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Reconceptualising School Science Teaching in the Context of Indigenous Methods of Food Preservation in Chivi, Zimbabwe

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Abstract
Science teaching in postcolonial Africa has remained Eurocentric in nature in spite of the provisions given by curricula documents. This paper examines how IK might be integrated with school science teaching in Chivi, Zimbabwe. The study adopted an interpretive research paradigm in which a multiple case study design of five (5) community elders and five (5) science teachers. Document analysis and in-depth semi-structured interviews were used to collect data on preservation of small grains, wild vegetables, sweet potatoes and meat. The postcolonial theory was used for the study. Findings were analysed using grounded analysis. Results revealed food preservation practices such as use of granaries, sun drying, smoking, salting and underground pits. Science documents show that IK could be integrated through teaching through cultural identity for epistemological equity, use of local language, use of content from culture, and use of suggested cultural pedagogy. Participants they indicated that cultural values were important when preserving their food. The chapter concludes that teaching should be reconceptualised in the context of cultural values; failure which school science teaching will remain irrelevant to learners in indigenous communities.

Keywords: Reconceptualisation, Indigenous Knowledge, School Science, Postcolonial, Cultural Identity

INTRODUCTION

Observations are that in many post-colonial African schools European education continues to distort and misrepresent African realities, their lives, experiences and thoughts [30]. In Zimbabwe, this situation is reflected in science education where teaching in schools is still embedded in the Eurocentric mode. This chapter aims to examine how school science teaching can be reconceptualised in the context of indigenous methods of food preservation in Chivi, Zimbabwe. The chapter focuses on preservation of foods by community members which are: small grains, meat and sweet potatoes. In this chapter words such as 'western education' and 'Eurocentric education' shall be used interchangeably to mean school education [21]. In addition also, 'indigenous' is used interchangeably with the word 'traditional' to mean the same meaning as unpacked in the background section of this paper.

Background for the Study

Some studies in science education show that IK could be lost if it is not integrated into the school system [for example, 30; 43; 14]. For example, African education has embraced European 'official language' and practice, at the expense of IK [43]. This absence of IK in the education system would be leading to a situation where African children found themselves living in the Western and African worlds [21]. One pertinent question to be posed here might be: how might this IK be taught at schools in the context of hegemonic Eurocentric epistemologies in indigenous communities in Chivi, Zimbabwe?

Since indigenousness carries with it a sense of belonging to a place [21]; the study area was Chivirural locality; where communities resident there recognize the importance of the physical world for their survival. The word 'indigenous' refers to something natural or innate [30]. The idea of locality has connection with culture [44],thus these indigenous people have a sense of identity of the landscape with regards to their way of doing things. This proposition had an implication on the methodology adopted for this study.

Notwithstanding the above, it must be noted that these indigenous people are still traditional. They eke out a living through subsistence farming. They grow crops such as: maize, rapoko, sorghum, millet, traditional rice, pumpkins, watermelons, sunflower and sweet potatoes. The communities have large tracts of land they use for pasturing. Most of their herd of cattle are hard '*mashona'* type, which withstand dry ecological conditions in the area. They also hunt wild animals and gather wild fruits for their sustenance. This location belongs to the Shona people with communities built around patterns of kinship relationships, dividing themselves along clan names (*mitupo*), sub-clan names (*zvidao*) [5].The area falls under ecological region 5 and has a dry ecology [ibid]. Due to this dry ecology indigenous people in the area make use of IK to sustain their day-to-day lives; for example, food preservation to ensure food security at household levels.

Rationale for the Study

Reconceptualization of school science teaching in the context of IK is essential for addressing the imbalances created by colonial education [43]. As a result teaching of science can be more fruitful for teachers, provided it starts from their cultural and cognitive experiences that connect the real world to its abstract formalism, and where IK is included in the curriculum [22]. This inclusion of IK in learning enables children and the communities they represent to feel authentic, respected and connected [21]. This study seeks to provide science teachers with the opportunities conceptualise, design and implement school science teaching in the context of IK.

