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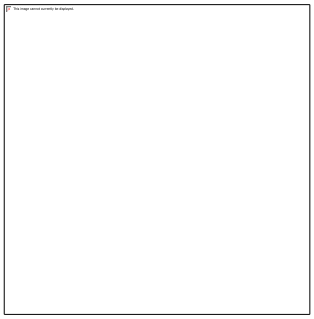

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF SCIENCE AND MATHEMATICS EDUCATION

Indigenizing a westernized chemistry curriculum for community empowerment: A case of manufacturing organic product

By

KELVIN MUTERO

B1647194

SUPERVISOR: Dr. Vongai Mpofu

A project submitted to the Department of Science and Mathematics Education, Faculty of Science Education, Bindura University of Science Education, Bindura, Zimbabwe, in partial fulfilment of the requirements of the degree of Bachelor of Science Education Honors Degree -Chemistry **2024**

Approval form

I, Dr. Vongai Mpofu, the undersigned certify that I have read this project entitled: **Indigenizing a westernized chemistry curriculum for community empowerment: A case of manufacturing organic product** conducted by Kelvin Mutero **B1647194 i**n partial fulfillment of Bachelor of Science Education Honours Degree - Chemistry 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: September 2024

Declaration

I, Kelvin Mutero **B1647194** declare that this project is my own, supervised work. It is being submitted for the **Bachelor of Science Education Honours Degree - Chemistry** 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……2024

Abstract

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. The study examines the value of this integrated approach on students' understanding of organic manufacturing, their connection to indigenous communities, and the potential for community empowerment. Additionally, the purpose of the study is to describe the possibility of integrating indigenous knowledge of indigenous knowledge of manufacturing organic products and school chemistry through an exploratory case design at secondary school located in the Nyanga East district of the Manicaland province, in Zimbabwe. Qualitative data were generated through document analysis and conversation with four Ordinary (‘O’) level learners, a teacher and two local elders participant. The school, class, and learners were purposively sampled. The qualitative content analysed data revealed three main findings/themes are (1) a fragmented approach on chemistry curriculum and manufacture of organic products which can be integrated into ordinary level chemistry;(2)an exclusive indigenous knowledge related to manufacture of organic products;(3) fragmented approach o integration of indigenous knowledge of manufacturing organic products into a chemistry curriculum; (4) indigenous knowledge of manufacturing organic products and community empowerment. The study concludes that though curriculum documents and classroom practices are largely IK exclusive, the study gave an insight through the suggested five staged process integrated teaching and learning of IKMOP and WCKMOP practically achievable. The researcher managed to offer 3 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 Chemistry.

Dedication

Dedication to my beloved wife Kundai nhamo and the Mutero family for their tireless support

Acknowledgement

I would like to thank the Almighty God for the guidance and strength to do this research. I have depended on the help and guidance from the firm, and committed supervisor, Dr Vongai Mpofu in correcting errors. Additionally, l appreciate her constructive comments and willingness to assist

Special thanks also to myself for being committed and my wife (Kundai Nhamo) and Mutero family as well for being there for me. I thank the form 3 and 4 learners at Munga Adventist Secondary School who volunteered to participate in this research and the school head for allowing me to conduct my research at this school

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List of Abbreviations

STEM	Science Technology Engineering and Mathematics
WSK	Western Scientific Knowledge
ICS	integrated classroom science
IKF	Indigenous Knowledge
CACS	cultural aligning classroom science
MOP	Manufacturing of Organic Products
IKMOP	Indigenous knowledge of manufacturing of organic products
CBC	Competency based curriculum
WCKMOP	Western chemistry knowledge manufacturing organic products

1 Chapter 1: Introducing the study

1.0 Introduction

This chapter introduces this study on **indigenizing a Westernized chemistry curriculum for community empowerment: A case of manufacturing organic product**. In doing so, it discusses the problem that motivated my undertaking of this study and elements related to it including the background, research questions and objectives, significance, limitations, delimitations, and assumptions. These elements form the structure of the chapter, which concludes with a summary.

1.1 The background of the study

The government of Zimbabwe introduced the competence-based curriculum (CBC, 2015) that emphasizes on teaching of sciences based on Science, Technology, Engineering, and Mathematics (STEM) and the philosophy of Unhu/Ubuntu/Vumunhu (Ministry of Primary and Secondary Education, 2015). Reforming the curriculum in this way enables teaching to focus on the acquisition of twenty-first (21st) century competencies, which learners need to participate in advancing the economy of Zimbabwe. The valuable economic participation of learners and graduates comes in pursuing further learning in STEM areas, taking up STEM careers, and being entrepreneurial. These outcomes are endeavoured to come from teaching and learning of sciences that draw from both Western and indigenous ways of education. This is what competency-based curriculum (CBC) 2015 guides teachers to do, that is to integrate Indigenous knowledge into the currently Westernized science classroom practices.

Colonialism in Africa and other Indigenous communities refuted Indigenous knowledge in all sectors such as technology, education and culture. Yet, before its advent, and others Africa survived on their own forms of knowledge. Among many people including the indigenous ones, colonialism injected negative perceptions of indigenous knowledge systems and preferences of Western knowledge. Western knowledge categories include medicine, science, climate and agriculture. These

existed in indigenous knowledge since time immemorial, the reasons why this body of knowledge is characterized as holistic. Western knowledge domains were extricated from indigenous knowledge (Grange (2007) (Msimanga, 2011) . In terms of education, African education systems have always been grounded in culture and history of indigenous communities (omolewa, 2007). This is the form of education that colonization led to its exclusion from the curricula. Today, Westernized school science and education systems have a marked colonial legacy.

Against this backdrop, it is no wonder that the integration of indigenous knowledge, which others refer to as traditional or local knowledge is now missing into the western science curriculum is now a well-recognized global 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. In other words this reform wishes learners to make sense of the world based on their experiences in it (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 (Barnhardt, 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.

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. The push for its inclusion in comes with the realization of its benefits to societies. Indigenous knowledge/ traditional knowledge /traditional ecological knowledge is a body of observations, oral and written knowledge, innovations, practices, beliefs that promote sustainability and the responsible stewardship of cultural and natural resources through relationships between humans and their landscape. It deals with the distinct of knowledge that relies mostly on a

balance interaction of the community with the inherently rich domains of the natural environment. Moreso, it reflects the indigenous peoples own thinking about how their nature is classified. It consist of various disciplines which are ethno biology, ethno chemistry, ethno physics, ethno mathematics, ethno medicine indigenous agricultural practices and food processing technologies.

indigenous education involve construction of knowledge from observing natural processes adapting modes of survival, obtaining sustenance from the plant and animal world, and using natural materials to make their tools and implements (Barnhardt, 2005). The spread of Western societal structures and institutionalized forms of cultural transmission caused a lot of problems including territorialization of knowledge and poor interpretation of globalization which led to the neglecting of Indigenous knowledge in the current chemistry curriculum all in the name of sustainable living. It has something to do with the ability to meet the needs of the present without destroying the environment, or the economic or social resources needed by future generations.

Existing in indigenous knowledge Chemistry intertwined with other domains. Chemistry is the scientific study of the composition, properties, and reactions of matter. It is an important and everyday science that requires a variety of teaching strategies that can enhance understanding and application for sustainable living. It is practical-oriented and is taught and learned through hands-on and minds on activities that relate to activities outside of school for relevance and sustainable living, this helps to sustain the unique world views of people of different cultures in different traditional spheres of life. Chemistry branches into inorganic, physical, analytical, biochemistry, and organic chemistry.

Organic chemistry is a branch of chemistry that deals with the study of organic compounds which are typically defined as chemical compounds. It involves the study of structure, properties, reactions, and preparation and creation of new organic products. The manufacture of organic products falls under organic chemistry. This deals with manufacturing different products from nature such as floor polish, skin care lotion, soap, contraceptives, coffee, cooking ingredients, and medicine. These indigenous knowledge and practiced processes are neglected from chemistry curriculum but they are widely practiced in our societies every day. It is important to

integrate indigenous knowledge and practices of people in a society into chemistry teachings to close the gap between Indigenous knowledge and practices and Western science (Ugwu, 2016).

The reviewed 2015 curriculum framework not only revives the erosion of Indigenous knowledge systems by making science teaching culturally relevant and responsive but also focuses 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 organic manufacturing into Western science curriculum for community empowerment.

1.2 Statement of the problem

Chemistry like other Science, Technology, Engineering, and Mathematics (STEM) subjects is considered complex. In particular, most learners view the subject of Chemistry as very difficult to comprehend. Teachers also find it difficult to teach learners to understand Chemistry concepts and their industrial community applications. Yet, the thrust of STEM education is on linking the teaching and learning of chemistry to other STEM subjects' real situations in their contexts and their culture for community relevance. This has not been easy for teachers who often meet learners who are negatively dispose towards chemistry learning. The learners' disinterest in the learning of subject is linked to several factors which include its abstract and complex nature, detachment to the cultural or indigenous backgrounds and the way knowledge is gained in their communities (community teaching and learning).The disconnection from what learners are taught in communities and what they learn in school distract their understanding of chemistry and make them not the value of this discipline to them and their societies. The introduced STEM education addresses the disconnection of indigenous and western science through the use of supportive pedagogy such as project based learning to help learners to generate and understand scientific knowledge and apply it to solve real world problems. Unhu driven curricula entail integrating indigenous knowledge into the teaching and learning of the westernized curricular aspects (purpose, content, context, pedagogy, interactions and

assessments). Connecting the chemistry curricular to the indigenous background of the learner potentially develops twenty-first-century competencies (knowledge, skills, values, and attitudes) in learners that enable or empower them to make meaningful contributions to their communities. The way this should be done is not documented for teachers to make. This research seeks to address how to integrate indigenous knowledge in the manufacturing and processing of organic products in organic chemistry. This study is focusing on the following research questions

1.3 **Research Questions (RQ)**

This research is guided by the following research questions

1.3.1 Main Research Questions (MRQ)

How can Western and Indigenous knowledge of manufacturing of organic products be integrated into the secondary school chemistry curriculum for community empowerment

1.3.2 Sub-Research Questions (SBQ)

SRQ 1: What knowledge of manufacturing organic products exists in the ordinary-level chemistry curriculum?

SRQ 2: What indigenous knowledge of manufacturing organic products (IKMOP) can be drawn from society?

SRQ 3: How can indigenous knowledge of manufacturing of organic products (IKMOP) be taught (integrated) in ordinary level chemistry curriculum?

SRQ 4: How does the integrated teaching and learning of knowledge of manufacturing organic products benefit the community?

1.4 **Purpose Statement**

The purpose of this research is to highlight the importance of integrating organic manufacturing practices and community empowerment into a westernized chemistry curriculum, while recognizing and valuing indigenous knowledge. This integration aims to create an inclusive approach to chemistry education that not only promotes

sustainable and environmentally friendly manufacturing processes but also empowers local communities by involving their traditional knowledge and practices. By bridging the gap between western science and indigenous knowledge, this curriculum seeks to foster a deeper understanding of chemistry that is grounded in cultural diversity, community engagement, and the preservation of traditional wisdom.

1.4.1 Research Objectives (RO)

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

RO 1: Identify the manufacturing knowledge of organic products provided in the ordinary level chemistry curriculum?

RO 2: draw indigenous knowledge of manufacturing organic products from the society?

RO 3 Illustrate how indigenous knowledge of manufacturing organic products can be integrated into organic learning are of the chemistry curriculum?

RO 4: Establish the potential benefits of the integrated teaching and learning b of indigenous and western knowledge of manufacturing organic products to the community?

1.5 **Significance of the study**

The study is valuable to learners, teachers, researchers as well as curriculum developers Subject areas. Additionally, 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 the education sector in general.

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The curriculum developers will be able to identify the loopholes in the syllabus concerning the topic manufacture of organic products. 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.The community and the school can establish a bond that is good for promoting the learning of science through integration of indigenous knowledge of manufacturing of organic products and western science. This study was conducted based on that the integration of two knowledge systems (indigenous and Western science) will promote community empowerment and effective teaching and learning of chemistry

1.6 **Assumption of the Study**

I assume that the ordinary-level chemistry curriculum has a lot of aspects to do with community empowerment. More so, l further assumed that the chemistry teachers are acknowledgeable enough to identify organic manufacturing processes within their local communities and establish missing links with chemistry offered in the ordinary level chemistry curriculum. All these assumptions are research question and objective-oriented.

1.7 Delimitation of the Study

This study was delimited in terms of geographical location, methodology, and key concepts. Geographically, this project was carried out at Munga Adventist Secondary School in Manicaland province of Zimbabwe. An exploratory case study design located in the qualitative methodology was adopted. Qualitative data was generated 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 the Form 3 and 4 classes at Munga Adventist Secondary School. Nyanga North is a district in Manicaland Province of Zimbabwe.

1.7.2 Methodology

This study adopted an exploratory case study design situated in a 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, comes to be known and/or developed, and the knowledge holders.

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. 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.

1.7.4 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 Nyanga North District.

