous studies that assign teaching roles to teachers.

4.1.2.4 Language

Language as the medium of instruction there is need to consider that learners are from different backgrounds with different languages. In the curriculum documents there is an element of code switching which clarifies the inclusion of indigenous type of knowledge. Though code switching was this is a Western oriented education because all the analysed documents are expressed in foreign language (English). The finding emerge from the following data excerpts.

Excerpt 7

The medium of instruction is in both local and foreign language leading to a blended knowledge. The medium of instruction used in the curriculum framework as a whole is more of Western oriented because it is written in foreign language, English. Though some of the statements mean indigenous knowledge, they are expressed in English very few words in the document are in Shona. Evidence e.g. content, assessment *(field notes, source - CBC 2015, pg 22, date 31/12/22).* The whole syllabus is written in English which is largely Western scientific oriented

The finding is explicitly showing that foreign language is used in schools as the medium of instruction. All documents as written in English it proves that the educators are taking indigenous knowledge as myths or misconceptions. Other researchers show how colonized are the minds of Zimbabwean educators with scientific ideas. Nherera, 2000 defended this fact by saying, 'though Zimbabwe attained independence more than two decades ago, colonial legacies has continued to influence her education '. Therefore the researcher discovered that it is vital to fully include indigenous knowledge in the education system.

4.1.2.5 Assessment

Assessment is considered as a measure of success, it is an important aspect in the teaching and learning process. The idea of assessment is just bits and pieces in indigenous context from the curriculum framework therefore it reflects a Western education dimension. In other words the indigenous knowledge is limited in the document. The other two analysed documents (text book and syllabus), the idea of assessment in indigenous knowledge is overtly missing. Thus the findings explicitly show that this aspect of assessment is Western oriented. The findings were drawn from some of the data excerpts below.

Excerpt 8

From Fig 5 pg 41 there is fair, relevant and reliable assessment of competency for the learner which shows that the learning process ends. Assessment is in two forms, formative and summative. Formative involves tracking learner behaviour and performance on an ongoing basis. It is used to assess knowledge, skills and values. Summative assessment measures learner performance at the end of a learning programme. It focuses on assessing knowledge and regurgitation of facts. Its purpose has largely been grading, placement, selection and informing system performance thereby being Western oriented. Evidence eg learning areas, forms of assessment (*field notes, source- CBC 2015, pg 51, date-31/12/22).*

Assessment is the systematic collection of data to monitor the success of a course in achieving intended learning outcomes from students. There are two types of assessment namely summative and formative. Summative comes at the end of the course for example final examinations. Formative is the ongoing or continuous assessment for example tests, quiz and assignments. Evidence eg language, methodology (*field notes, source -- Combined Science syllabus, pg 13 , date-31/12/22).*

Exerpt 8 above clearly show that assessment is a scientific tool which is used to measure success as classified into formative and summative. The way success is measured in the society is different from the way it is in schools. Markus and Borsboom (2013) define testing as “any technique that involves systematically observing and scoring elicited responses of a person or object under some level of standardization. Indigenous kind of assessment is limited in the curriculum documents. Thus the education system is slightly including indigenous knowledge.

4.1.3 Knowledge of fruits in the locality of the school

As in section 4.3 above the presentation and discussion of findings under this theme emerged from conversation data and are based on data generated in line with to classroom science practices aspects.Under this theme, the analysis of conversation data revealed a exclusive approach to the integration of indigenous knowledge of fruits in the Biology component of the combined science curricula offered in Zimbabwe. This is elaborated under the following section.

4.1.3.1 Philosophical multipluralism

Data revealed that participating learners hold multiple philosophy inclusive that of the western and indigenous African philosophy of Unhu/*Ubuntu*.