Contribution to Knowledge for the Study

The study might contribute to the scholarly debate by science educators on how IK might be integrated with school science teaching. The study may reveal how postcolonial school knowledge orientation and content continues to mirror colonial legacy; and possibly offers suggestions on how to Africanize or indigenize school curriculum in Zimbabwe [43]. An understanding of the IK methods of food preservation may provide new insights to educators that pedagogy should be approached from diverse cultural perspectives. However, some studies show that school science content and methodology is Eurocentric, with teachers shunning IK in their classroom teaching [for example, 23; 31; 40]. Hence, other researchers may find the study worthwhile on how school science can integrate both IK and Western knowledge content and methodology teachers might use in classroom teaching. Hence, the study may serves to provide ways to science educators to reclaim African indigenous voices in the school curriculum.

Statement of the Problem

Studies in science education show that IK can be integrated with school science teaching. Although it has been emphasised that indigenous knowledge (IK), which forms the basis of the indigenous community's means of survival, should be integrated into school system, current observations show that teaching is still Eurocentric [31]. Policymakers and teachers in Zimbabwe do not give equal respect to western and indigenous forms of knowledge, giving superior and inferior derivative when distinguishing them [43]. Moreso, science content taught in schools lacks indigenous content and methodology [14; 40]. It is against this backdrop that this study sought to examine how school science teaching might be reconceptualised in the context of IK methods of food preservation practised in the indigenous communities.

Research Aim and Objectives

The aim of this research was to analyse the reconceptualization of teaching through integration of IK methods of food preservation with school science in Zimbabwe.

To achieve the above research aim, the objectives of the study were to:

- Identify forms of IK which teachers might use to teach the topic food preservation in school science, in Chivi, Zimbabwe.
- Assess how science curriculum documents provide as guidance for the integration of IK for school science teaching in Zimbabwe.
- Examine spaces for the integration of IK methods of food preservation with school science teaching in Zimbabwe

LITERATURE REVIEW

Postcolonial Theoretical Framework

Teachers and elders in the study were from a rural community which still practised its Shona cultural way of life. So, integration of their IK methods of food preservation with school science was examined using the postcolonial theory of knowledge construction. The colonial education system in Zimbabwe was tailored to serve the interest of the colonial power through provision of cheap labour in the industry. This colonial education or 'colonialism' is any form of human exploitation, normalization, repression, and domination; where the practice assumes the superiority of Western science against the 'ignorance' of local sciences [47].Postcolonial theory challenges the formerly colonised to reclaim their culture and return to their cultural knowledge [23]. The term 'post-colonial' has different connotations to many people as a practice, era [40] and an intellectual direction in education [5]. In pursuit of this direction, postcolonial theory emphasises the power of IK as the conduit for competitive advantage [40]. The theory explains how the colonised people resisted the supremacy of Eurocentric education after attaining their independence [46]. Thus the theory challenges students and teachers to return to their cultural values, norms, beliefs and expectations in schools.

Reconceptualising teaching in the context of postcolonial perspective sentails teachers facilitating learning that challenges school knowledge that is designed within Western approaches; and requires learners to construct their 'own' knowledge by drawing from the cultural experiences. Such perspectives in science education would reveal Western and non-Western borders to be harmonised; and allow science educators to re-claim pedagogical or other spaces without being bounded in normative models (creating particular ruler of behaviour) [5].Such approaches in science education are in line with 'cross-cultural perspective' [18], and 'third space' or 'cultural mixes [24]; as points of departure

for developing understanding of concepts. So, selection of science concepts in postcolonial classrooms should be based on,'re-examining issues of cultural diversity, identity, globalisation and inclusivity' [47, pp. 79]. Put simply, such selection implies rejection of the hegemony of conventional science and acknowledges other ways of knowing and being in the world to define school science teaching in curricula.