1.8 Summary of the chapter

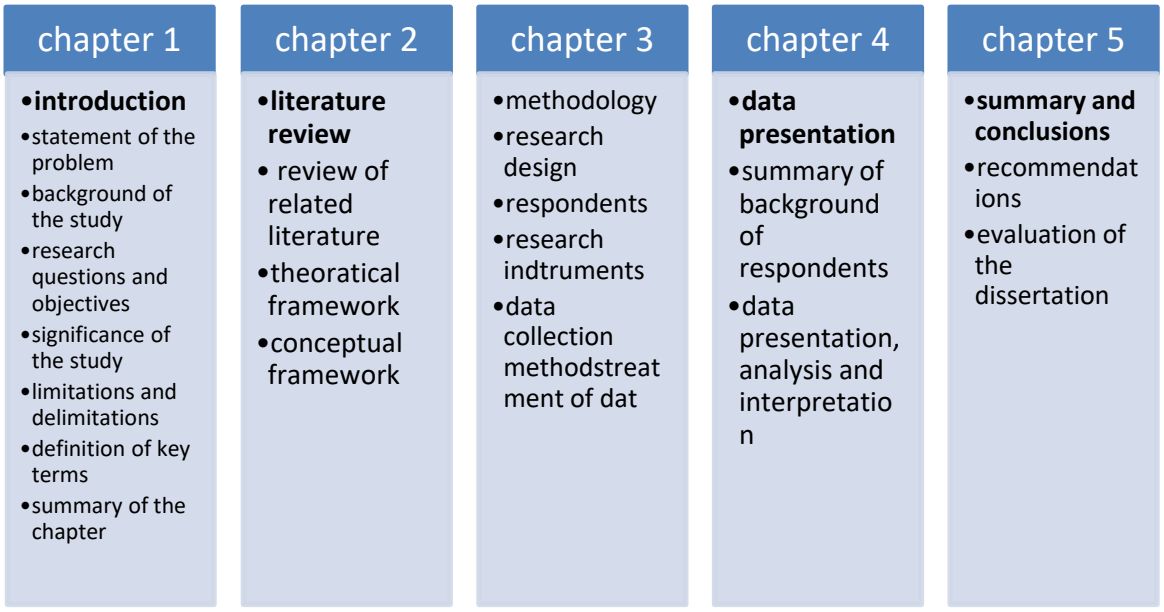

Figure 1. Summary of the chapter

The identified problem under investigation is the integration of the prior knowledge of indigenous organic manufacturing and community empowerment into Chemistry concept taught in schools. In terms of structure, the study consists 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

2 CHAPTER TWO

2.0 Introduction

This chapter discusses the literature relevant to Integration of manufacturing of organic products into ordinary level chemistry for community empowerment. Literature is reviewed to demonstrate and understand the relevant theories, concepts and debates in the field of study. The other reason is to enable the researcher to identify the strength and weaknesses of the previous studies and how they inform the research design and questions. The literature is discussed in four themes which are (1) chemistry curriculum and manufacturing of organic products (2) indigenous knowledge related to manufacturing of organic products (3) integration of chemistry curriculum and indigenous knowledge of manufacturing of organic products (4) indigenous knowledge of manufacturing organic products and community empowerment which insisted my choice of culturally aligning classroom science model (Mpofu, 2016) as a conceptual framework. The chapter ends with a summary.

2.1 Chemistry Curriculum and Manufacture of Organic Products

2.1.1 Chemistry curriculum

It refers to the specific topics and skills that are taught in a chemistry course or program. It typically includes a combination of theoretical concepts, laboratory experiments, and problem-solving exercises (Kaiser, 2020). The curriculum generally covers fundamental principles of chemistry such as atomic structure, chemical bonding, and stoichiometry, states of matter, thermodynamics, kinetics, and equilibrium (Herr, 2007). The curriculum is designed to provide students with understanding of the principles and applications of chemistry and to develop their critical thinking and analytical skills in the field. Chemistry helps us understand the composition, structure, properties, and behavior of matter. It explains why substances react with each other, how new materials can be synthesized, and how energy is transferred during chemical reactions. Chemistry has numerous practical applications in various fields such as medicine, engineering, environmental science, and materials science (Kaiser, 2020). By studying chemistry, we can develop solutions to real-world problems, create new

products, and improve existing technologies, critical thinking, and problem solving skills.

It includes topics such as organic chemistry, inorganic chemistry, biochemistry, and environmental chemistry. Organic chemistry is the branch of chemistry that focuses on the study of carbon-containing compounds and their properties, structure, composition, reactions, and synthesis. Organic compounds are found in living and non-living organisms and have a wide range of applications in various industries. Organic products in chemistry, refer to substances that are manufactured from organic compounds or synthesized using organic chemistry principles (Abozenadah, Bishop, Bittner, & Flatt, 2017). These products can be found in many aspects of our daily lives including pharmaceuticals (drugs and medications are organic products. Organic chemistry is used to develop and synthesize new drugs, analyze their structure-activity relationships, and understand their mechanisms of action in the body. Food and flavorings, natural and artificial flavors and food additives are organic compounds. Organic chemistry is used to isolate, identify, and synthesize these compounds to enhance the taste and aroma of food products. Cosmetics and personal care products, organic compounds are commonly used in the formulation of cosmetics, such as moisturizers, skin care lotions, soaps, shampoos, and perfumes (Philips, 2023). Agrochemicals, development of pesticides, herbicides, and fertilizers. The products help improve crop yield and protect plants from pests and diseases. Dyes and pigments, such as dyes and pigments for textiles, paints, and inks. Energy, such as, fossil fuels are organic compounds derived from ancient plant and animal remains, biofuels and solar cells (Poulsen, 2010). The study and understanding of organic chemistry are essential for advancing these fields and improving our everyday lives

2.1.2 Manufacture of organic products

Manufacture of organic products refers to the production of organic products by indigenous communities or using traditional knowledge and practices. Indigenous communities often have a deep understanding of their local ecosystems and traditional methods of cultivating, harvesting, and processing natural resources (Abozenadah, Bishop, Bittner, & Flatt, 2017). They may utilize sustainable and environmentally friendly practices to create organic products that are unique to their culture and region.

It encompass a wide range of items, including food products, herbal medicines, natural cosmetics, textiles, handicrafts and beverages. These products are often made using locally available organic materials, such as plants, herbs, fruits, and traditional techniques that have been passed down through generations (RIOA, 2018). It offers several benefits which are Preservation of traditional knowledge and cultural heritage, sustainable use of natural resources, economic empowerment, promotion of biodiversity and environmental conservation and social and cultural well-being. It is important to recognize and support indigenous communities in their efforts to manufacture organic products. This can be done through fair trade practices, partnerships, capacity building, and respect for traditional knowledge and intellectual property rights. By so doing, this can promote development, sustainability, cultural diversity, and social justice while enjoying the unique and high-quality organic products created by our local communities.

2.2 **Community Indigenous Knowledge Related To Manufacture Of Organic Products**

2.2.1 Community indigenous knowledge

Community indigenous knowledge refers to the traditional knowledge, practices, and beliefs held by indigenous communities or groups (Jessen, 2021). It encompasses a wide range of knowledge related to various aspects of life, including spirituality, culture, ecology, and medicine, agriculture, and resource management. This knowledge is often passed down orally from one generation to another and is deeply rooted in the specific cultural and environmental contexts of the community. It is considered an integral part of indigenous identity and plays a crucial role in their sustainable livelihoods and the preservation of their culture and environment. Community indigenous knowledge is valuable for understanding and addressing local challenges, promoting cultural diversity, and enhancing sustainable development. Community indigenous knowledge related to the manufacture of organic products encompasses traditional practices and knowledge systems that indigenous communities have developed over generations for cultivating and processing organic materials. This knowledge often includes specific techniques for growing, harvesting, and processing organic crops, as well as methods for preserving and storing them.

Indigenous communities have long relied on sustainable agricultural practices, such as intercropping, crop rotation, and natural pest control methods, which are now recognized as key principles of organic farming (Jessen, 2021). They have also developed knowledge about the use of natural fertilizers, such as compost and animal manure, to enhance soil fertility and promote healthy plant growth. In addition to agricultural practices, indigenous communities often possess expertise in traditional methods of processing organic materials. This can include techniques for drying, fermenting, and preserving crops, as well as methods for extracting and processing natural dyes, fibers, and medicinal plants. Community indigenous knowledge also encompasses a deep understanding of the local ecosystems and their interconnectedness. Indigenous communities have traditionally practiced sustainable resource management, including the use of traditional ecological knowledge to identify and protect important habitats and species. This knowledge can inform the sustainable sourcing and harvesting of organic materials for the manufacture of products.

Indigenous knowledge into the manufacture of organic products, is of vital importance as it provides an opportunity to promote cultural heritage, support sustainable livelihoods, and contribute to the preservation of biodiversity and traditional practices. It also helps to ensure that the production of organic products respects the principles of sustainability, social equity, and cultural diversity. Moreso, it increases awareness of local culture and identity, it solves environmental problems in all social and cultural dimensions which benefit from perspectives other than science. It brings about sustainability, cultural preservation among other benefits. By involving this knowledge into the manufacturing process, organic products can be sourced in a way that respects the rights and needs of indigenous communities and supports fair trade practices. This ensures that indigenous communities are fairly compensated for their knowledge, labor, and resources, helping to address historical injustices and create more equitable economic opportunities. Indigenous knowledge plays a crucial role in manufacturing organic products by promoting sustainability, cultural preservation, quality, authenticity, ethical sourcing, and fair trade. By recognizing and valuing indigenous knowledge, we can develop organic products that not only benefit the environment but also contribute to the well-being and empowerment of indigenous communities.

2.3 Integration of indigenous knowledge of manufacturing organic products into the chemistry curriculum

Integrating indigenous knowledge of organic manufacture into the chemistry curriculum (western science) refers to a wide use and application of the indigenous knowledge systems in their forms of knowing and doing in reciprocal relation with the scientific knowledge system without any forms of subordination. It can be a valuable way to promote cultural diversity, sustainability, and a holistic understanding of chemistry (Chacha, 2022). Science education needs to address immediate concerns of poverty, health, livelihoods, values, and world views. Through the community's involvement in schools and taking curriculum projects into the community, world-view sharing is promoted, i.e., students are prepared to acknowledge their Indigenous worldview in class, and learning in schools will be more available to community members. According to (Stein, 2023), Community is essential to the achievement of well-defined and well-practiced education. Indigenous communities possess vital knowledge of the environment and traditional practices which can be used in education system, food processing industries, weather forecast, textile industry, medicine and engineering industry. Integrating indigenous knowledge of manufacturing organic products into the chemistry curriculum offers important benefits which are cultural diversity, local relevance, community empowerment, preservation of traditional knowledge, sustainability and environmentally friendly practices, promotion of innovation and creativity (Moyo & Tichaawa, 2017)

Integration of these bodies of knowledge can be done through values education, collaboration, cross-cultural science education, field trips, guest speakers, and in-service professional development of teachers, research projects, inclusion of language and establishment of national, international environmental and education development framework. Inclusion of a broader spectrum of voices in science curriculum design, culturally relevant pedagogy, focus on socio-scientific issues and learner centeredness. This helps to extend the relations between indigenous knowledge and western science beyond classroom boundaries and communities where indigenous knowledge originates. On values education, it is education that is

founded on values for learners to develop a sense of responsibility and concern for individual and reinforce interrelationships and interdependence (WHO, 2024). Moreso, develop culturally responsive teaching materials: Create teaching materials that incorporate indigenous knowledge in a culturally appropriate manner. This could involve developing case studies, including indigenous examples and perspectives, or designing experiments that reflect traditional methods of organic manufacturing. Incorporate storytelling, traditional practices, and local examples to make the content more engaging and relatable. Participative and collaborative learning, communities are involved in making decisions about the content and values that students will learn. If the process is carried out well, the elders and local people can teach local content to both teachers and learners (Bush, et al., 2014). This foster collaborative learning by encouraging students to work in groups to explore and present indigenous knowledge related to organic manufacture. This can involve group discussions, presentations, or creative projects that showcase the integration of traditional practices with scientific principles. Furthermore, Guest speakers and community engagement as a way of integration. Inviting guest speakers from indigenous communities or local experts who can share their knowledge and experiences related to organic manufacture. This can provide students with firsthand insights into traditional methods, cultural significance, and sustainability practices associated with organic products. Moreover, field trips and hands-on experiences, organize field trips to indigenous communities or local organic farms where students can observe and learn about traditional organic manufacturing processes. Engage students in hands-on activities such as herbal product preparation, natural dye extraction, or soap making using traditional methods.

Incorporate case studies, include case studies that highlight indigenous knowledge and practices related to organic manufacture. These case studies can focus on traditional methods of extracting, processing, and utilizing organic materials in different cultural contexts. Discuss the scientific principles underlying these practices and their relevance to modern organic chemistry. Research projects, assign research projects that require students to explore and document indigenous knowledge of organic manufacture. Students can investigate traditional manufacturing techniques, the use of local resources, and the cultural significance of organic products in specific indigenous communities (Mukuka, 2010). Encourage students to critically analyze and

compare traditional practices with modern scientific approaches. Continual learning and reflection: As educators, it is essential to engage in ongoing learning, reflection, and professional development around indigenous knowledge and its integration into the curriculum. Seek feedback from indigenous communities, adapt and improve teaching materials based on their input, and remain open to new perspectives and understandings. Foster experiential learning opportunities, providing opportunities for students to engage directly with indigenous communities and learn from their knowledge and practices. This could include field trips, guest speakers, or community-based projects. These experiences can deepen students' understanding and appreciation of indigenous knowledge and its relevance to organic manufacturing. By integrating indigenous knowledge of organic manufacture into the chemistry curriculum, students can gain a deeper appreciation for the cultural diversity, sustainability, and interconnectedness of scientific knowledge. This integration can foster a more inclusive and holistic understanding of chemistry and promote a respectful and collaborative approach to scientific inquiry (Grange, 2007). It enhances the educational experience, promotes cultural diversity and sustainability, and empowers indigenous communities. It helps students develop a well-rounded understanding of chemistry and encourages them to approach scientific knowledge with a broader perspective.

2.4 **Indigenous knowledge of manufacturing organic products and community empowerment**

2.4.1 Indigenous knowledge of manufacturing organic products

Community Indigenous knowledge refers to the collective knowledge, practices, and skills that have been developed and passed down through generations within Indigenous communities (Jessen, 2021). Indigenous knowledge of manufacturing of organic products covers areas of medicine, indigenous communities have long relied on traditional herbal remedies for various ailments. Their knowledge of medicinal plants, including their cultivation, harvesting, and preparation, forms the basis for manufacturing organic herbal products such as teas, oils, and salves. Furthermore, it also covers sustainable agriculture, indigenous communities have developed sustainable farming practices that minimize environmental impact. Techniques like crop rotation, intercropping, and natural pest control methods are integral to

manufacturing organic food products. Moreso, artisanal crafts, indigenous communities often possess knowledge of natural materials and traditional crafting techniques. This knowledge is applied in manufacturing organic crafts like baskets, textiles, pottery, and jewelry, which are made using sustainable methods. Natural cosmetics, indigenous communities have expertise in using local plants and natural ingredients to create organic cosmetics. Examples include using clay for face masks, skin care products, plant-based oils for moisturizers, and traditional pigments for natural dyes.