Excerpt 9

> Indigenous knowledge is the knowledge that we know without using scientific means to gather the knowledge….*Zvisiri zvokudya chete, vakuru vedu vanotidzidzisa tsika nemagariro anoumba munhu nokut munhu unhu, unhu munhu (Group 1 Convesartion).*
>
> *Ini ndinokosherwa neruzivo rwandinowana kumba kupfuura zvandinodzidza kuchikoro, vamwe munot kudii?* That knowledge is for free, easy to learn and understand. …Indigenous knowledge is the knowledge that we have besides scientific knowledge. We learn through different activities like rain making ceremony*, bira*, rituals (*kurova guva), kurapa tichishandisa mishonga yechivanhu, nhimbe (Group 2 Convesartion*)
>
> Both indigenous knowledge and scientific knowledge is found in learners. Indigenous knowledge is existing knowledge in learners they get from their homes. Learners are much knowledgeable about indigenous knowledge. They know indigenous concepts like history, language, cultural practices, and healing skills. There are unique ways of learning in a community whereby people connect through stories, knowledge is shared through art and objects, rituals. People practice hunting and gathering, fishing and farming (Whole group *Conversation researcher fieldnotes*).

From the data in excerpt 9, it can be drawn that learners hold both the indigenous and Western philosophy. The words expressed in Shona (unhu philosophy) are an evidence that learners are knowledge holders who are significant in integrating indigenous and Western scientific knowledge. Zimbabwean scholars have tried to define what unhu philosophy is. For instance, Mandova (2013) explains unhu philosophy as a social philosophy which embodies virtues that celebrate mutual social responsibility, mutual assistance, trust, sharing, unselfishness, self-reliance, caring and respect for others among other ethical values.

4.1.4 Context/ environment

The participants also provide that the environment in which the teaching and learning process takes place depends on the type of knowledge which is being acquired. An indigenous kind of context is a bit different from the Western scientific environment. The findings were drawn from some of the data excerpts below.

Excerpt 10

> Ruzivo rwatinowana munharaunda zvakanaka kut zvibatane nezvidzidzo zvedu muzvikoro (Group 1 conversation)
>
> By inviting local elderly people who know about these indigenous knowledge to teach pupils at school. (Group 2 conversation)
>
> Indigenous fruits are easily accessible as compared to exotic fruits. Indigenous fruits are found almost everywhere they are not limited. Exotic fruits are expensive no free access to them (Conversation researcher field notes)

The finding implies that knowledge can be shared despite of the environment. Also it expresses that an indigenous environment is free which may lead to better understanding. The researcher finds out that the indigenous type of environment is missing in schools. For example learning science in nutrition in a natural environment where learners have access to plants, they can build a better level of understanding. Mugambiwa (2018) also found out that indigenous people who live in the vicinity of natural resources observe the activities around them. By so doing the researcher is advocating for an integration of indigenous and Western knowledge.

4.1.5 Content

The type of knowledge that can be drawn from the learners is both indigenous and Western scientific knowledge. They have much knowledge of indigenous content, which shows that from the environment they live, it is good possible to educate one another. In support of this, it is evidenced by the following excerpts from the participants.

Excerpt 11

A fruit is a product of a tree that contains some nutrients. A mature ovary of the plant. Mangoes, lemons and oranges are fruits found in our community. We eat these fruits every day to get nutrients. These fruits exist seasonally. Matohwe, tsubvu, nzvanzvara and nhengeni are also found in the locality of the school(Group 1 conversation)

Isu vanhu vechishona tine upfumi kwazvo kusanganisira michero yemusango.

A fruit is a product of a tree that can be eaten or a mature ovary of a plant. Indigenous fruits are matohwe, nhunguru, tsvubvu, mauyu, matunduru, matufu, maroro. We eat these fruits every day to gain nutrients specifically vitamins. Michero yemusango inopa utano hwakanaka uye inokurudzirwa kudya zvakaita semauyu, Masawu uye tsvubvu dzinodzivirira gomarara Exotic fruits are blueberries, mulberries, oranges, bananas, pineapples, apples. Fruits like matunduru are used to predict a drought season (matunduru akawandisa anoreva kuti kuchaita nzara) (Group 2 conversation)