Reconceptualization Defined

If you understand something fully, you conceptualise it [3]. The process-object model can be useful to conceive the concept in two fundamentally different ways, namely; as a process and as an object [42]. Reconceptualization can be regarded as an act of developing a new concept for something [37, 45]. Overall, it can be deduced that in reconceptualisation, the word 'concept' is equated to an 'idea'; and the rationale for the act is that current conceptualisations or ideas do not capture the essence of a phenomenon [12]. Hence, reconceptualization can be regarded as an act of expressing an idea about something in a new way. Seen thus in this context; to reconceptualize science teaching in the context of IK implies practicing the process in a way that takes into consideration the integration of this form of knowledge into education.

Defining Indigenous Knowledge

The concept IK has varied meanings in literature. Some regard IK to mean the same as indigenous knowledge systems (IKS) (for example, 35; while others inclusive of 29, 22 and 31, regard them separately. In this study, IKS is viewed as different from IK; which is a less comprehensive form of knowledge than the former [30].

More specifically, IK is the, 'localized knowledge passed down through generations and historically been considered to have originated from a particular place' [22, pp. 20). In this chapter, IKis defined as the skills and technologies that result from the indigenous peoples' practical interaction for sustenance within a particular place or environment.

Nature of Ik and Western Science

Several characteristics of IK and Western or school science have been identified in literature [for example,34; 43, 36]. Key among these include: place-based knowledge [36], anthropomorphic worldview, holistic, IK-spiritual connectedness [35]; and value-laden, oral, not documented [43]. These characteristics contrast Western science which is taught as true, reliable dependable and value-free knowledge [43]. As result, the choice of my study's research methods were influenced, necessitating use of open-ended interviews, and documentary analysis, to collect data from a people's culture.

2.5 Culture Defined

The term culture is complex, hence has varied meanings in literature. For example, the term can be defined as values and norms of a group of people, which represent their way of life [10]. So, culture can be regarded as a way of life. In the context of education, since science is selected culture [20], school science is a cultural way of knowing. For this reason, it might be valuable if IK methods of food preservation are integrated with school science teaching.

Pathways of integrating IK with school science teaching

Three main pathways have been suggested by different authors for the inclusion of IK in the school curriculum: the incorporationist approach which seeks how best IK fits into science; a separatist approach, which holds IK side-by-side with scientific knowledge; and an integrationist approach that links and makes connections between IK and science [40]. For instance, [32] and [33] suggest integration of IK with school science using argumentation teaching strategy. Some suggest incorporation of relevant aspects of IK into school science teaching [17].

Challenges of Integrating IK with Science Teaching

Philosophical differences between knowledge systems and different worldviews are main challenges that may militate against integrating IK into school science curriculum [32]. These differences arise since science is embedded in a mechanistic and reductionist worldview, while IK is located in an anthropomorphic, pluralist and holistic worldview [31]. By implication, therefore, such variations might impede knowledge system integration.

Principles of Food Preservation

Extant literature shows that there are different methods used for food preservation but all are based on the general principle of preventing or retarding the causes of spoilage [for example, 39; 41].These studies show that drying, use of high or low temperatures, use of chemicals, and fermentation process as the main principles in food preservation in relation to my study.

METHODOLOGY

The research was conducted as interpretive case study approach to data collection because the main goal was to understand how participants make sense of reality [9]. Since interpretivist studies focus on in-depth understanding of the phenomenon [11], the study investigated people's cultural methods of food preservation, and how such methods might be integrated with school science teaching.

Five community elders and four science teachers selected from two villages and two secondary schools respectively were used. By community, I mean a 'group of persons linked by interpersonal bonds-which are not necessarily biological-who share common values, interests, and goals' [13, pp. 25]. In this context, therefore, members comprising the community in my study, while they need individual development; they value most the success of the wider society.

Purposive sampling was used to select participants for the study. By using purposive sampling the researcher focuses on those few whom I thought had necessary information for the study [11]. Teachers were used in the study as they, 'play a critical role in preparing learners to lead successful and productive lives' [28, pp. iii].

Research Design and Methods

A multiple case study design focusing on several cases of the participants' indigenous methods of preserving small grains, meat, and wild vegetables was used. Science curriculum documents inclusive of teachers' documents and science policy were analysed. The process involved checking for the ideas or concepts contained in these documents related to IK integration with teaching**.** This implies content analysis of documents [11].

