



Teaching **Indigenous Knowledge and Technology**

Natural Sciences and Technology
Grades 4–6

Soul Shava & Rob O'Donoghue

This is a teacher education text. Its purpose is to expand educators' knowledge of environmental topics to support the teaching thereof in the curriculum. Teachers and teacher educators should consult CAPS documents and textbooks for specific curriculum content, as these units are not a textbook, but rather a resource for teacher education.

VERSION 1 – February 2014

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Tel. 033-330 3931
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Copy-editing: Kim Ward
Illustrations: Basil Mills
Cover design: Francis Lotz
Layout: Dudu Coelho

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Orientation

Introduction

What is indigenous knowledge?

The knowledges of indigenous people have been variably termed Indigenous Knowledge, Indigenous Knowledge Systems (IKS), Endogenous Knowledge, Traditional Knowledge, Traditional Ecological Knowledge (TEK) and Traditional Environmental Knowledge. These terms are related analogues that all attempt to define and give meaning to the knowledge of indigenous peoples from different parts of the world. However, Indigenous Knowledge is a widely used term throughout the world.

Indigenous knowledge can best be described in terms of the following: people, place/context, language, knowledge, culture, practices and dynamism (see Shava, 2013). Indigenous **people** (the knowers) create **knowledge** from their experiences during interactions with the lived environment and among themselves. This knowledge is derived from and related to the **local context** in which the indigenous people live. This knowledge is embedded in their **culture** and embodied in their **practices**. It is passed on from generation to generation orally (through stories, narratives, poetry and songs), visually (through the arts, such as 'bushmen' paintings or rock art, craftware, traditional rituals and dance) and practically (through such activities as crop farming, keeping livestock, hunting, traditional healing, making crafts and artefacts). Indigenous **language** is the main medium for representing and transmitting indigenous knowledge. Indigenous knowledge is created over time in relation to changes in the local environment that bring about changes in the needs of local communities as they adapt to the local context. In this regard indigenous knowledge is **dynamic**.

Most indigenous children are born into this wealth of indigenous knowledge in their local context which they acquire in their day to day life experiences. As they grow up, they learn about local plant and animal names and uses, the land, crops and livestock, the seasons, the stars, local cultures, the community, family ties and kinship, as well as responsibilities. Such knowledge is useful for survival and livelihood sustenance.

Why is indigenous knowledge important?

Our school curricula have, to a large extent, been highly westernised, with little opportunity for including indigenous knowledges. Indigenous knowledges have been excluded, marginalised, misrepresented, invalidated and labelled as inferior. Education institutions (such as schools) in particular have been zones of exclusion of such knowledges. This has created a situation where what the learners learn at school is different from their lived experiences at home. It has also excluded the role of parents and elderly people in the education of their children about their culture, values and livelihoods.

How do these units support teaching and learning about indigenous knowledge?

In an attempt to reframe and contextualise formal education processes, indigenous knowledge aspects have now been included into the curriculum, as is evident in the Curriculum Assessment Policy Statement (CAPS) for the Intermediate Phase Natural Sciences and Technology, Grades 4-6. These units intend to bring out these Indigenous Knowledge (IK) aspects and also indicate possibilities for including indigenous knowledges into teaching and learning processes.

Indigenous Knowledge in the CAPS

The intermediate phase Indigenous Knowledge units

These units work with the Life and Living as well as the Matter and Materials strands of the CAPS Intermediate Phase Natural Sciences and Technology for Grades 4-6. The content knowledge on indigenous knowledge can be found in Grade 4 (Terms 1 and 3), Grade 5 (Terms 2 and 3) and Grade 6 (Term 1).

The units cover several indigenous knowledge topics (Habitats of Plants and Animals, Indigenous Structures, Energy for Life, Movement and Musical Instruments, Traditional Processing, Use of Metals, and Food Groups) that have been developed to expand teachers' knowledge and expertise in ways that also support teaching Indigenous Knowledge in the CAPS Intermediate Phase Natural Sciences, Grades 4-6 (see Table 1).

The sections do not necessarily follow the sequence of the CAPS; instead the progression is from exploring **ecosystems**, to **structures**, to **energy**, to **systems and control** (movement and music are an example), to **processing**. This is intended to build an understanding of indigenous knowledge and how indigenous knowledge of environmental resources is used for livelihood sustenance.

The three units are:

1. Ecosystems and Structures (including indigenous knowledge of habitats of plants and animals; indigenous housing structures);
2. Energy and Systems and Control (including traditional energy sources; traditional musical instruments);
3. Processing (including traditional processing of raw materials; metal processing; food processing).