There are indigenous and exotic fruits. Indigenous fruits are easily accessible as compared to exotic fruits. Indigenous fruits are found almost everywhere they are not limited. Exotic fruits are expensive no free access to them. Indigenous fruits in the local area.. matohwe, matufu, maroro, tsubvu, mauyu, nhunguru, nhengeni, mazhanje, matunduru, Masawu, chakata, matamba, nyii, nzvanzvara. Exotic fruits they know..mango, apple, orange, pineapple, guava, pawpaw, banana, strawberry, peaches, narjtie, grape, granadilla. Indigenous fruits are wild fruits a'd exotic fruits are from Western countries. Learners know the exact time to find indigenous fruits in the wild, how to preserve them for future use, as well as the benefits they get from those fruitsThey know indigenous concepts like history, language, cultural practices, healing skills (Conversation researcher field notes)

Learners are much knowledgeable about indigenous knowledge. They have much content as evidenced in the excerpt by the content of indigenous fruits. Instead of teaching the content of exotic fruits only, it is good as well to teach them what they interact with in their everyday life (indigenous fruits). Some researchers already came up with this finding for example, an understanding of such indigenous knowledge within school education

leads to a deeper understanding about the local area (Barnhardt, 2005). This becomes a foundation of a better understanding of the concepts since researchers has consistently shown that most learners of indigenous background struggle with understanding scientific concepts.

4.1.6 Purpose

The aim of the teaching and learning process is to share or pass knowledge to others. Also it is for a good reason of developing life skills in the learners for them to fit into the society as well as contributing to the economic development. The following excerpts show the purpose of teaching and learning as discussed by the participants.

Excerpt 12

> Introducing indigenous knowledge to new curriculum is the only way it can be taught in schools. Ruzivo rwatinowana munharaunda zvakanaka kut zvibatane nezvidzidzo zvedu muzvikoro. Zvinoita kut tinzwisise zvidzidzo zvevachena izvi nekut tinenge tichishandisa mienzaniso yatinoziva uye zvatinoita (Group 1 conversation).
>
> By inviting local elderly people who know about these indigenous knowledge to teach pupils at school. Hatidi kurasikirwa neruzivo rwevakuru vedu tinoda kuzodzidzisao vana vedu saka vabereki ngavapiwe mukana muzvikoro vadzidzise vana nezvazvo (Group 2 conversation).
>
> Indigenous knowledge of fruits must be included in the curriculum so that the knowledge of our elders will not be totally eroded but preserved. (Conversation researcher field notes).

The phrase written in Shona from Group 1 conversation in the excerpt reflects that for the purpose of teaching and learning process to be accomplished it is important to integrate the two types of knowledge. By so doing the researcher is advising the curriculum developers to integrate the two types of knowledge.

4.1.7 Pedagogy

Several strategies or approaches may be applied in the process of imparting or acquiring knowledge emerged from the data. The strategies depends on the type of knowledge that is either indigenous knowledge or Western scientific knowledge. Also the approach can be determined with the environment in which the learning and teaching process is taking place. In expressing the idea, participants provided the following data.

Excerpt 13

> We learn through different activities like rain making ceremony, bira, rituals (kurova guva), kurapa tichishandisa mishonga yechivanhu, nhimbe. (Group 2 conversation)
>
> There are unique ways of learning in a community whereby people connect through stories, knowledge is shared through art and objects, rituals. People practice hunting and gathering, fishing and farming (Conversation researcher field notes).

The finding gives a view that learning is interesting. The ways of learning identified by the participants show that it's learning by practical. People learn through doing several activities thereby developing life skills. It is a bit similar to Western scientific ways of learning like observing, experimenting and recording. In support of this Grange (2007) acknowledges that though colonialism has led to low appreciation of indigenous knowledge systems among many people including the indigenous ones, some acknowledge that most Western knowledge categories such as medicine, magic, poisons, climate and pesticides are grounded in indigenous knowledge. Therefore if the two types of knowledge are equally appreciated the learners will enjoy the learning process.