Community indigenous knowledge is invaluable in manufacturing organic products as it promotes sustainability, preserves cultural heritage, and fosters a harmonious relationship between humans and the environment. When it comes to manufacturing organic products, community indigenous knowledge plays a crucial role in ensuring sustainable and environmentally-friendly practices. Indigenous knowledge of the manufacture of organic products play a crucial role in community empowerment. By recognizing, respecting, and utilizing indigenous knowledge, communities can benefit in the following ways, Economic empowerment, indigenous communities often possess unique knowledge of local plants, resources, and traditional manufacturing techniques. By incorporating this knowledge into the manufacture of organic products, communities can develop sustainable livelihoods, create local businesses, and generate income (Wiggins, 2011). This can lead to economic empowerment and reduce dependency on external sources of income. Furthermore, Cultural preservation and indigenous knowledge are deeply rooted in cultural traditions and practices. By integrating this knowledge into the manufacture of organic products, communities can preserve and pass on their cultural heritage to future generations. This helps maintain cultural identity, pride, and a sense of belonging within the community. Moreover, environmental sustainability, indigenous knowledge often emphasizes sustainable practices and a deep connection with the environment (Fraser, 2021). By incorporating this knowledge into the manufacture of organic products, communities can promote environmentally friendly processes, reduce waste, and preserve natural resources. This contributes to long-term environmental sustainability and biodiversity conservation. Community well-being: The manufacture of organic products based on indigenous knowledge often focuses on natural and

holistic approaches to health and well-being. By utilizing traditional medicinal plants and natural ingredients, communities can promote community health and address local healthcare needs. This can lead to improved physical, mental, and spiritual well-being within the community. Moreover, community empowerment, integrating indigenous knowledge into the manufacture of organic products empowers communities to take ownership of their cultural heritage, resources, and economic activities. This promotes self-determination and autonomy, enabling communities to make decisions that align with their values, needs, and aspirations. Furthermore, knowledge transmission and intergenerational learning, by valuing and incorporating indigenous knowledge into the manufacture of organic products, communities can ensure the transmission of this knowledge to future generations. This facilitates intergenerational learning, strengthens community bonds, and maintains a sense of continuity and resilience .It is important to note that community empowerment should involve collaboration, informed consent, and fair recognition of indigenous knowledge. Empowering communities should also include equitable partnerships, access to markets, and the protection of intellectual property rights to ensure that the benefits flow back to the communities themselves (Kruahong, 2023).

2.4.2 Community empowerment

Indigenous people are diverse, within and across nations. Indigenous people have experienced colonization processes which hindered their educational opportunities and outcomes of successive generations (OECD, 2017). Community empowerment refers to the process of enabling individuals and groups within a community to gain control over their lives, make decisions that affect them, and take action to address their own needs and aspirations. It is also defined as a dynamic and ongoing process that requires the active involvement and commitment of community members, as well as supportive external resources and structures (Malqvist, 2018).community empowerment is a process of re-negotiating power in order to gain more control (WHO, 2024). It involves fostering a sense of ownership, agency, and active participation among community members. Community empowerment can occur in various domains, including social, economic, political, and cultural aspects (Kruahong, 2023). Here are some key aspects and strategies related to community empowerment and capacity building: Providing opportunities for skill development, education, and training to

enhance the knowledge, abilities, and confidence of community members. This can include workshops, vocational training, mentoring, and leadership development programs. Moreso, participatory decision-making, Involves community members in decision-making processes, giving them a voice and influence over matters that affect their lives (Kruahong, 2023). This can be achieved through community meetings and participatory research methods. Furthermore, access to resources and opportunities facilitates access to resources, services, and opportunities that empower communities. This can involve creating avenues for employment, entrepreneurship, access to credit and finance, healthcare, education, and infrastructure development. Moreover, collaborative partnerships, encourage collaborations and partnerships between community members, local organizations, government agencies, and other stakeholders. This helps mobilize collective resources, expertise, and support for community initiatives. Moreso, cultural preservation and identity, by recognizing and valuing the cultural heritage, traditions, and practices of the community. Promoting cultural preservation can enhance community pride, cohesion, and a sense of belonging. According to World Health Organization, (2021) sustainable development encourages community-led initiatives that promote environmentally sustainable practices, economic self-sufficiency, and long-term resilience. This can include initiatives related to sustainable agriculture, renewable energy, waste management, and conservation (WHO, 2021). Lastly, information and communication, ensuring access to accurate and relevant information, as well as facilitating effective communication channels within the community. This helps in sharing knowledge, fostering dialogue, and enabling informed decision-making.

2.5 **Adapted CACS Conceptual Framework**

Figure 1 below shows a culturally aligning classroom science conceptual framework adapted from (Mpofu, 2016) . The integrated classroom science (ICS) framework provides a process model that this study used to integrate indigenous knowledge of manufacturing organic products into the chemistry curriculum offered at the ordinary level in Zimbabwe used to integrate indigenous knowledge of manufacturing organic products into the Chemistry curriculum offered at Level in Zimbabwe. The original model emerged the original model emerged the CACS conceptual framework which guides the integration of indigenous knowledge into science teaching and learning can

be done. framework which guides how the integration of indigenous knowledge into science teaching and learning can be done when exploring the cultural knowledge systems contribution, teaching organic chemistry helps learners to understand its worthiness and provides the potential of learners to set up a strong foundation for culturally embedded knowledge essential for their advancement in science and technology when taking indigenous knowledge from the community, teachers and curriculum designers and implementers should sort and extract information that is beneficial to child development that information should help learners to bridge the gap between what they learn from school and what they do at home. Many cases, the process of teaching learners has been detached from cultural realities and context of indigenous learners (Dekeza & Chingarande, 2019). The government of Zimbabwe through the Ministry of Primary and Secondary Education-MoPSE, introduced the competence-based curriculum (CBC 2015) encourages teachers to integrate STEM education and indigenous knowledge, now the can take a living laboratory from nature to draw meaningful examples from nature for diversity, equity and fairness (CBC, 2015)

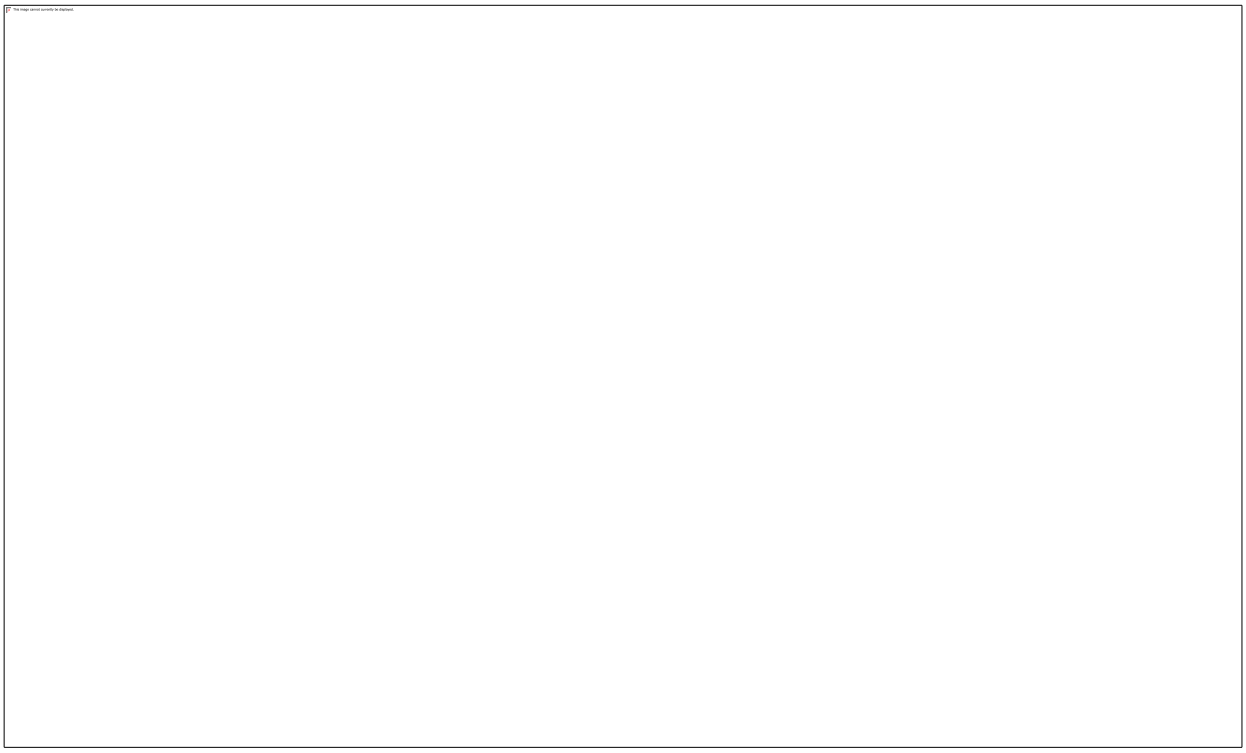

Figure 2. Shows the CACS conceptual framework

The CACS conceptual framework summarized in Figure 2.1 above related above relate five aspects: (1) indigenous knowledge in the community where learners acquire it (2) western scientific knowledge that was imported into Africa, Zimbabwe in particular (3) indigenous curriculum that is rooted in indigenous knowledge (4) chemistry curriculum that is drawn from the western knowledge. Indigenous knowledge in the community where learners acquire it (2) Western Scientific Knowledge that was imported in to Africa, Zimbabwe in particular (3) indigenous curriculum who is rooted in indigenous knowledge, (4) .western Chemistry curriculum which is drawn from the western knowledge and (5) classroom aspects inclusive of purpose, content, context, teaching and learning roles, assessment and pedagogy can be drawn from both western and indigenous bodies of knowledge to form a meaningful curriculum. Classroom aspects inclusive of purpose, content, context, teaching and learning roles, assessment and pedagogy can be drawn from both western and indigenous bodies of knowledge to form a meaningful curriculum a curriculum that includes the indigenous body of knowledge and western body of knowledge. This kind of curriculum allows learners to bridge the gap between school and home. Up to now the school science is detached from cultural realities, however, CACS model is advocating the integration of knowledge of organic products from the community into that of the school science curriculum. Moreso, it is pushing for collaborative curriculum where the teaching and learning process should consider the integration of manufacture of organic products into a western chemistry curriculum.

Of The focus of indigenous knowledge of manufacturing organic products (IKMOP) is on sustainability, environmental responsibility, and traditional methods of production. Indigenous communities have a deep understanding of the land and its resources, and they prioritize practices that promote biodiversity, soil health, and community well-being. It also emphasizes the use of natural materials and traditional techniques in the production of organic products. This includes methods such as handcrafting, fermentation, and natural dyes. These practices not only result in high-quality products but also help to preserve cultural traditions and support local economies. Lastly, it focuses on creating products that are not only healthy for consumers but also respectful of the environment and the communities that produce them.

The focus of western chemistry knowledge in manufacturing organic products (WCKMOP) is on understanding the chemical reactions and processes involved in creating organic compounds, acquire a general knowledge of current state of agriculture, benefits and challenges of organic agriculture (RIOA, 2018). This includes studying the structure and properties of organic molecules, as well as the mechanisms by which they can be synthesized and manipulated. It looks at developing new methods and technologies for producing organic products more efficiently and sustainably. This may involve using catalysts, enzymes, or other tools to facilitate chemical reactions, as well as optimizing reaction conditions to minimize waste and energy consumption. Additionally, western chemistry knowledge in organic manufacturing often involves an emphasis on quality control and ensuring that products meet regulatory standards for safety and purity. This may include testing for impurities, monitoring reaction conditions, and implementing quality assurance processes to ensure consistent and reliable production of organic products. Organic manufacture which are separate knowledge which are grounded in indigenous and western knowledge systems.

2.6 **SUMMARY**

This chapter holds a discussion related to the literature concerning the study. The chapter's discussions were guided by four main research questions and objectives. CACS model was adopted as a conceptual framework to show how two bodies of knowledge can be related to each other in the process of teaching and learning.

3 CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

This study focuses on investigating the integration of indigenous knowledge of manufacturing organic products into a Westernized chemistry curriculum for community empowerment. Additionally, the study focuses on the methods, design, and research instruments. The study discussions will focus on how to do the research and how the research was conducted to collect reliable and valid data for both the research questions and objectives of the study. The methodology is made up of different components which are (1) the Context of the study (2) Paradigm (3) Design (4) Research participation (5) Data and generation methods (6) Reporting on data generation. According (Wilkinson, 2023), research methodology is the specific procedures or techniques used to identify, select, process, and analyze information about a topic. In addition, the methodology allows the reader to critically evaluate a study's overall validity and reliability. The research methodology ends with a summary of the chapter.

3.1 Context of the study

The context of the study is discussed based on geographical location of the school and the reasons for this location. The study was carried out at Munga Adventist Secondary School. The school is located in a rural area of Nyanga West District in Manicaland Province of Zimbabwe. The reasons for choosing the location in Nyanga includes the area has a wide range of indigenous raw materials for manufacturing organic products. Most raw materials comes in different seasons and most of them they are available in large quantities. These raw materials includes indigenous fruits such as Masawu(Ziziphus Mauritiana), Mawuyu(Boabab fruit), Mapfura(Amarula fruit) which are used for beer and wine brewing and some Mawuyu drinks, coffee ,and powder for instant porridge, its shells are used to bypass contraceptives ,Matohwe (Snot apple) and chocolate berry (Tsubvu). Additionally, there is Aloe Vera which is used for decoration, treatment of coccidiosis in poutry, skin care products and it is also used for heartburn, Mafeso which are used for making soap, Matamba for matamba

cream, and its roots are used for cancer treatment in its early stages. Moreso, the Mushamba tree is used to make floor polish, Nhundurwa for livestock eye treatment, and in humans, it is used for tooth treatment as well as mhopo treatment, Muroro is used for treating snake bites as well as to keep snakes away from homes. Apart from medicines, there are other organic products such as baskets from Tsanga and Makavi, maturi from Mungongoma tree, furniture from Mugoriwondo tree, and writing pens from Tsanga. The fact that in Nyanga there's a variety of wild fruits and trees makes it a suitable location to undertake the study.