In these three units, we support you as a teacher and facilitator or interested reader to:

- Strengthen your subject content knowledge;
- Enhance your teaching practice; and
- Support your assessment practice.

Teaching practice and assessment aspects are integrated into each unit, with a reflective summary provided in the Teaching Practice and Assessment activities at the end of the three units.

Indigenous knowledge in the CAPS

The intention of these units is to draw attention to indigenous knowledge aspects embedded in the CAPS Intermediate Phase Natural Sciences and Technology for Grades 4-6. The three units cannot provide all the information or perspectives on indigenous knowledge, so teachers need to consult other indigenous knowledge resources. It is also important to review carefully what indigenous knowledge aspects are presented in textbooks and other information sources.

The same is true for the methods and assessment practices suggested here. A more extensive learning resource *Methods and Processes to support Change-Oriented Learning* is provided as part of the Fundisa for Change materials.

The table below outlines the three units, the topics covered in each and the links to the CAPS.

Table 1: Outline of Indigenous Knowledge units

UNIT	THEME	TOPIC	CONTENT	CAPS NATURAL SCIENCES & TECHNOLOGY (INTERMEDIATE)	GRADE	TERM
1	Ecosystems	Habitats of animals	Indigenous people's knowledge of plant and animal habitats	p.18 – Different habitats ◆ a habitat is the place where a plant or animal lives ◆ there are different kinds of habitats such as grassland, forest, river, sea	4	1
	Structures	Indigenous structures	Indigenous housing structures	p.22 – Indigenous structures ◆ indigenous, traditional homes such as a Zulu hut (<i>uguqa</i>), Xhosa (<i>rntabile</i> and <i>ungqu-phantsi</i>) and Nama (<i>matjieshuis</i>) make use of a framework of struts (such as branches)	4	2
2	Energy	Energy for life	Traditional energy sources and their uses	p.23 – Energy for life ◆ we use energy for everything we do ◆ we get our energy from food ◆ energy in our food comes from the Sun (plants use the energy from the Sun to make food for themselves and for animals and people) p.39 – ◆ everyday fuels that we use include coal, wood, petrol, paraffin, gas and candle wax	4 5	3 3
	Systems and Control	Movement and musical instruments	Traditional musical instruments	p.24 – Movement and musical instruments ◆ many musical instruments (systems) use movement input energy (such as blowing, beating and plucking) to make them work ◆ many instruments have parts that can move or vibrate ◆ musical instruments produce sound as the main output energy	4	3

UNIT	THEME	TOPIC	CONTENT	CAPS NATURAL SCIENCES & TECHNOLOGY (INTERMEDIATE)	GRADE	TERM
3	Processing	Traditional processing	Traditional processing of materials	p.38 – Traditional processing ◆ in Africa people have processed materials for hundreds of years to make ◆ clay pots and bricks ◆ baskets, hats, mats, thatched roofs made from plant fibre such as grasses and reeds	5	2
		Uses of metals	Traditional uses of metals	p.36 – Uses of metals ◆ metals are used to make things such as coins, wire, jewellery, furniture, buildings and bridges, motor cars, kitchen utensils, roofs	5	2
	Food processing	Food groups	Traditional foods and food processing	p.48 – Food groups ◆ most natural foods contain a mixture of more than one nutrient group ◆ most processed (manufactured) foods have added salt, sugar, preservatives, flavourings and colourings p.49 – Balanced diet ◆ a balanced diet contains sufficient quantities of food from all four nutrient groups, as well as water and fibre ◆ some diseases can be related to diet p.49 – Methods for processing food ◆ there are many different methods (ways) to process food ◆ researching how to process food (raw material) by combining, cooking, freezing, pickling, fermenting, drying and salting to make a product, including indigenous ways of processing of food in different communities	6	1

Ecosystems and structures

The theme of the first unit is ecosystems and structures. Indigenous communities have in-depth knowledge of animal and plants which they use as a source of food and raw materials. They also have knowledge of interrelationships within the environment. They can thus be considered as experts in ecosystems. The second part of this unit looks at indigenous dwellings. These are constructed using locally available and often biodegradable materials from the natural environment.

This unit therefore covers two main topics:

1. Indigenous knowledge of habitats of plants and animals; and
2. Indigenous housing structures.

This is summarised in the table below.