4.1.8 Language

Data showed that learners resorted to Shona when the discussed about the knowledge in the community and used English to communicate Western scientific knowledge as evidenced in Excerpt 14 below and across other Excerpts (see 12 &13) .

Excerpt 14

Magwaro ezvidzidzo zvedu akanyorwa nemutauro wedu zvinoita nyore kunzwisisa tobudirira muzvidzidzo zvacho (Group 1 conversation).

Let indigenous knowledge of fruits be a subject on its own at O level. Learners are encouraging curriculum developers to include indigenous fruits in the syllabus as a topic (Conversation researcher field notes).

This aspect is vital in the education system. It is the medium of instruction. We cannot talk of the teaching and learning activity whilst ignoring this aspect, language as it has an impact on success. It has a greater effect because people know and speak different languages depending on their backgrounds but indigenous language is restricted in schools leading to the resistance in integrating indigenous knowledge into western scientific knowledge. A certain research by Shizha (2007) shows that the resistance is sometimes associated with the scenario that indigenous knowledge is looked down upon as primitive (Shizha, 2007).

4.1.9 Assessment

Except 15 below exemplifies the data from which participants showed that indigenous assessment is oral, practical and ongoing (formative) whilst learning of science is both formative and assumptive as well as theoretical and practical.

Excerpt 15

For example we do farming practices in our everyday life which includes a lot of activities like animal rearing, soil preparation (kurima ne mombe ne gejo, mapdza), sowing (kudhara), manuring (kuisa mupfudze), weeding (kusakura) and harvesting (kukohwa, kupura zviyo). If we learn farming related concepts it becomes easier to measure our success because it's part of our everyday life (Group 1 conversation).

Indigenous fruits are also used to predict forthcoming seasons for example matufu, mbumi, nhunguru ne tsvubvu zvikaberekwa zvakawanda zvinoreva kuti ignore remaguta. Fruits like

matunduru are used to predict a drought season (matunduru akawandisa anoreva kuti kuchaita nzara) (Group 2 conversation).

Learning indigenous related concepts may assist learners' to achieve their success without struggling since they have prior knowledge of those concepts (Conversation researcher field notes).

Success can be measured to tell whether the one who was acquiring knowledge grasped the concept or not. Assessment is common in both indigenous and Western education systems. It is more like a feedback of what has been done during the teaching and learning process. If the feedback is positive it means the learner is successful.

4.2 Conversation and document analysis synthesized findings

The synthesis of curriculum and conversation findings show that the curriculum documents are explicitly directing on the Western paradigm grounded teaching and learning IOF grounded. In this regard, six aspects of the classroom science aspects context, content, purpose, pedagogy, teaching and learning roles and language are largely western in the curriculum documents with two aspects, assessment and philosophy showing a mere inclusion of indigenous knowledge. This has been reinforced by the conversation findings which shows that though both Indigenous knowledge of fruits (IOK) and Exotic/Western knowledge of fruits (EKF/WKF) are extant in the local community of the school, the teaching and learning of the nutrition topic has remained largely western. On the whole, only bits and pieces of IOK are taken into the Western classroom practice ways and most indigenous know of fruits is excluded from the nutrition topic. Moreover. The fact that the community holds both indigenous knowledge of fruits and Western knowledge of fruits provides a basis of integrated teaching and learning.

4.3 Strategies for teaching and learning of KIF in the nutrition

The synthesized findings from document analysis and conversation data proposes a six staged process of teaching and learning of indigenous knowledge of fruits in the nutrition topic at 'O' level. First, teachers to establish the western orientation of each of the eight

aspects of classroom science.This according to CACS brings about an understanding of the two knowledge systems inclusive of similarities, connections and difference. Furthermore it leads to the documentation of IOK adjust to that EOK for teachers to refer to. In support of this view, Otulaja, Cameroon, and Msmanga (2011) educate that teachers need documented indigenous knowledge to refer to for their planing to teach and integration of western science and indigenous knowledge in lessons.