Each participant was individually interviewed at their places of residence. Interview questions sought to find out first their IK methods of food preservation and then how this knowledge might be integrated with school science teaching. All interviews were recorded with permission of the participants. In analysis, grounded theory approach was used, capturing participants' responses verbatim and categories of analysis, in line with requirements for a qualitative research study [38].

RESULTS AND DISCUSSIONS

Main categories on food preservation emerged from the study include: cultural identity for epistemological equity, provision of guidance of content to be taught, identification of pedagogy for use, and requirement of the use of local languages. This led to unveiling of their responses implications to school science teaching.

Community elders and teachers in Chivi had a unique way of preserving their small grain crops which they suggest if used in schools would result in epistemological equity in teaching and learning. They mainly grow and preserve grain crops which are millet, rapoko, and sorghum.

"We store our grain crops in '*hwikwiyo'* (granary with plastered roof and then thatched on top), to ensure that no organism or even air enters into it. We cover these grains with '*hwindi yerukweza'* (chaff of thrashed millet) so that grains are protected from moisture and air. When millet is stored in a granary, '*rutandira'* (a web-like structure) develops which covers the grains for a long time'.

The above excerpt show that elders have cultural institutions like granaries and storage huts to preserve their grain crops; which reflects their cultural identity. Teachers indicated that the elders' practices demonstrate the importance of acknowledging the role of air and moisture to food decay [39]. For teachers, the science involved in storage of grains in granaries can be used when they use the 'environment as a laboratory' to teach the topic 'food preservation'.

Related to the issue of preserving by excluding air from food, community elders also dried their '*mbambaira*' (sweet potatoes). For them, '*mbambaira*' were/ are preserved in a '*pfimbi*' (a hole dug underground). All community elders maintain that only '*majeza*' (immature) and scratched sweet potatoes are suitable for underground storage. They argued that both immature and scratched plants will quickly decay if buried underground. Teachers further noted that such forms of knowledge drawn from people's culture can be useful in the teaching of science in schools.

These findings are sync with the curricula guidance given by some science documents. For example, the Zimbabwe's Ministry of Primary and Secondary review' aims on section 2.1 states that, 'the curriculum lacked values that should mould the learners into useful citizens of Zimbabwe' [26, pp. 1). Furthermore, the review targets among other issues, 'integration of new, emerging and cross-cutting issues' [26, pp. 5). Focusing of cultural values and ways of understanding shifts IK-science integration away from content to ways of teaching and learning [18]. Such a shift has a potential of avoiding any disregard of the indigenous learners' value system that school science worldwide has failed to prioritise [16]. Rather, school science content should be drawn from students' cultural experiences.

Apart from the above, the Nziramasanga report seeks to prepare learners for life and work including self-employment [8]. Since, for an indigenous learner skills to be gained also include those that are relevant to cultural practices [33], it implies that IK of food preservation might be suitable for schooling as well.

Identification of pedagogy for use

Identification of pedagogy for use surfaced-out from the interviews with community members. Both elders and teachers concurred that their IK methods of food preservation could be used in teachers' pedagogy at

school. For example in the context of using wood dust to preserve their grains, one elder commented:

> 'We sprinkle *'dota'* (wood dust) obtained from plants such as '*mutsviri'* (*combretum imberbe*) and '*musumha'(Diospyros mespiliformis*) which repel insects from stored grains'.

In this above excerpt, reference to the use of *'dota'* (wood dust) shows that community elder was cognisant of the fact that big organisms responsible for food decay can be repelled by use of chemicals. The Combined science syllabus content coverage stipulates methods of food preservation (refrigeration, dehydration, canning, pickling, salting, sugaring and smoking) [47, pp. 7). Some of these methods namely, salting, sugaring and smoking are not just western but are also used by the indigenous people as well.

Some teachers commented that community elders' food preservation practices were scientific. For example, one teacher commented:

> 'Wood dust is effective in preserving grains. The chemical comes from wood, no matter what type of wood that is. The disadvantage of this method is that food can lose its taste'.