3.2 Paradigm

This study is guided by a qualitative paradigm, which is a key research approach for educational researchers. The Qualitative research paradigm is a research methodology that aims to get a deeper understanding and insight into a particular subject, rather than just examining surface features (Shava, 2021). It is commonly used in social sciences, anthropology and other fields where subjective experiences and interpretations are of interest (Jain, 2023). This research methodology encourages discussions with participants but it is time-consuming. This method is used in exploratory research where the research problem being investigated is not clearly defined. I aim to understand experiences drawn from the context of real situations. In this case, context refers to the facets of a situation, fictional or non-fictional, that inspire feelings, thoughts and beliefs of groups and individuals. In qualitative research, the researcher is considered the primary instrument in data gathering for a qualitative study. This means that the primary collection instrument in qualitative research is the researcher. The advantage of adopting this paradigm is that the researcher does not require a large study sample, it offers the opportunity to meet respondents and it encourages discussions with the participants. Additionally, qualitative research is humanistic, it leads to the development of theory which makes it suitable for this study

3.3 Exploratory case study

Exploratory case study design was adopted for this study. Exploratory research is often primary and qualitative in nature. It is defined as a methodology approach that investigates research questions that have not previously been studied in-depth

(George, 2021). It is characterized by no processual rules (it is flexible), low cost, unstructured and it is interactive between the researcher and participants. It helps the researcher to answer questions like what topic can be studied or what is the research problem. It aims to provide a detailed and comprehensive understanding of the case being studied (Hassan, 2024). Because of the above reasons, this design is suitable for study. During the research, the researcher is going to adapt to any changes which shows the flexibility of the research design. This research is going to help further studies in the manufacture of indigenous organic products.

3.4 **Research participation**

The study participation components comprise participants (sample), sampling, and target population.

3.4.1 Sample

The target sample had 7(n= 7) participants which consisted of 4 students, a teacher, and 2 local elders. Below is a summarized table 3.1 with relevant features/ characteristics of the participants.

Table 3-1 shows the characteristics of participants

Participants	Class	Gender	Ethnic group
Chipo	Form 3 sciences	Female	Hwesa
Siphiso	Form 3 sciences	Male	Hwesa
Tatenda	Form 4 sciences	Male	Hwesa
Tadiwa	Form 4 sciences	female	Hwesa
Russell	teacher	Male	Hwesa
Mr chitsike	Local elder	Male	Hwesa
Tanyaradzwa	Local elder	female	Hwesa

Table 3.1 shows the characteristics of participants which takes into consideration gender, ethnicity and class which maintains balance. The names of participants are not provided to uphold confidentiality and to protect participants. Contributions of

participants are valuable regardless of gender, table 3.1 consists of boys and girls, and this does not give room for segregation.

3.4.2 Sampling

Purposive sampling was used to select schools, learners, and classes. According to (Nikolopoulou, 2022), purposive sampling refers to a group of non-probability sampling techniques in which units are selected because they have characteristics that you need in your sample. In this type of sampling, units are selected on purpose. It is important if you need to find information-rich cases out of limited resources. The selection of participants was based on residence in the locality of the school, voluntary consent of the local elders, and the form of learners upon approval by their parents.

3.5 Ethical considerations and gaining field access

This study was ethically conducted. Research is based on the pillars of innovation, trust, and transparency, it is recommended that scientists and academics abide by certain ethical considerations in research (George, 2021). Ethical guidelines for research are principles that protect morality and guide the researchers when they conduct research. Additionally, ethics considered are protection, human participants' right to confidentiality, voluntary and informed (Mazumdar, 2022)

Research authority started with obtaining an introductory letter from the Department of Science and Mathematics. The application to conduct this research letter written to Munga River Adventist Secondary School will be accompanied by this introductory letter. The authority to do this research and evidence of participants agreeing to participate in this study is shown by the completed voluntary consent form.

3.6 Data generation methods

Relevant data which answers the research questions in chapter one was generated and summarized in Table 3.2. For easy reference, research questions are re-stated as follows (1) chemistry curriculum and manufacturing of organic products (2) indigenous knowledge related to manufacturing organic products (3) integration of chemistry curriculum and indigenous knowledge of manufacturing organic products (4)

indigenous knowledge of manufacturing organic products and community empowerment

Table 3-2 shows the data generation mix

Research question	Source	Generation method	tools	recording	Type
1	curriculum documents	Document analysis	Document analysis guide	Field notes or writing	Text
2	Students and elders	conversation	Conversation guide	Writing or field notes	Text
3	Curriculum documents and students	Conversation and data analysis	Document analysis and conversation	Field notes and writing	Text
4	Elders and students	conversation	conversation	Field notes and writing	Text

3.6.1 Data sources

Data generated from curriculum documents, elders and students is shown in the table above. Curriculum documents include chemistry and combined science syllabus, textbooks and competence based curriculum for primary and secondary education in Zimbabwe. Students as data source for question 2, 3 and 4 were suitable participants because they possess both indigenous and western knowledge competences that can help in generation of a curriculum which include both bodies of knowledge to solve community problems. Curriculum documents are free data sources which provide a basis for teaching and learning. In addition, curriculum documents provide the foundation for further development and implementation assessment and resources.

3.6.2 Methods of data generation

Conversation and document analysis are two methods which were used to generate data. These methods gave sufficient triangulation and credible data. Data generation refers to the use of multiple methods, data sets, theories and investigators to address a research question. It helps in enhancing the credibility and validity of findings (Bhandiri, 2022). Credibility refers to the confidence that the data and its analysis are valid and reliable. The following section discusses conversation and document

analysis in detail. This shows that the researcher can compare two data sets in the same category, this increases validity and credibility and enables the researcher to ensure the accuracy and validity of the findings

3.6.2.1 Document analysis

Data from curriculum documents was generated by the use of document analysis methods (CBC2015, textbook, and chemistry syllabus). A document is a human artifact that contains information such as letters, diaries, photographs, official documents, and medical records that relate to some social world. Document analysis refers to a systematic procedure for reviewing or evaluating documents, which can be used to provide context, generate questions, supplement other types of research data, track change over time, and corroborate other sources (Dalglish, Khalid, & shannon, 2020). Additionally, it involves document evaluation and it is regarded as an effective method for generating data from readily available sources.

3.6.2.2 Conversation with pupils/students

Conversation is an oral exchange of sentiments, observations, opinions, or ideas. It is a suitable method of generating data with human participants such as elders and students especially when the data relates to their community. Additionally, conversations create greater ease of communication and they produce naturalistic data. It also gives the researcher social support. Moreso, the researcher knows how a particular group perceives the topic, this helps respondents to speak freely and openly. Conversations help the researcher to gather rich and detailed data and clarify participant's responses and tailor conversation to the specific needs of the research project. The researcher allowed learners to interact in groups and share some ideas on organic products that can be extracted from nature as a way to promote interaction between learners. This may further help fast learners to help slow learners to grasp the concept. However, some learners do not want to share their answers and some are antisocial. The researcher corrected this by ensuring that every learner contributed to the group discussion.

3.6.3 Development of data generation tools

Data collection tools were checked and self-made for validity and reliability. Reliability and validity are key aspects of quality research. Validity refers to how well the results among the study participants represent true findings among similar individuals outside the study. Reliability refers to a concept describing how reproducible or replicable a study is. These concepts are used to evaluate the quality of the research.

3.6.3.1 Development of document analysis guide

The guide was self-developed because the motive behind document analysis is to present reliable and accurate data. The document analysis guide was self-developed. Additionally, it was self-developed to select appropriate pieces for the study. Literature review and research questions 1 and 3 informed the development process. The development process involved 3 steps. In step 1, the researcher has read the literature review, particularly on the organic manufacturing concepts. Step 2 was to list the resources that are to find and decide on the curriculum documents to use. The choice of the documents was based on this criterion; a curriculum document, a chemistry document, and organic manufacturing 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, the guide should outline issues that are meaningful and good enough 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, 3 and 4 are being answered through conversations. Lastly, the last step was to generate the guide items from the questions in the document analysis guide.

3.6.3.3 Validating research tools

On validity, I gave this document to my supervisor (Dr Mpofu) and my classmates to check for mistakes and errors to ensure that the guide is valid and reliable. Thereafter

I accepted all the changes and alterations by removing unnecessary stuff and adding relevant information to come up with a meaningful dissertation, this guide is valid in doing this research.

3.6.4 Data collection procedure

A four stage process was used to generate data as follows in figure below

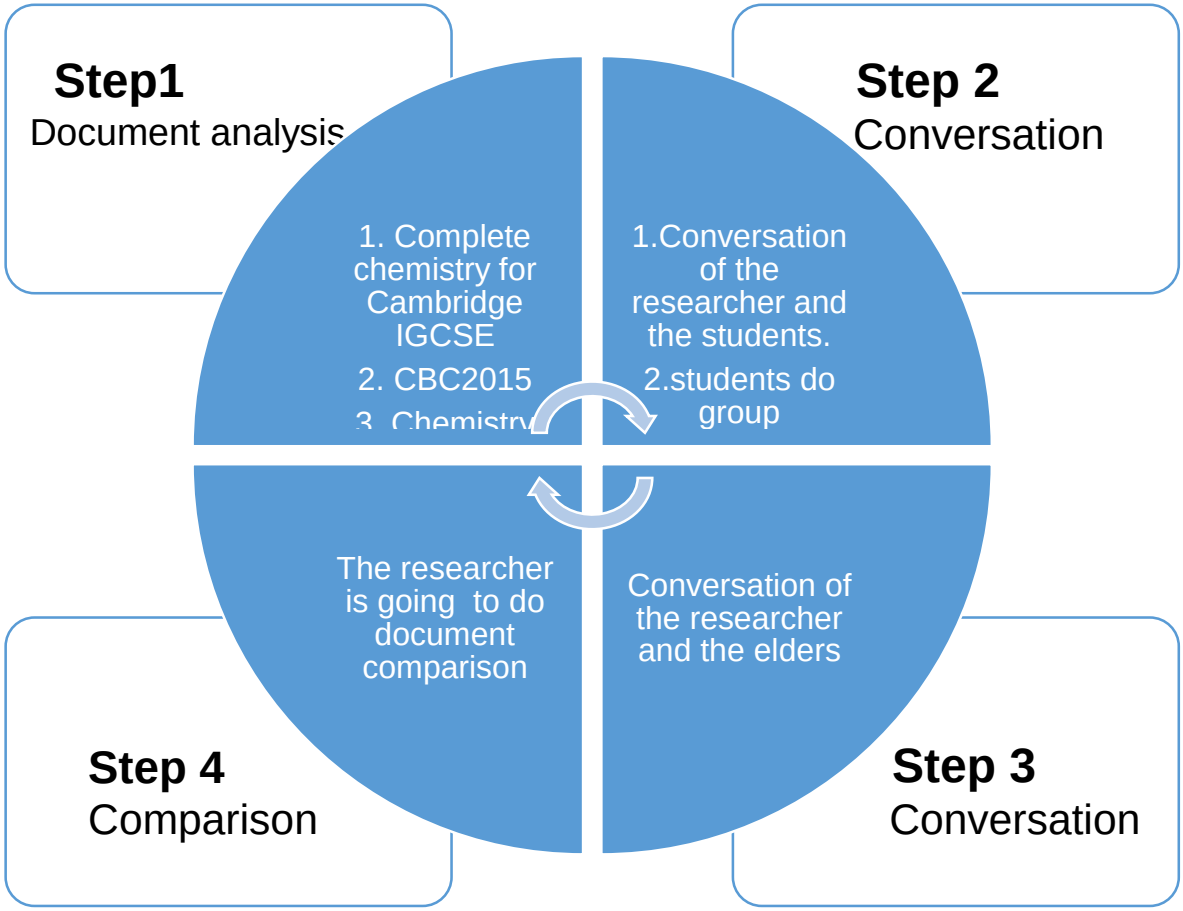

Figure 3. Shows data generation processes

3.6.4.1 Step1: document analysis

Step 1 involves document analysis. Documents analyzed are the chemistry syllabus, Curriculum Based Competence 2015, and Complete Chemistry for Cambridge IGCSE. Document analysis was done because these documents contain relevant information which answers questions 1 and 3

3.6.4.2 Step 2: conversation (researcher and students)

Conversations between the researcher and the students were done in stage 2. This was done in two ways which resulted in pre- and post-conversation. Firstly individuals answer questions on the guide followed by group conversation to create comparative notes. Secondly, students answer questions in pairs to create field notes to use on answering question 2. Two sessions of conversations were carried out. The first session was a conversation between participants and the researcher. The second session involves the students on their own. From these sessions, the researchers have managed to create field notes. The conversation guide was created from research questions.

3.6.4.3 Step 3: conversation (researcher and elders)

The researcher carried out conversations with two elders. After the conversations the researcher compares the notes noted down to create field notes.

3.6.5 Nature of data

Data collected is both quantitative and qualitative. Data is regarded as information in narrative form collected using interviews, questionnaires and observations. Qualitative data is non-numerical data generally refers to text such as open ended response to survey questions or user interviews and audios, videos, and photos Since the paradigm which is guiding this research is qualitative, this clearly shows that data to be used should be in pictures, words, descriptions objects and symbols. The main focus of qualitative data methods is to give a voice to the lived experience, offering researchers a deeper insight into a topic or individuals' experiences.