Secondly, the teachers need to collaborate with learners in documenting indigenous knowledge of fruits for teaching in the nutrition topic. The documented indigenous knowledge of fruits constitutes content to be taught. As the teachers document this content they enhance their understanding of what indigenous knowledge of fruits entails and how different this knowledge is from EOF. Thirdly, they are to analyse and connect all other indigenous aspects to the nutrition topic. Fourthly, they draw from their comparison to develop IKI teaching and learning of fruits. Fifth, they implement the blending of Western and indigenous knowledge pedagogues.

To illustrate, teachers can blend the Unhu pedagogy with inquiry based learning and collaboration to enable learners to learner through problem solving. Collaboration extent to teachers' engagement with local elders who are knowledge holders of indigenous knowledge. These elders from the community must be given time to educate both teachers and learners on indigenous knowledge in schools. This is an effective way of practically integrating indigenous knowledge of fruits into the school science. Lastly, IKI teaching and learning can be broadcast (radio and television program) at a well-known specific time and channel so that everyone will have a chance to learn about it. It will result in the integration of indigenous knowledge and western knowledge at large. Therefore the teaching of the indigenous knowledge of fruits in the nutrition is missing but it is possible to integrate the two using the emerged strategies as per findings.

4.4 Chapter summary

To conclude this Chapter presented and discussed the findings of the study which are answering the research questions. The chapter revealed that (1) a fragmented approach

to the integration of indigenous knowledge of fruits; (2) exclusive approach to the integration of indigenous knowledge of fruits in the Biology component of the combined science curriculum; and (3) a five staged process for blending of Western and indigenous knowledge of fruits in the Biology component of the combined science curricula offered in Zimbabwe.

CHAPTER 5: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter summarizes and concludes the study as well as make recommendations from the findings to. It is organized into thrr subheading- (1) summary of findings, (2) conclusion and (3) recommendations. The chapter ends with my final remarks.

5.1 Summary of finding

The three themes which are major findings of this study and answers to the research questions (1) a fragmented approach to the integration of indigenous knowledge of fruits ; (2) exclusive approach to the integration of indigenous knowledge of fruits in the Biology component of the combined science curriculum; and (3) a five staged process for blending of Western and indigenous knowledge of fruits in the Biology component of the combined science curricula offered in Zimbabwe. These themes emerge from the findings aligned to the research questions that curriculum documents are curriculum documents are largely western oriented because they are explicitly western and here and there include IKF, that is there is a slight inclusion of indigenous knowledge in the western dominated curriculum. The local community is rich in both IKF and EKF and integration of these knowledge systems can be achieved through a five staged process.

5.2 Conclusions

It can be drawn from the findings above that though curriculum documents and classroom practices are largely IKF exclusive, the study gave an insight through the suggested five staged process integrated teaching and learning of IKF and EKF practically achievable.

5.3 Recommendations

Drawing from the research findings and conclusion drawn from them, the study recommends that the curriculum designers review that syllabus and textbook to incorporate indigenous knowledge in balanced and connected way. Secondly, teachers integrate, learners and community need to collaborate in reviewing curriculum documents

and teaching. Lastly, teachers should be professionally developed on how to integrate indigenous knowledge when teaching Biology.

5.4 Final remarks

Nutrition is a key and interesting topic in Biology. It should be well connected with the prior knowledge of learners because they are involved in nutritional practices everyday either at home or at school. Thus there is need for teachers to be well equipped with the knowledge or how to connect the school and the community.

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APPENDICES

Appendix 1: Permission letter from Department of Science Education

ZIMBABWE

Tel: 0271 - 7531 ext 1038
Fax: 263 - 71 - 7616

BINDURA UNIVERSITY OF SCIENCE EDUCATION

TO WHOM IT MAY CONCERN

NAME: Munokori Tatenda Gracious REG NUMBER: B1437706.

PROGRAMME: *HBScEd Physics/~~Maths~~/~~Chemistry~~/Biology* PART: 2.2

This serves to confirm that the above is a bona fide student at Bindura University of Science Education in the Faculty of Science Education.