The above excerpt by the teacher is in line with the guidance given in some science documents. For example, the O'Level Combined science syllabus requires that science pedagogy in schools should be drawn from the communities. Among other aspects, this syllabus aims to, "recognize that the study and practice of science are inter-related and are subject to economic, technological, social, political, ethical and cultural influences" [47, p.2). The desire to integrate IK into school science is also captured in section 5.1.4 of this syllabus, on the teaching aspect of the topic 'food preservation' requiring, "investigation of methods used in local communities and discussion of their advantages and disadvantages" [47, p.31). Although IK is not mentioned specifically in this teaching approach suggested, what emerges from this syllabus is that pedagogy should be based on school-community knowledge inter-relationships [18]. A pedagogy that focuses on the development of curricula that acknowledges the priorities of indigenous peoples [16].

The Combined science (code 5006) is a compulsory subject offered to all Government secondary schools in Zimbabwe [47, pp. 1). Furthermore, this syllabus is a two-year course of study consisting of five content sections: science in agriculture, science in industry, science in energy uses, science in structures and mechanical systems, and science in the community.

Table 1: Content for Combined science syllabus

Section	Integrated science syllabus (5006) Zimbabwe
1	Science in Agriculture
2	Science in Industry
3	Science in Energy Uses
4	Science in Structures and Mechanical Systems
5	Science in the Community

[Source: 47, pp. 7].

Table 1 above shows five sections of the integrated science syllabus used by secondary schools in Zimbabwe. The focus of this study was under 'science in the community' on the food preservation strand of the syllabus. An examination of the content and activities under the 'science in the community' section indicates that teachers can investigate methods from the local community to assist learning. For the purposes of this study, extract of section 5.14 'Science in the community' strands is shown in Table 2 below.

Table 2: Food preservation section

Topic	Learning Objectives	Content	Notes and Activities
Food Preservation	Investigate the optimum conditions for the growth of micro-organisms	Temperature, moisture, air	Experiments on growth of bacteria in sour milk and growth of mould on bread only
	Describe methods of food preservation	Refrigeration, dehydration, canning, pickling, salting, sugaring and smoking	Suitability of each method to foods
	Explain how each method limits growth of micro-organisms		Methods used in local communities and discussion of their advantages and disadvantages

[Source: 47, pp. 31].

This part of the syllabus also articulates that learners are required to master two broad areas: first, optimum conditions necessary for the growth of micro-organisms; second, methods of food preservation. The emphasis of this syllabus' methodology is placed on providing pupils with practical experience; through problem–solving and group work approaches [47, pp. 6). However, this syllabus is not explicit on which methods are useful specifically for use by teachers in schools. Similar observations were also found in some textbooks used by teachers in two schools.

Identification of Content to be Taught

Community elders suggested important content to be taught in school science as they explained use of salting and smoking to preserve their meat. For example, one elder commented:

> 'We add salt to our fresh meat and dry it on fire. On fire smoke is also very important in preserving our meat. You hang meat on top of the flame and smoke will cover it to keep it fresh for a long time when it dries'.

One teacher concurred with the elders' method of preserving and further elaborated:

> 'Foreign business people who own in this country who sell game meat, they do not forget to sell dry meat or biltong "*chimukuyu"* because they know traditional foods are very good'.

The above two excerpts show that meat is mainly preserved by smoking, salting and dried. These practices are in line with what some science documents require for the teaching of the topic, food preservation. For example, the Combined syllabus and teachers' schemes of work do provide content coverage that includes: conditions for the growth of micro-organisms (temperature, moisture, and air), and method of food preservation (refrigeration, dehydration, canning, pickling, salting, sugaring and smoking). Some of these methods namely, salting, sugaring and smoking are not just western but are also used by the indigenous people as well. Evidence shown from these documents has support in literature as well, for example, it has been observed that indigenous people in Zimbabwe had their own 'cold room technology' [7]. What all this position suggests is that there might be useful IK from the communities that can benefit school science. Hence, IK content could be integrated into school science teaching and learning via community interactions.