3.6.6 Analysis of data

Research data analysis is a process used by researchers to reduce data to a story and interpret it to derive insights (Singh, 2024). It helps to reduce a large chunk of data into smaller fragments which makes sense. Additionally, research data analysis is a process of gathering, structuring, and interpreting qualitative data to understand what it represents. The main purpose of data analysis is to extract actionable insights from raw data, enabling researchers to make informed decisions and predictions. Moreso,

it is used to discover useful information, support decision-making, and inform decisions. A four-stage process was used to analyze data as follows

3.6.6.1 Data preparation

Data collected through conversations with participants and document analysis was recorded in the form of participants' research field notes and written documents. Additionally, handwritten field notes were typed and consisted of qualitative text. The data was tabulated in line with classroom aspects which are pedagogy, language research questions, and assessment, content, purpose, and teaching and learning roles illustrated in the table below.

3.6.6.2 Data familiarization

Data familiarization entails the reading and re-reading of the entire dataset to become intimately familiar with the data. All the data was generated in text form, familiarization started during fieldwork (Bryne, 2021).

3.6.6.3 Coding

Coding is defined as the process of transforming raw data into a more structured and manageable format, enabling researchers to identify patterns, themes, and relationships within their data. Numerical codes or labels are assigned to different categories of information; these codes act as the bridge between the analytical phase of research and raw data to facilitate the interpretation and organization of data (Bazeley, 2021). Conceptual framework, classroom aspects and research questions informed coding and deductive coding themes.

3.6.6.4 Categorization of codes into themes

Themes drawn from research questions are assigned codes for analysis which are (1) chemistry curriculum and manufacturing of organic products (2) indigenous knowledge related to manufacturing organic products (3) integration of chemistry curriculum and indigenous knowledge of manufacturing organic products (4) indigenous knowledge of manufacturing organic products and community empowerment. The study suggests that indigenous knowledge of manufacturing organic products should be integrated into the chemistry curriculum.

3.7 Presentation and discussion of findings

Research findings (processed data/ information) are going to be discussed and presented in chapter four. Findings are presented in descriptive text form and data excerpts

3.8 Research rigor and trustworthiness

The research framework was informed by Lincoln and Guba's (1985), framed research rigor and trustworthiness enhance the validity and reliability of the research findings and processes. Rigor and trustworthiness are a measure of the trust or confidence in the data from which they are drawn, the analysis processes, consistency in the methods used over time, and accurate representation of the participants studied (Lincoln& Guba, 1985).

Table 3-3shows the framework for qualitative research rigor and trustworthiness

Elements	Description	How it is achieved
Dependability	It refers to stability of findings over time and involves participants evaluating the findings and the interpretation and recommendations of the study	Member checks Peer examination
Conformability	Refers to the degree to which the study findings could be corroborated by other researcher	triangulation
Transferability	the degree to which the findings of a qualitative research can be transferred to other contexts with other participants	Engagement in the field observation
credibility	It establishes whether or not the research process and findings are plausible The confidence that can be placed in the truth of the research findings and its process.	Triangulation observation

The rigor and trustworthiness of this study clearly show that throughout this chapter, the researcher obtained the information from reliable textbooks and participants who speak about their culture and how they interact with their environment to enhance the trustworthiness of both the data, and information drawn from it through triangulation. Triangulation entails the generation of data through multiple sources to study a

phenomenon in-depth understanding. Additionally, it can be viewed as a strategy for evaluating and assessing the validity of qualitative research findings through the convergence of information drawn from different sources and with more than one method. Data triangulation consists of (1) theory triangulation (2) investigator triangulation, (3) data triangulation to enable interpretation of a phenomenon, and (4) methodological triangulation. In this study, the researcher mainly used the methodological and data forms of triangulation

3.9 **Chapter summary**

This chapter ends with a summary. The summary consists of the aspects of paradigms, the exploratory case study, contexts, how the participants were sampled, methods and procedures of data collection as well as the analysis to solve the problem understudy. Additionally, the chapter highlighted how ethics were taken into consideration. The next chapter focuses on data presentation and discussion on the findings concerning the study.

4 CHAPTER FOUR: FINDINGS AND DISCUSSIONS

4.1 Introduction

The research aimed at indigenizing a Westernized chemistry curriculum for community empowerment, a case study on the manufacture of organic products. This chapter, therefore presents the findings of the study, which answer the four research questions that were presented in Chapter One. The findings provide solutions to the problem which was stated in Chapter One. The chapter is organized into themes, which are research questions and research objectives. The findings discussed under each theme- (1) chemistry curriculum and manufacturing of organic products (2) indigenous knowledge related to manufacturing organic products (3) integration of chemistry curriculum and indigenous knowledge of manufacturing organic products (4) indigenous knowledge of manufacturing organic products and community empowerment emerged from the data generated. Findings and discussion are based on themes that emerged from the collected data in line with the research questions. According to Mpofu and Mutseekwa (2023), there are eight aspects of classroom science practices findings which are 1) philosophy, (2) context, (3) content, (4) purpose, (5) pedagogy, (6) teaching and learning roles and responsibilities, (7) language and (8) assessment. The above practices are used in the presentation and discussion of the findings

4.2 Knowledge of manufacture of organic products in the curriculum

Under this theme, the curriculum documents revealed a fragmented approach to the integration of indigenous knowledge of the manufacture of organic products in chemistry curricula offered in Zimbabwe as presented in the following sub-sections (sub-themes).

4.2.1 Limited inclusion of indigenous philosophy into westernized school science

The textbooks and syllabus reveal that there is limited inclusion of indigenous philosophy into Westernized science. Additionally, the documents ask the teachers to teach STEM subjects that are in line with 21st-century skills, this neglects the local philosophy which left western science in isolation. The indigenous knowledge philosophy tends to be fragmented, it exists in pieces and bits. Therefore the inclusion

of indigenous types of philosophy is limited. The findings emerge from data as in the following excerpts:

Excerpt 1

> Zimbabwean rootedness in the foregoing beliefs and values reflects pan-Africanist philosophy even in the face of globalization. Unhu/Ubuntu/Vumunhu epitomizes universal human inter-dependence, solidarity, humanness, and a sense of community in African societies CBC 2015, page. 22)…The chemistry learning area encompasses cross-cutting themes such as inclusivity, teamwork, food security…. Environmental issues, safety, and health issues…. Indigenous knowledge systems and disaster and risk management (Chemistry syllabus 2015, page 1)

The curriculum documents, as presented in Excerpt 1 focus on the philosophy of Ubuntu-grounded teaching and learning. Unhu grounded teaching and learning. Refers to educational approaches rooted in African values and principles. Unhu emphasizes interconnectedness, mutual support, respect, collective responsibility, and shared humanity. Unhu-grounded teaching and learning involves community-based learning, storytelling and oral traditions, respect of elders and tradition, teacher-learner relationship built on mutual respect and inclusive and participatory methods. This clearly shows that Western philosophy dominates in our education system as compared to indigenous philosophy. Hunhu philosophy is mentioned but it is used to a lesser extent. Additionally, indigenous science is not perceived as useful science content. However, this philosophy is explicit on the curriculum framework and with no mention in the syllabus and text

The indigenous knowledge philosophy is fragmented, that is Unhu philosophy is just a small fragment within a western grounded western science philosophy. It's just bits and pieces not being fully considered. Therefore the inclusion of indigenous philosophy is limited. Unhu philosophy is weak as compared to that of western, the western 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.

4.2.2 Acquisition of Westernized 21st-century skills

The documents (CBC, syllabus, and textbook) reveal that the purpose of teaching and learning Western knowledge is to develop learners ready for life and work in a globalized environment, with digital skills meant for an information-driven economy. Additionally, it encourages learners to take STEM subjects (chemistry, physics, biology, and mathematics) so that they will obtain 21st-century skills.

Excerpt 2

> The goal of an appreciation for lifelong learning, visual and performing arts, and civic education centers for Indigenous knowledge. Establish and consolidate a firm grounding in Science and Technology disciplines (STEM). Demonstration of communication, problem-solving, technological, management, and leadership skills. (CBC 2015, pages 22 -23)… The syllabus aims to develop learners' basic scientific skills in physics, chemistry, and biology such as safely and confidently handling apparatus chemicals, and plant and animal specimens. Learners should be able to follow interactions, measure, and express quantities to a given level of accuracy and precision, design practical solutions to real-life problems using chemicals… present, analyse, and interpret data to establish relationships (chemistry syllabus 2015, page 2)… IGCSE ….. Aimed at helping you develop the examination skills necessary to achieve your potential examination…….. Also deals with experimental skills (IGCSE 2011, page 5)

The curriculum documents, as presented in Excerpt 2 directs on the need for learners to be strongly grounded in STEM subjects (purpose of the curriculum). The competences advocated for by the curriculum documents include handling of apparatus chemicals, plant and animal specimens safely and confidently, communication, problem-solving, and management and leadership skills. The purpose of Western scientific content is scientific and technological advancement, which

supports democratic governance, written records, and documentation and also encourages competition and innovation. Western scientific content promotes an inclusive learning environment, critical thinking, and cultural awareness. The curriculum documents strongly represent Western content rather than indigenous content which promotes cultural erosion, disconnection from our heritage, and marginalization of indigenous knowledge. Physics, chemistry, and biology

The documents (syllabus and textbook) reveal the indigenous kind of objective which clearly shows that the syllabus is Western-oriented. In the CBC the indigenous knowledge is in bits and pieces. It is not fully developed meaning there is not much content specifically for manufacturing organic products that can be taught. Therefore the slight inclusion of indigenous knowledge gives a conclusion that it is largely Western. The curriculum documents keep in possession of Western scientific knowledge. Though the CBC appreciates the inclusion of indigenous knowledge, it is not practiced on the ground because the syllabus interpreters are focusing on the Western perspective which is found in the syllabus. Shizha (2005) revealed that teacher resistance to indigenous knowledge and its integration into school science curriculum is a major challenge. However, Indigenous kind of objectives are not considered in the education system

4.2.3 Fragmented Indigenous content into a Western science

Overall, the curriculum documents reveal that the inclusion of Indigenous content is included as fragments thereby giving the majority of the content in Western orientation. Additionally, in the syllabus, the indigenous knowledge is missing. The teaching and learning of knowledge related to the manufacture of organic products can only be inferred in the textbook as compared to that of Western knowledge of organic products which is explicit, thus the content to be taught is largely Western. The findings emerge from the data as in the following excerpt

Excerpt 3

> The learning environment should promote various things like independence and interdependence, learner-centered learning, motivation, and self-esteem as well as the values, needs, and interests

> of learners and society 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 (Researcher field notes from the CBC 2015, p, 48-49).

Excerpt 3 above reflects that organic chemistry concepts are largely Western concepts. The teaching of organic chemistry only possesses Western content which gives a reflection that the indigenous knowledge of manufacture of organic products is missing in the school science curriculum. Therefore there is a need to integrate the Western knowledge of organic and indigenous knowledge of the manufacture of organic products. The curriculum documents show limited inclusion of the indigenous context and competencies into that of a Western scientific environment. The integration of the two types of knowledge is found but there is no specific deep content of the indigenous type of an environment. However, this gives a perspective that Western science is dominating in the document.

4.2.4 More Westernized than indigenized pedagogy

The curriculum documents clearly show that indigenous ways of teaching are not documented well as compared to Western science methods of instruction they are clearly explained and documented, so it's not easy to trace how indigenous teachers taught their learners. Henceforth Western pedagogy is being used to achieve set objectives in schools expressing how restricted is the indigenous perspective. The following excerpts appear in the data to come up with the given findings.

Excerpt 4

> 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 problem is solving based, practical's, challenging and fun. Additionally, it is an interactive pedagogy (classroom interaction and participation). An example of an approach that characterizes the learner-centered method is inquiry-based

> learning. Inquiry-based learning is an approach that aims at nurturing thinking, reflection, and problem–solving among learners (CBC2015, page 43)… The principles of teamwork, concreteness, totality, stimulation, and self-activity should guide teachers as they employ models, site visits, research, seminars, discovery, simulations, demonstrations, and experimentation (chemistry syllabus page 2)…The course book deals with experimental skills……. (IGCSE 2011, page 5)

The methods of instruction used in schools are more westernized than indigenized, meaning they are not balanced. From excerpt 4 above, phrases like ' ...being their knowledge, ideas and past experiences, classroom interaction and participation, learner-centered and problem-solving approaches can be applied in either Indigenous or Western education. The teaching and learning strategies should be from both indigenous and Western perspectives but in this case, it is not balanced. The curriculum documents show that Western pedagogy is being used to achieve set objectives in schools expressing how restricted is indigenous pedagogy. The knowledge, ideas, and past experiences, classroom interaction and participation, and learner-centered and problem-solving approaches can be applied in either indigenous or Western education. 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 (Cheryl & Cajete, 2020). Thus the teaching and learning strategies are considering both indigenous and Western perspectives. The teaching and learning strategies are considering both indigenous and Western teaching methods. The curriculum should balance the teaching methods to blend the strategies considering both Indigenous and western perspectives

4.2.5 Fragmented Indigenous context into Western Science

Curriculum documents indicate pieces and bits of indigenous context in a Westernized scientific curriculum. The integration of the two types of knowledge is found but there is no depth in indigenous context offered in chemistry documents. This clearly shows that Western science is dominating in the documents. The following excerpts are evidence of these findings.

Excerpt 5

> The curriculum framework stresses learner-centered approaches that address real-life problems, discovery of new knowledge and understanding of content, and demonstration of skills acquired. The learning environment should promote motivation and self-esteem, independence and interdependence, and learner-centered learning, as well as the values, needs, and interests of learners and society. The learner-centered classroom environment must encourage self-confidence in learners as well as value 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, pages 40-49).

Except 5 above shows the inclusion of the indigenous context into that of a Western scientific environment. The integration of the two types of knowledge is found but there is no specific deep content of the indigenous type of an environment. The environment in which the teaching and learning process takes place depends on the type of knowledge that is being acquired. An indigenous kind of context is a bit different from the Western scientific environment. If it is an indigenous type of knowledge it requires the teacher and learners to be outdoors while they are doing the lessons. However, Competence-based curriculum documents encourage the teaching of science in school settings which neglects the natural laboratories. The emphasis on society suggests that teaching of the manufacture of organic concepts can also be done in the community and natural environment.