The student has to undertake research and thereafter present a Research Thesis in partial fulfillment of the Bachelor of Science Education Honours Degree programme. The research topic is:

Exploring the integration of indigenous knowledge of fruits into an 'O' Level Biology curriculum in Zimbabwe.

In this regard, the department kindly requests your permission to allow the student to carry out his/her research in your institutions.

Your co-operation and assistance is greatly appreciated.

Thank you

N Zezekwa (Dr.)
CHAIRPERSON - DEPARTMENT OF SCIENCE AND MATHEMATICS EDUCATION

Appendix 2: Permission to conduct research

Munokori Tatenda Gracious B1437706

0772983961

gracioustate6@gmail.com

Bindura University of Science Education, Faculty of Science Education, Department of Science and Mathematics Education

August 2022

Mutoko Central High School

P. O. Box 43

Mtoko

Dear Sir/-Madam

RE: Request to conduct research at Mutoko Central High School

I am seeking to conduct a research titled Exploring the Integration of indigenous knowledge of fruits into an 'O' level Biology curriculum in Zimbabwe at Mutoko Central High School in the district of Mutoko of Mashonaland East Province in Zimbabwe.

Purpose: The purpose of the study is to study to establish how variant are students 'conceptions of the chemical bonding concepts in order to inform the teaching and learning of this topic at ordinary level in Zimbabwe. This purpose was pursued through the following objectives.

Procedures and duration: I wish to conduct this study with the students in Form 3 class learning biology. The participation of these students in this study is on voluntary basis with parental consent. The participants will respond to questions in two sets of written work as class exercises. These responses form part of data generated which will be analyzed.

Risks, discomforts or injury: There are no potentially harmful risks related to participating in this study. Though no risks of any injury is envisioned as consequence of participating in this study, in the event of any direct injury resulting from your participation in this study contact the researcher at 0772983961 24/7

Benefits, compensation and additional costs: the students will not receive any financial or material benefits or any other compensation for participating in this study. This research is conducted on partial fulfilment of the honours degree in biology certificate requirements at Bindura University of Science Education. It is important to note that any costs related to participation in the study are met by the researcher. Participation in this study has no financial cost to the students. Any costs related to participation are borne by the study and are not a responsibility of the participant. Though no direct benefit from this study to the participants is promised, you may gain individual understanding of the concepts of the knowledge of indigenous fruits. This gives you a good foundation for the subsequent study of nutrition related studies in this level and at higher levels.

Confidentiality: All data and information generated in this study will be kept confidential. The participating school and students will be identified by pseudonyms in place of real names unless otherwise they feel so and give their consent. The researcher will keep the data material from this study in a protected place. Only the researchers will have access to these and they will be destroyed by burning them.

Voluntary participation: Participation in this study is voluntary. Students may choose not to participate in this study. Those who would have agreed to participation may choose to withdraw at any time without any consequences. Participant's image(s), if it appears anywhere, will be blurred so that the participant will not be visually recognized. Students can only participant in this study with full parental consent.

Additional information: For any further information regarding his/her rights as a research participant, he/she may contact: Dr. V.Mpofu via email at vmpofu@buse.ac.zw or cell 0775 184 200

Conclusion: I am prepared to answer any questions on any aspect of this study that is unclear to you. You may take as much time as necessary to think it over. If you have any concerns or questions about the conduct of this program of research study (project) you may contact me at location stated above.

Authorisation: By signing consent form attached to this letter, you are authorising this research to be conducted at Mutoko Central High School in Mtoko. Alternatively you can give a written reply to the researcher.

Yours sincerely,

[Munokori Tatenda Gracious]

Appendix 3: School authority letter

Mutoko Central High School

P.O . Box 43

Mtoko

23 December 2022

Bindura University of Science Education

P. Bag 1020

Bindura

REF : Permission to conduct a research in Biology for Munokori Tatenda Gracious B1437706 at the above named school.