So, what seems to be brought out open is the issue of knowledge integration in school science through culturally responsive teaching [19]. The function that is alluded to here is that learners will be prompted to discuss the application or evaluation their IK of food preservation in light of its relevance to their social lives. Such links were found to be absent from teachers' schemes of work in two schools.

Importance of Cultural Values

Elders and teachers indicated the importance of cultural values in teaching. For example, in explaining use of fresh plant leaves to protect their grain crops, one of them said:

> 'We use small branches of smelling plant line *'zumbani'* (*lippia javanica*) so that no boring insects attack our grains'.

This assertion by the above elder was supported by one science teacher who lamented that:

> 'You can use plant leaves, but you keep on replacing since they dry up easily'.

Another teacher indicated that such knowledge can be taught in schools. The above excerpts by elders and teachers are in line with some guidelines in some documents. For example, the Draft Constitution of Zimbabwe's founding provisions formulated by the in January 2013 are anchored on 'values and principles are based on 'the nation's diverse cultural, religious and traditional values' [10, pp. 2]. To put it another way, documents are placing emphasis on the recognition and response to the influences and strengths of learners' culture in science education. This is in keeping with the view that connecting learners' cultural background to science education has crucial importance as it makes science relevant to learners [24]. This recognition of the knowledge that learners possess is crucially important in the learning of new concepts as suggested by the postcolonial theoretical framework guiding this study.

Use of Local Language

Teachers suggest that use of local language might help learners to understand concepts taught in science. This was indicated in response to elders' methods of food preservation of their wild vegetables. One elder commented that:

> 'We harvest fresh wild vegetable leaves or fresh branches, boil them. For example, *'rudhe'* we harvest it, cut into small pieces and boil mixed with tomatoes, then sun dry to avoid it being stale or become mouldy *'kuvhunda'*.

What is coming out of the above excerpt is that community elders have their own way of describing the detrimental effects of large organisms on food using specific cultural terms, for example, food stale or mouldy, that is, *'kuvhunda'* or *'kuvhuvha'*.Teachers agreed with these practices by elders arguing that they were scientific; and should be included in formal education when teaching practical aspects of science. Teachers also suggest that these cultural terms should also be used for learner assessments including public examinations.

Some documents are explicit on the use of local languages in school science. For example, the Zimbabwe's Ministry of Primary and Secondary Education curriculum framework 2015-2020 suggests that from Forms 1 to 4, teaching and learning should be done in indigenous languages and English language. Echoing similar sentiments, use of local language for indigenous peoples supports life-long learning; and is important for strengthening identity [16]. All documents are written in English without any reference to the local languages. Such a view contradicts the assertion that use of local language for local people allows for articulating knowledge for integrating various dimensions coherently [15]. This

probably explains why the Nziramasanga report recommends that there should be a language policy-Ndebele/Shona as national languages in Zimbabwe [8, pp. 3].

CONCLUSIONS

This study sought to analyse the reconceptualization of teaching through integration of IK methods of food preservation with school science in Zimbabwe. The study had limitations of generalising results to all communities; however findings could be applicable to other communities with similar contexts. Results show that science teaching can be reconceptualised in terms of indigenous methodologies found to be abundant in the indigenous community. There is rich IK in this indigenous community which school science teaching could benefit. It can be reiterated that reconceptualisation of school science as a cultural way of knowing provides a significant insight into how science teaching could be done from a cultural perspective. Such a reconceptualisation would have implications for indigenous communities with abundant IK cultural values relevant for school science teaching in Zimbabwe. As a consequence, such IK values would help in inculcating a sense of identity in the learners' content knowledge, and thus avoiding loss of cultural heritage, indigenous language and content which are relevant to the learners' lives. It can be concluded that school science teaching should be reconceptualised in the context of cultural values existing in indigenous communities. If these cultural values are not integrated with school science teaching, education will remain irrelevant to learners in indigenous communities.

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CONFLICT OF INTEREST

1, declare that the author has no conflict of interest with this manuscript.

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