4.2.6 More Westernised Languages than Indigenous

From the curriculum documents analysed it is reviewed that most of the books are written in foreign languages which clearly shows that local indigenous knowledge is not properly represented and is documented as pieces and bits. Language as the medium of instruction there is a need to consider that learners are from different backgrounds with different languages. In the curriculum documents, there is an element of code-switching that clarifies the inclusion of indigenous types of knowledge.

Though code-switching is a Western-oriented education because all the analyzed documents are expressed in a foreign language (English). The findings emerge from the following data excerpts.

Excerpt 6

> The medium of instruction used in the curriculum framework as a whole is more Western-oriented because it is written in a 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 (CBC 2015, page 22)…Throughout the chemistry course… it is important to use clear and correct chemical language. Chemistry has a huge number of specialist terms and symbols….use them correctly. (IGSE 2011, textbook, page 8)…The whole syllabus is written in English…… (Researcher field notes, 09/2024)

Language is regarded as a medium of instruction, but local languages are not properly balanced with foreign languages as evidenced by books written in foreign languages and the Competence-based curriculum is encouraging the STEM subjects to be taught in foreign languages as their examinations are set using foreign languages not local languages. This indicates that the Zimbabwean education system is still under colonization. There is a need to review the curriculum to focus on local knowledge at the heart of the curriculum make use of local languages set examinations in local languages and write textbooks of STEM subjects in local and understandable languages like other countries. 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. Therefore the researcher discovered that it is vital to fully include indigenous language in the education system.

The finding is clearly showing that foreign language is used in schools as the medium of instruction. All documents are written in English, which proves that the educators are taking indigenous knowledge as a misconception. Though Zimbabwe attained

independence more than two decades ago, colonial legacies have continued to influence her education (Nherera, 2000). Therefore the researcher discovered that it is vital to fully include Indigenous knowledge in the education system

4.2.7 Limited inclusion of Indigenous assessment into a Western science

The introduction of a Competence-based curriculum brought Braille, which is a system of dots that can be eee4read with fingers by people who are blind or with low vision as an Assessment tool. 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 the indigenous context from the curriculum framework therefore it reflects a Western education dimension. In other words, the indigenous knowledge is limited in the document. In the other two analyzed documents (textbook and syllabus), the idea of assessment in Indigenous knowledge is 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 7

> 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 performance1 on an ongoing basis. It is used to assess knowledge, skills and values1. Summative assessment measures learner performance2 .at the end of a learning program. It focuses on assessing knowledge and regurgitation of facts (CBC 2015 page 51)…The scheme of assessment is grounded in the principle of inclusivity and equalization of opportunities….. The three main objectives are knowledge and understanding, handling information and problem-solving, and experimental skills, investigations, and application (Chemistry syllabus 2015, page 33)…The IGCSE examination tests three different assessment objectives…..knowledge with understanding, handling information, problem-solving skills, and experimental skills and investigations (IGCSE 2011, page 5)

The curriculum documents, as presented in Excerpt 7 direct on assessment at the end of each learning process. The assessment is concerned with measuring learner performance against the set standards or benchmarks. Tools such as quizzes, tests, assignments, projects, class discussions, written examinations, essays, standard tests, multiple-choice questions, presentations, and oral examinations are used to measure students' performance, feedback, and progress. Values are essential for moral development, cultural competencies, and character education among other reasons to promote positive relationships, academic achievement, and personal development so that learners will develop respect, responsibility, confidence, and environmental stewardship among others. However, all the tools are largely Western and there are limited indigenous tools. The curriculum documents should blend the assessment tools when measuring students' performance.

Assessment is a scientific tool that is used to measure success and is classified into formative and summative. The way success is measured in society is different from the way it is in schools. Nherera (200) 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. Indigenous kind of assessment is limited in the curriculum documents. Thus the education system does not include indigenous knowledge assessment tools.

4.2.8 Fragmented Indigenous learning Environment than western

The findings show that the teaching and learning of manufacturing organic products is based in the laboratory, which is a Western learning environment. The competence-based curriculum advocates for teaching and learning of chemistry to be done in laboratories neglecting the natural laboratories which is nature. The findings were drawn from some of the data excerpts below

Excerpt 8

> The learner-centered classroom environment must encourage self-confidence in learners as well as value 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, pages 48-49)

The curriculum documents, as presented in Excerpt 8 focus on the classroom environment. It aims to provide a school and classroom environment that promotes the cognitive, social, physical, psychomotor, and affective growth of learners. The focus of learning revolves around the learner as they engage in the search and discovery of new knowledge. The learner-centered classroom environment, such as site visits, peer assessment, service learning (connecting learning to community service), simulation-based learning (real-world simulations), gamification, learning journals, learning centers (hands-on and self-directing learning stations), and collaborative learning. These methods promote active learning, collaboration, and flexibility. The curriculum documents support these strongly Western teaching methods even though they involve a few indigenous teaching methods such as gamification and service learning but most of the teaching methods are Western-oriented. The curriculum should balance the teaching methods to blend the strategies considering both indigenous and Western perspectives. Additionally, in Learning environments such as classrooms, school premises, communities, and industries (advocates for multiple teaching and learning places) teaching and learning of MOP involves community engagement (elders), land-based learning (forests, waterways, and traditional lands), mentorship programs (pairing students with mentors and knowledge holders) traditional skills workshops (crafting, gathering and traditional arts), food sovereignty (teaching indigenous food systems, harvesting and preparation methods and digital archives(cultural materials). All this develops learners with deeper Indigenous cultures and communities, gains practical skills and a hands-on approach, and supports cultural preservation. However, the curriculum documents strongly suggest that the learner should be at the front whilst the teacher offers the supervisory role. However, the environment in which the teaching and learning process takes place depends on the type of knowledge that is being acquired.

The curriculum documents show the inclusion of the indigenous context into that of a Western scientific environment. The integration of the two types of knowledge is found

but there is no specific deep content of the indigenous type of an environment. The environment in which the teaching and learning process takes place depends on the type of knowledge that is being acquired. An indigenous kind of context is a bit different from the Western scientific environment. If it is the indigenous type of knowledge it requires the teacher and learners to be outdoors whilst they are doing the lessons.

4.3 Indigenous knowledge related to the manufacture of organic products in the community

Discussions and findings under this heading emerged from conversation data and are based on data generated in line with classroom science practices aspects. Under this theme, the analysis of conversation data revealed indigenous knowledge related to the manufacture of organic products in the chemistry curricula offered in Zimbabwe. This is described and explained in the following section.

4.3.1 Limited inclusion of indigenous philosophy into westernized school science

From the information gathered, it is reviewed that the majority of learners hold both indigenous African philosophy and Western philosophy.

Excerpt 9

> Indigenous knowledge is the knowledge that we have besides scientific knowledge. The data collected, it shows that most learners are taught how to live in harmony with the environment, life skills, and hunhu/ ubuntu. Apart from school content, we are taught how to make hutyora, maponde, dyes, soap from mafeso, floor polish from Mushamba tree bucks, medicines from nature, and weather forecast using movements of birds (group 1 conversation).Ini ndinokosherwa neruzivo rwandinowana kumba kupfuura zvandinodzidza kuchikoro, vamwe munot kudii? That knowledge is free, easy to learn, and understand. We taught the kids through different activities like rain-making ceremonies, bira, rituals (kurova guva), kurapa tichishandisa mishonga yechivanhu, nhimbe. (Group 2 conversation, elders). Both indigenous knowledge and scientific knowledge are found in learners. Indigenous knowledge is existing knowledge in learners they get from their homes. Learners are

> much more knowledgeable about Indigenous knowledge because they learn from each activity they do at home. They know Indigenous concepts like the fermentation of mawuyu, masawu, and mapfura beers, the making of hutyora, detergents from plants, skin lotion from nature, history, language, cultural practices, and healing skills. Learners get indigenous knowledge through stories, knowledge is shared through art objects and rituals. People practice hunting and gathering, fishing, and farming (learners group and elders' group conversation and field notes 09/2024).

Unhu philosophy is a social philosophy that embodies virtues that celebrate mutual social responsibility, mutual assistance, trust, sharing, unselfishness, self-reliance, caring, and respect for others among other ethical values (Mandova & Wasosa, 2013). From the above data, it shows that learners possess both bodies of knowledge.

4.3.2 Fragmented Indigenous context into Western Science

The participants also provide that the environment in which the teaching and learning process takes place depends on the type of knowledge that is being acquired. For example, when you are being taught about herbs you should be in the forest so that you will be shown the trees and how they are used, unlike western science you can buy all the materials needed in a lesson. 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

> Indigenous knowledge is of vital importance to our pupils from the local communities because the community holds vital information about its surroundings which should be taught to these kids for continuity. It is important to invite elders to teach kids in schools about their surroundings for sustainable development and to keep the remaining natural resources. Ruzivo rwatinowana munharaunda zvakanaka kut zvibatane nezvidzidzo zvedu muzvikoro (learners Group 1 conversation). By inviting local elderly people who know about this

> indigenous knowledge to teach pupils at school, it will help on the integration of western knowledge with indigenous knowledge. (Learners Group 2 conversation) The elders should be invited to teach about fermentation using local and natural fruits in the environment, making cereals from nature and medicines from easily accessible Indigenous fruits. (Conversation researcher field notes 09/2024)

The finding 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, can build a better level of understanding. Indigenous people who live in the vicinity of natural resources observe the activities around them (Mugambiwa (2018). The researcher is advocating for the integration of these bodies of knowledge.

4.3.3 Fragmented Indigenous content into a Western science

The learners possess much of Indigenous knowledge than Western knowledge since they experience a lot of Indigenous knowledge daily. They have much knowledge of Indigenous content, which shows that they are learning a lot from the environment they live. This is supported and evidenced by the following excerpts from the participants.

Excerpt 11

> Learners learn from nature daily. They learn about fruits and their importance to diet, making animal skin products, medicines from nature, and detergents from nature. We eat these fruits every day to get nutrients 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, miti, zvicherwa nemishonga inorapa.(Group 2 conversation)They know Indigenous concepts like history, language, cultural practices, and healing skills (Conversation researcher field notes 09/2024)

Learners are much more knowledgeable about indigenous knowledge. They have much content as evidenced in the excerpt by the content of indigenous knowledge. Instead of teaching the content of Western content only, it is good as well to teach them what they interact with in their everyday life (indigenous processes). It is witnessed that most learners are struggling to understand western concepts because of their indigenous background.

4.3.4 Acquisition of Westernized 21st-century skills

The teaching and learning aim to pass knowledge to other generations. Also, it is for a good reason to develop life skills in the learners for them to fit into the society they are going to build in the future as well as contribute to economic development. The following excerpts show the purpose of teaching and learning as discussed by the participants.

Excerpt 12

> Introducing indigenous knowledge to a new curriculum is the only way to integrate with western science and teaching it in schools. Ruzivo rwatinowana munharaunda zvakanaka kut zvibatane nezvidzidzo zvedu muzvikoro, zvinoita kut tinzwisise zvidzidzo zvevachena izvi nekut tinenge tichishandisa mienzaniso yatinoziva uye zvatinoita (learners Group 1 conversation). It is important to invite local elderly people who know about relevant Indigenous knowledge to include and teach pupils in schools. Hatidi kurasikirwa neruzivo rwevakuru vedu tinoda kuzodzidzisao vana vedu saka vabereki ngavapiwe mukana muzvikoro vadzidzise vana nezvazvo. Vabereki vanofanirwa kuuya kuzodzidzisa mararamiro avayiita kare uye maitiro avayiita kugadzira mishonga, nezvavaishandisa pakugadzira zvakawanda wanda. Izvi zvinoita kuti tinzwisise nharaunda dzatigere uye kugadzira nzira dzekupedza amwe nematambudziko atiri kusangana nawo ikozvino(learners Group 2 conversation).Indigenous knowledge of medicine making, and processing of organic chemicals must be included in the curriculum so that the knowledge of our elders will be preserved and passed to the next generations(Conversations, researcher field notes 09/2024).

The phrase written in Shona from Group 1 conversation in the excerpt reflects that for the 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.

4.3.5 More Westernized than indigenized pedagogy

Several strategies or approaches may be applied in the process of imparting or acquiring knowledge. Learning Indigenous knowledge can be done through practice, demonstration, and observation. For example, to learn about poisonous and non-poisonous fruits and mushrooms, you simply observe what animals eat. The strategies depend on the type of knowledge which is either indigenous knowledge or Western scientific knowledge. Also, the approach can be determined by 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 ceremonies, bira, rituals (kurova guva), kurapa tichishandisa mishonga yechivanhu, nhimbe. (Group 2 conversation)Kuti uzive nezve magorwa anowanikwa kuhowa nemichero, unofanirwa kuongorora michero nehowa hunodyiwa nemhuka nezvipembenene ndihwo hunenge husiri magorwa(learners group 1 conversation). There are unique ways of learning in a community whereby people connect through stories, knowledge is shared through art and objects, and rituals. People practice hunting and gathering, fishing, farming, and making medicines (Conversation researcher field notes 09/2024).

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. Some acknowledge that most Western knowledge categories such as medicine, magic, poisons, climate, and

pesticides are grounded in indigenous knowledge. The learners will enjoy learning if the two knowledge bodies are equally appreciated.

4.3.6 More Westernised Languages than Indigenous

Data showed that most of the textbooks, syllabuses, and final assessments are written in English whilst our learners are from local communities where they their local languages as a medium of communication. So it is important to translate books into local languages so that it will be easier to discuss and learn about the local community. It is evidenced by all the content learners learn is in English which is used to communicate Western scientific knowledge.