This note serves to confirm that Munokori Tatenda Gracious was permitted to conduct a research in Biology using Ordinary level pupils in form 3 class of 2022 at the above named school. It will be a 2 hour session with the participants (learners).

Yours faithfully

Mr Chipuriro

Head

THE HEAD
MUTOKO CENTRAL SEC SCHOOL
23 DEC 2022
P O BOX 43 MUTOKO
CELL 0773 065 400
SIGN

0773783821

Appendix 4: Learners' consent form

I agree to participate in the research study titled: Exploring Students' Understanding of Chemical Bonding Concepts taught at Ordinary level in Zimbabwe to be conducted at …White head high School.

I further agree to video recording during the study. (Mark either "Yes" or "No")

I agree to having his/her **video recorded**	Yes	
	No	
I agree to having his/her **participation in study**	Yes	
	No	

Name of Research Participant	**Designation**
Signature	**Date**
Researcher Name	**Signature**

Appendix 5: Parents' consent form

I being the parent or guardian of……..do hereby authorise his/her participation in this research study titled: Exploring Students' Understanding of Chemical Bonding Concepts taught at Ordinary level in Zimbabwe to be conducted at White head High School.

I further agree to video recording during the study. (Mark either "Yes" or "No")

I agree to having his/her **video recorded**	Yes	
	No	
I agree to having his/her **participation in study**	Yes	
	No	

Name of Research Participant	**Designation**
Signature	**Date**
Researcher Name	**Signature**

Appendix 6: Document analysis guide

Section A: Introduction

The curriculum documents were analysed with the guidance of the following items. The Curriculum Based Competence 2015, Biology syllabus and the G.C.E 'O' level Biology Matters textbook.

Section B: Session background

Type of document _____

Learning area_____

Venue _____

Time start_____

Time end_____

Section C: Guide items

1. What type of knowledge (concepts, skills, values and attitudes) can be drawn from the curriculum documents? Is it indigenous knowledge, is it Western science (Biology knowledge), is it a blended (indigenous or Western), if it is a blend what is it's orientation (largely Western oriented, balanced or largely indigenous oriented or both and pieces of indigenous knowledge)?
2. What knowledge of fruits is provided in the curriculum documents? Is it exotic knowledge of fruits, indigenous knowledge of fruits, blended and how oriented?
3. How are the curriculum documents justifying or rationalizing the teaching of the knowledge of fruits at 'O' level
4. How are curriculum documents guiding on how these knowledge are to be taught and learned?

Section D: Parting remarks

The remarks show an appreciation of the analysed data. The document shows the nutrition concepts which are being acquired by pupils through schooling which were collected from the curriculum documents.

Appendix 8: Conversation guide

Section A: Introduction

Welcome to our session and thank you for volunteering to take part in this activity (conversation). You have been asked to participate as your point of view is important. I appreciate your time. You were invited because you hold relevant knowledge that I am seeking in this study and you all live in this community. There are no wrong answers but rather different point of view even if it differs from what others ave said. Does anyone have any questions? Well let's begin.

Section B: Session background

Number of participants' _____

Venue _____

Date _____

Time start _____

Time end_____

Section C: Guide items

1. What type of knowledge (concepts, skills, values and attitudes) can be drawn from the learners? Is it indigenous knowledge, is it Western science (Biology knowledge), is it a blended (indigenous or Western) if it is a blend what is it's orientation (largely Western oriented, balanced or largely indigenous oriented or bits and pieces of indigenous knowledge?
2. What knowledge of fruits is within the learners? Is it exotic knowledge of fruits, indigenous knowledge of fruits, blended and how oriented?
3. How are 'O' level learners prospecting or rationalizing the teaching of the knowledge of fruits at 'O'level.

4. How are learners guiding on how these knowledge are to be taught and learned?

Section D: Parting remarks

Thank you students for coming and sharing your precious time with me as well as your thoughts, ideas and knowledge. I really appreciate your contribution in this research, you participated very well.