Excerpt 14

> Magwaro ezvidzidzo zvedu mazhinji akanyorwa nemutauro wemhiri izvo zvinoita kuti tiite matambudziko pakudzidza zvidzidzo zveScience, asi magwaro nemazmanishoni zvikanyorwa nemutauro wedu zvinoita nyore kunzwisisa tobudirira muzvidzidzo zvedu.(Group 1 conversation). Tinovimba kuti vanogadzira magwaro evana okudzidza kuti vanyorewo mabhuku nomutauro wedu kuti vana vedu vagonzwisisa mukudzidza kwavo(elders conversation). Let indigenous knowledge of manufacturing organic products be a subject on its own at O-level chemistry. Learners are encouraging curriculum developers to include indigenous knowledge of manufacturing organic products in the syllabus as a topic (Conversation researcher field notes 09/2024).

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 to integrating indigenous knowledge into Western scientific knowledge. Certain research by Shizha (2007) shows that resistance is sometimes associated with the scenario that indigenous knowledge is looked down upon as primitive.

4.3.7 Limited inclusion of Indigenous assessment into a Western science

Data from which participants showed that Indigenous assessment is oral, practical, and ongoing (formative) whilst learning of science is both summative and formative as well as practical and theoretical.

Excerpt 15

> Teaching and learning of indigenous knowledge involves oral teaching, practicals, and demonstrations. Learners are taught how to extract medicines from nature and how to apply it or treat patients including quantities, so they are asked to do the practical's when the need arises. Tinodzidziswa kugadzira mishonga nekuichengetedza uyezve nemashandisirwo ayinoitwa.if we learn medicine extraction and application in schools it will be easier for us to check the progress, because it's part of our everyday life (Group 1 conversation). Learning indigenous-related concepts may assist learners in achieving success without struggling since they have prior knowledge of those concepts (Conversation researcher field notes 09/2024).

Assessment is common in both indigenous and Western education systems. It is used as a way of assessing if the concepts have been grasped or not, It is more like feedback of what has been done during the teaching and learning process. If the feedback is positive it means the learner is successful.

4.4 **Integrating Indigenous knowledge of MOP into the chemistry curriculum**

The synthesized findings from document analysis and conversation data propose strategies that can be employed in the teaching and learning of Indigenous knowledge of manufacturing organic products at 'O' level chemistry

Table 4-1shows strategies of integrating indigenous knowledge and western science

Curricula Aspects	Integrated curriculum
Philosophy	Chemistry education researchers and other stakeholders should collect the list of chemical concepts and aspects of unhu philosophy that relate to local practices and disseminate the same as a bulletin to teachers at their various schools. The chemistry curriculum should

	be reviewed to include cultural knowledge and practices in the curriculum content. There is a need to constantly enlighten the general public on the prospects of integrating cultural practices into the teaching and learning of chemistry.
Content	The teachers need to collaborate with learners in documenting indigenous knowledge of the manufacturing of organic products for teaching in organic chemistry. The documented indigenous knowledge of the manufacture of organic products constitutes content to be taught. As the teachers document this content they enhance their understanding of indigenous knowledge of organic products. Furthermore, making use of traditional products in science lessons for example when teaching acids bases and salts make use of fruits, tea, and other products from nature to test for pH. Secondary school Indigenous learning materials should be designed and made available to chemistry teachers at their various secondary schools.
Environment	Aesthetics, increasing outdoor activities
Purpose	Indigenous knowledge teaching and learning can be broadcast (radio and television programs) 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.
Language	Natives and local technicians should be involved by making time to support the training of teachers on the integration of cultural practices into the classroom chemistry interaction pattern. Collaboration extends to teachers' engagement with local elders who are knowledge holders of Indigenous knowledge. Use of native language, encouraging learners to explain or summarize concepts learned in local languages to create a classroom dialogue
Pedagogy	Implementation of blended Western and indigenous knowledge pedagogies. Teachers can blend the Unhu pedagogy with inquiry-based learning and collaboration to enable learners to learn through problem-solving. 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 differences. Furthermore, it leads to the documentation of IKMOP 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 planning to teach and integrate Western science and Indigenous knowledge in lessons. 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 school science

Therefore the teaching of the indigenous knowledge of the manufacture of organic products in organic chemistry is missing but it is possible to integrate the two using the emerged strategies as per findings.

4.5 Benefits of teaching and learning of indigenous knowledge of manufacturing organic products and community empowerment.

Community empowerment refers to the process of enabling communities to increase control over their lives. "Communities" are groups of people who may or may not be spatially connected, but who share common interests, concerns, or identities. Communities can be empowered by equipping them with scientific knowledge that can be used in different ways which include

The use of organic waste in making energy, i.e., making methane through the biogas process which makes use of organic products. Teaching learners about biogas production can help in controlling pollution.

Additionally, disseminating information about manufacturing organic products such as medicines (cancer herbs) from nature will improve the livelihood of the local communities. This will help to venture into the pharmaceutical business.

Moreover, local Indigenous knowledge of manufacturing organic products can be used in securing food shortages in communities by providing sustainable agricultural activities. For example the use of organic fertilizers which do not damage the ecosystem and well as human health.

4.6 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) knowledge of manufacturing of organic products in the curriculum (2) indigenous knowledge related to manufacturing organic products (3) integrating indigenous knowledge of manufacturing organic products into the chemistry curriculum (4) indigenous knowledge of manufacturing organic products and community empowerment.

5 CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

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

5.2 Summary of finding

The findings which are the answers to the research questions emerged in four themes. These themes are (1) a fragmented approach on chemistry curriculum and manufacture of organic products which can be integrated into ordinary level chemistry;(2)an exclusive indigenous knowledge related to manufacture of organic products;(3) fragmented approach o integration of indigenous knowledge of manufacturing organic products into a chemistry curriculum; (4) indigenous knowledge of manufacturing organic products and community empowerment. The curriculum documents are western oriented because six out of eight classroom aspects are directly advocating for western content domination. The indigenous knowledge is found in bits and pieces in the entire curriculum (two out of eight aspect), meaning the curriculum is explicitly western oriented. However, learners possess both indigenous knowledge and western knowledge even though the concept of indigenous knowledge of manufacturing organic products is missing in the chemistry curriculum which needs to be integrated.

5.3 Conclusions

The conclusions were drawn from the research findings in chapter 4. The indigenous knowledge of manufacturing of organic products is excluded in the chemistry curriculum. Additionally, findings brought out that learners possess both indigenous and Western knowledge but there is no integration between their existing indigenous knowledge of manufacturing organic products and the school chemistry.

5.4 Recommendations

The researcher assists or help learners, parents and all the stakeholders in the education sector with ideas on how to overcome or minimize the poor performance in Chemistry. The researcher recommends that knowledge in the curriculum designers must incorporate indigenous knowledge of manufacturing organic products in the chemistry curriculum documents (syllabus, textbook). Additionally, the researcher recommends that learners and teachers should integrate the indigenous knowledge of manufacturing organic products into the school chemistry. Teachers should be professionally developed on how to integrate indigenous knowledge of manufacturing organic products when teaching Chemistry through workshops. Furthermore, the universities should include modules that teaches importance of integrating indigenous knowledge and western knowledge and how to blend them together. Lastly, the ministry should allow local elders to teach indigenous concepts in schools.

5.5 Final remarks

Manufacturing of organic products is an important and interesting aspect in teaching and learning of organic chemistry. The teachers should make sure that they taught well since it is well connected to the learners daily experience. Additionally, teachers should be well equipped with knowledge and materials that will enable them to connect the community and the school.

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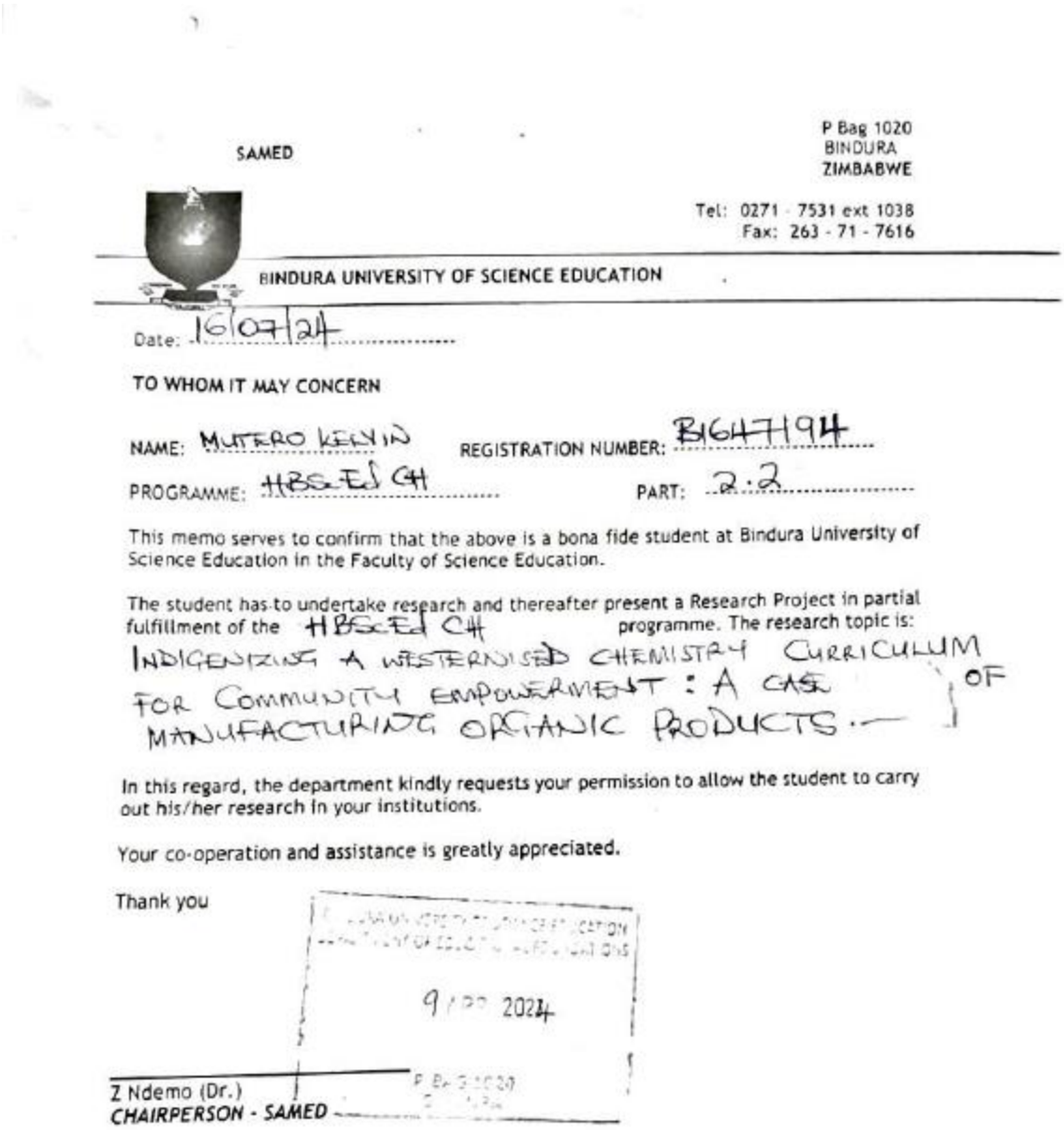
7 APPENDICES

Appendix 1: permission letter from department of science education



SAMED

P Bag 1020
BINDURA
ZIMBABWE

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

BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 16/07/24

TO WHOM IT MAY CONCERN

NAME: MUTERO KELVIN REGISTRATION NUMBER: B1647194

PROGRAMME: HBSc Ed CH PART: 2:2

This memo 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 Project in partial fulfillment of the HBSc Ed CH programme. The research topic is:

INDIGENIZING A WESTERNISED CHEMISTRY CURRICULUM FOR COMMUNITY EMPOWERMENT: A CASE OF MANUFACTURING ORGANIC PRODUCTS.

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

9/7/ 2024

Z Ndemo (Dr.)
CHAIRPERSON - SAMED

Appendix 2: Permission to conduct research

Mutero kelvin B1647194

0771488536/0715298589

Muterokelvin15@gmail.com

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

July 22, 224

Munga Adventist Secondary School

P O Box 249

Nyanga

Dear Madam

RE: Request to conduct research at Munga Adventist Secondary School.

I'm hereby seeking to conduct research titled Indigenizing a westernized chemistry curriculum for community empowerment. A case of manufacturing organic products at Munga Adventist Secondary School in the Nyanga East District of Manicaland Province

Purpose: The purpose of this research is to highlight the importance of integrating organic manufacturing practices and community empowerment into a westernized chemistry curriculum, while recognizing and valuing indigenous knowledge. This integration aims to create an inclusive approach to chemistry education that not only promotes sustainable and environmentally friendly manufacturing processes but also empowers local communities by involving their traditional knowledge and practices. By bridging the gap between western science and indigenous knowledge, this curriculum seeks to foster a deeper understanding of chemistry that is grounded in cultural diversity, community engagement, and the preservation of traditional wisdom.

Procedure and duration: I wish to conduct this study with two form 3s and 2 form 4s who are learning chemistry. The participation of these learners is on voluntary basis, they are not forced to participate. The participants will answer questions asked by the researcher. The conversation will take 2 hours at most, the responses will form part of data generated which will be further analyzed and presented in chapter 4 of my dissertation.

Benefits, compensation and additional costs: the participants will not receive any material or financial benefits or any other compensation for participating in this study. This research is conducted in partial fulfilment of the honors' degree in chemistry certificate requirements at Bindura University of Science Education. Participation in this study has no financial costs to the students, no direct benefit is promised to the students. The main benefit is for students to gain in-depth content of manufacturing

organic products. This allows you to have a strong foundation in organic chemistry and other studies related to organic chemistry

Confidentiality: The researcher is promising the participants that all data generated in this study is going to be kept confidential, and it is going to be kept in safe pace. The researcher will not use names in the documents. The information will only be accessed by the researcher and is going to be destroyed by burning.

Voluntary Participation: the students should bear in mind that participation is voluntary, they may choose not to participate. Those who wish to withdraw during the conversation will withdraw without hesitation and consequences. Students can only participate in this study with full parent consent.

Additional information: if the participants have any queries regarding his/her rights you may get in touch with Dr. V. Mpofu via email at vmpofu@buse.ac.zw or cell 0775184200

Conclusion: you may take as much time as necessary to think over it. I'm prepared to answer any questions on any aspect of this study which is not clear. If you have doubts about this study you may contact me on the stated address above.

Authorization: if you sign the consent form attached to this letter, you are authorizing this research to be conducted at Munga Adventist Secondary School in Nyanga. You can also send a written reply.

Yours sincerely

Mutero Kelvin

Appendix 3: school authority letter

Munga Adventist Secondary School
P. O Box 249
Nyanga

July18, 2024

Bindura University of Science Education
P. Bag 1020
Bindura.

Dear sir/madam

RE: Permission to conduct a research in chemistry for Mutero kelvin B1647194 at the above mentioned school.

This note serves to confirm Mutero Kelvin was granted permission to conduct a research in chemistry using ordinary level pupils in form 3 and 4 classes of 2024. It will be a 2 hour session with the participants.

Yours faithfully

Ms Midzi. F

HEAD

Phone number: 0718842439

Appendix 4: learners' consent form

I agree to participate in the research study titled: Indigenizing a westernized chemistry curriculum for community empowerment: A case of manufacturing organic product to be conducted at …Munga Adventist Secondary 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 authorize his/her participation in this research study titled: Indigenizing a westernized chemistry curriculum for community empowerment: A case of manufacturing organic product to be conducted at Munga Adventist Secondary 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: documment analysis guide

Section A: Introduction

The curriculum documents were analyzed with the guidance of the following items. The chemistry syllabus, complete chemistry for Cambridge IGCSE 'O' level Chemistry textbook, and the Competence Based Curriculum.

Section B: Session background

Type of document: **curriculum documents**

Learning area ……

Venue……

Time start……

Time end…….

Section C: Guide items

1. What content of (concepts, skills, values) of manufacturing organic products (KMOP) is provided in the curriculum documents (competence curriculum, chemistry syllabus textbook)?
2. How is teaching (pedagogy, class interactions, language, and assessment) of this knowledge framed in the chemistry syllabus?
3. What benefits of teaching KMOP (purpose) are provided in the curriculum documents?
4. Where should the teaching and learning of MOP takes place (environment, conditions, activities)
5. How oriented on the indigenous or western continuum is the knowledge in the curriculum documents?

Section D: Parting remarks

The remarks show an appreciation of the analyzed data. The document shows the Indigenous knowledge of manufacturing organic products concepts which are being acquired by pupils through schooling which were collected from the curriculum documents

APPENDIX 7: CONVERSATION GUIDE

Section A: Introduction

Welcome and thank you for volunteering to take part in this activity. I appreciate your time. You were invited because you hold relevant knowledge that I'm seeking in this study and you all live in this community, and your point of view is highly appreciated. There are no wrong answers but rather different viewpoints even if they differ from what others have said. Does anyone of you 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 indigenous content (concepts, skills, values) of manufacturing organic products (KMOP) can participants provide?
2. How the knowledge is taught teaching (pedagogy, class interactions, language, and assessment) in participants or society?
3. What benefits of teaching and learning KMOP (purpose) are provided by the participants?
4. What are the appropriate places for teaching and learning of manufacture of organic products?
5. How oriented on the indigenous or western continuum is the knowledge in participants/ society?

Section D: Parting remarks

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

APPENDIX 8: SYNTHESIS GUIDE

Section A: Introduction

The curriculum documents were analyzed with the guidance of the following items. The chemistry syllabus, complete chemistry for Cambridge IGCSE ‘O’ level Chemistry textbook, and the Competence Based Curriculum.

Section B: Session background

Type of document…….

Learning area ……

Venue……

Time start……

Time end…….

Section C: Guide items

1. What content of (concepts, skills, values) of manufacturing organic products (KMOP) is provided in the curriculum documents (competence curriculum, chemistry syllabus textbook)?
2. How is teaching (pedagogy, class interactions, language, and assessment) of this knowledge framed in the chemistry syllabus?
3. What benefits of teaching KMOP (purpose) are provided in the curriculum documents?
4. Where the teaching and learning of MOP should takes place
5. How oriented on the indigenous or western continuum is the knowledge in the curriculum documents?

Section D: Parting remarks

The remarks show an appreciation of the analyzed data. The document shows the Indigenous knowledge of manufacturing organic products concepts which are being acquired by pupils through schooling which were collected from the curriculum documents

Appendix 8: Curriculum Data

Document	CBC	SYLLABUS	TEXTBOOK
Content	The learning area should allow the learners to identify with their chosen path. For example …..STEM pathway should study additional mathematics, physics, chemistry geography, and biology. Some of the cross-cutting issues are digital literacy, enterprise skills and financial literacy (CBC 2015, page 33) …Issues like sexuality, HIV and AIDS, Heritage studies, disaster risk management, and enterprise skills should be integrated… climate change and environmental issues(CBC 2015 page 37)	Topics –physical chemistry…. Inorganic chemistry……organic chemistry-classification and naming organic compounds, hydrocarbons,… alcohols…environmental chemistry…waste management……herbs (chemistry syllabus page 2)	Contents … planet earth….chemical reactions….acids, bases and salts……organic chemistry…….chemical analysis and investigations (IGCSE 2011, page 1)
Pedagogy	The curriculum framework stresses learner-centered approaches…as learners engage in research and discovery of new knowledge to promote cognitive, social, physical, psychomotor, and effective growth of the learner. (CBC 2015, Page 41) Approaches that characterize the learner-centered method include inquiry-based learning, discovery method, project-based learning, problem-solving, and design learning method. (CBC 2015, Page 43) Features of methods of teaching and learning include research-driven, participatory, integrated, and interdisciplinary teaching,	The principles of teamwork, concreteness, totality, stimulation, and self-activity should guide teachers as they employ models, site visits, research, seminars, discovery, simulations, demonstrations, and experimentation(chemistry syllabus page 2)	The course book deals with experimental skills…….(IGCSE 2011, page 5)

	assessment, performances, projects, and multiple forms of media used for learning page (CBC 2015, page 48)		
Purpose	The mandate of the Ministry of Primary and Secondary Education is to provide wholesome education for all….. participate in the socio-economic transformation of the nation(CBC 2015 page 4) The goal of an appreciation for lifelong learning, visual and performing arts, and civic Education centers for indigenous knowledge. Establishment and consolidation of a firm grounding in Science and Technology disciplines (STEM). Demonstration of communication, problem-solving, technological, management, and leadership skills. (CBC 2015, page 22 -23).	Learners should be able to follow interactions, measure, and express quantities to a given level of accuracy and precision, design practical solutions to real-life problems using chemicals… present, analyze and interpret data to establish relationships (chemistry syllabus 2015, page 2).	This book offers you an opportunity to polish your knowledge in all ZIMSEC syllabus areas and acquire the requisite skills to pass your examinations APA 2023, page 6 IGCSE ….. Aimed at helping you develop the examination skills necessary to achieve your potential examination…….. also deals with experimental skills (IGCSE 2011, page 5)
Assessment	Assessment is concerned with measuring learner performance against the set standards or benchmarks….it is both formative and summative, and it takes various forms namely profiling, portfolio, continuous assessment, and formal examinations. Assessment entails knowledge, skills, abilities, values, traits, demonstrations, and ability competencies in an integrated manner.	The scheme of assessment is grounded in the principle of inclusivity and equalization of opportunities….. the three main objectives are knowledge and understanding, handling information and problem-solving, and experimental skills, investigations, and application (	The IGCSE examination tests three different assessment objectives…..knowledge with understanding, handling information, problem-solving skills, and experimental skills and investigations(IGCSE 2011, page 5)

	Assessment strategies include performance-based assessment, self-assessment, peer assessment, learner-teacher assessment, and learner profile (CBC 2015, page 55)	Chemistry syllabus 2015, page 33)	
Language	The curriculum framework emphasizes useful indigenous language……to master and achieve linguistic competencies for learning and communicative purposes. Foreign languages create opportunities for learners to interact with the closed world…..develop communication skills, critical understanding, and active participation in society and the world at large(CBC 2015, page 34)	The whole document is written in English.	Throughout the chemistry course… it is important to use clear and correct chemical language. Chemistry has a huge number of specialist terms and symbols….use them correctly. (IGSE 2011, textbook, page 8)
Context	The concept of teaching space explains the interaction and synergies that learners create in exchanging information. The learning environment should promote, learner-centered learning, independence and interdependence, motivation, self-esteem, values, needs, and interests of learners and society . The learner-centered classroom environment must encourage self-confidence in learners as well as value 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)		
Philosophy	The country's values and principles are largely traceable to the unhu/Ubuntu/vumunhu philosophy….optimizes universal human interdependence, solidarity, humanness, and a sense of community in African societies. The Zimbabwean beliefs and values underpinning the curriculum include sovereignty, interdependence, mutual support, respect, discipline, and readiness to help others(CBC 2015 page 13)	The chemistry learning area encompasses cross-cutting themes such as inclusivity, teamwork, food security…. Environmental issues, safety, and health issues…. Indigenous knowledge systems and disaster and risk management(Chemistry syllabus 2015, page 1)	

Appendix 9: indigenous knowledge data

Document	Elders	Teachers	Students
Content	Elders possess knowledge of …. Kusurudza hutyora, kuziva makorwa nezvisingaurayi pamichero ne howhwa, kuchera, kusanganisa kuye nekupatsanura mishonga inorapa vanhu uye nemhuka, kugadzira zvikafu zvakafanana nekugadzira mabumbe nemafuta ekubikisa kubva kumapudzi, kushandisa gavakava kurapamudumbu uye nekurapa mhuka, kushandisa makoko emawuyu kuti madzimai abate pamuviri, mufenje pakubatanidza mabhonzo akatyoka(mhuka pamwe nevanhu), kushandisa muroro kurapa kurumwa nenyoka, uye nekudzivirira kut nyoka dzisasvike pamba, ruzivo rwekuziva kuti mvura ichanaya yakawanda sei	The participants possesses the knowledge of making kachasu (ethanol) from masawu,mawuyu, and amarula, making soap from mafeso, lotion from matamba, making baskets from tsanga, making cooking oil from mapudzi seeds, making soda(hutyora) from ash, we know how to make dyes using tree leaves , Remedies that are used to cure diseases such as stomache, snake bites, toothache and other diseases, We also know how to make contraceptives from	Ruzivo rwegavakava nemashandisirwo arinoitwa(kuapa mudumbu nehuku) Kubika kachasu nemasawu, mapfura nemawuyu Kugadzira sipo nemafeso Kugadzira mafuta nemabumbe kubva mumapudzi Kugadzira maponde, nenguwani kubva kumirara nemakavi Kusurudzu hutyora kubva kudotakuchera

	tichishandisa matunduru, kutarisa tsambati dzinotiudza kuti mvura inonaya riini, kubata nekukanda mapfumo, mabakatwa nemiseve, ruzivo rwekugadzira uye kukaka ngoma tichishandisa matehwe emhuka.	mawuyu ,Making coffee from mawuyu and mufandichimuka herb	kugasanganisa mishonga yekurapa vanhu kutsvaga howa
Pedagogy	Ruzivo urwu rwunodzidziswa mumatare, musango tichivhima, kutaurirwa ngano, kurairidzwa nevakuru vedu, mumabira, munhimbe, mukurova makuva, muzvidzidzo zvechivanhu	Indigenous teaching methods include storytelling, hunting and gathering trips, oral tradition, outdoor education, cultural camps and workshops, traditional ceremonies and elder-in-residence programs	Ruzivo urwu rwunodzidziswa mumatare, musango tichivhima, kutaurirwa ngano, kurairidzwa nevakuru vedu, mumabira, munhimbe, mukurova makuva, muzvidzidzo zvechivanhu
purpose	The purpose of learning this knowledge is for… kuchengetedza chivanhu, kusimudzirwa kwenharaunda nevagari vayo, kudyidzana zvakanaka kwedudu vanhu nenharaunda uye kuenderera mberi kwechivanhu uye nehunyanzvi	Preservation of traditional knowledge… protection of traditional lands, community-based- development and environmental stewardship	The purpose of learning this knowledge is for… kuchengetedza chivanhu, kusimudzirwa kwenharaunda nevagari vayo, kudyidzana zvakanaka kwedudu vanhu

			nenharaunda uye kuenderera mberi kwechivanhu uye nehunyanzvi
assessment	Vechikuru vapote vachienda nevana musango vachinoonawo kuti vana varikubatawo here zvavari kudzidziswa…..kubata uye nekukanda mapfumo….. kusurudza hutyora….. kuruka maponde.	Teachers assess learners using tools such as quizzes, multiple choice, experiments, homework and assignments.	Learners are assessed using tools such as quizzes, multiple choice, experiments, homework and assignments.
language	Dai vana vadzidzawo zvidzidzo zvavo nemutauro wedu kuti vanyatsonzwisisa.	Teachers make use of both indigenous and western languages.	Hatinyatsonzwisise nekuda kwemutaura watirikushandisa kuchikoro
context	The suggested places where teaching and learning should take place include musango, munzizi, mumakomo, munzvimbo dzemasvikiro, muzvikoro, munharaunda, mudzimba	The environments in which teaching and learning is expected to take place includes schools, industries, heritage sites, universities,	Manufacture of organic products should be taught in school, online platforms, homes, industries, universities, and nature and heritage sites.

	dzemadzitateguru edu, mumishando uye padande mutande	homes, online platforms and community centers.	
philosophy	The philosophy guiding the manufacture of organic products is based on….. tinochengetedza chivanhu chedu, kusimudzirwa kwenharaunda uye kuenderera mberi kwechivanhu.	The philosophy behind manufacture of organic products is based on community based economic development, environmental stewardship.	Preservation of traditional knowledge….development of traditional skills and practice….community based innovation and entrepreneurship.