THEME	TOPIC	CONTENT	CAPS NATURAL SCIENCES & TECHNOLOGY (INTERMEDIATE)	GRADE	TERM
Ecosystems	Habitats of animals	Indigenous people's knowledge of plant and animal habitats	p.18 – Different habitats ◆ a habitat is the place where a plant or animal lives ◆ there are different kinds of habitats such as grassland, forest, river, sea	4	1
Structures	Indigenous structures	Indigenous housing structures	p.22 – Indigenous structures ◆ indigenous, traditional homes such as a Zulu hut (<i>uguqa</i>), Xhosa (<i>rontabile</i> and <i>ungqu-phantsi</i>) and Nama (<i>matjieshuis</i>) make use of a framework of struts (such as branches)	4	2

Subject Content Knowledge

Indigenous knowledge of habitats of plants and animals

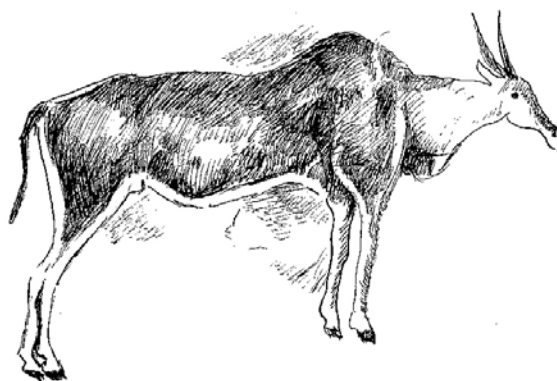
Key ideas:

Indigenous communities have in-depth knowledge of the habitats of animals and plants in their lived environments, which they use as a source of food and raw materials. They also have expert knowledge of interrelationships within the environment as well as seasonal variability in ecosystems.

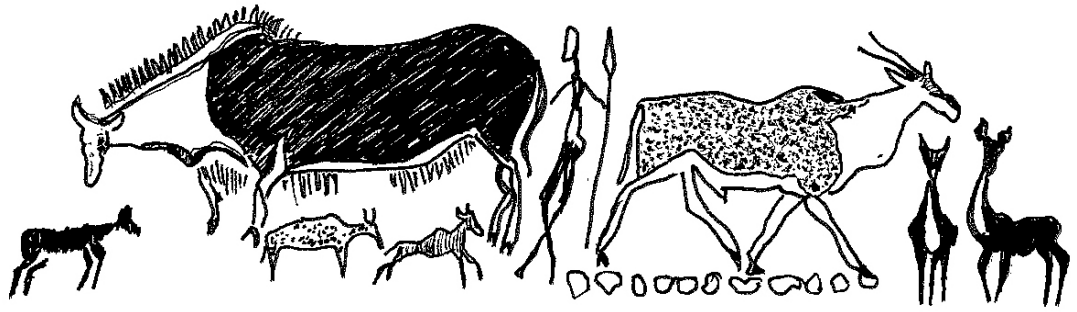
Indigenous local communities have an intimate relationship with the land (lived environment). This is particularly so in rural communities, where the environment provides resources for their basic day-to-day livelihood sustenance. This includes relying on the natural environment as a source of food (wild meat, fruits and vegetables), building materials, craft materials (for example making utensils used in the home) and medicinal herbs. In order to use these resources, indigenous people have to be able to identify them accurately and know their seasonal availability.

Indigenous communities that still derive their livelihood directly from the natural environment include the Khoi (Khoes) and the San people of Southern Africa (Abathwa who used to live throughout the whole of southern Africa but are now found mainly in the Northern Cape of South Africa, Botswana and Namibia). They are depicted as hunter-gatherers and have in the past been derogatorily called the 'bushmen' by European settlers (a term that many San in the Eastern Cape have preferably adopted today as their homeland habitat was the valley thicket that the Xhosa cattle people seldom ventured into). Their knowledge of animals and their habitats enables them to successfully pursue, hunt and bring down game, for example, antelopes (such as impala, kudu, eland, wildebeest, giraffe, as well as buffalo in the open savanna, the nyala, waterbuck and wild pig near wetlands, rivers and streams) using the bow and arrow and traditional poisons made from locally available poisonous plants (such as the bushman's arrow poison *Acokanthera oppositifolia*).

The Khoi and San also track the honey guide bird and use it to locate beehives and harvest honey. The Khoi and San are among some of the best animal trackers in the world, employing their knowledge of the terrain, wind direction, plant camouflage and animal droppings to find and follow the animals they are hunting. They are able to tell the direction and distance of different animals from their footprints and the freshness of their droppings, a process that is now referred to as **scat analysis** by scientists studying animal distribution, feeding and habits through their dung. For this reason they have been used in the past by colonial settlers to gain knowledge of the African environment enabling them to adapt to it and trek inland beyond the Cape. They have also been employed for animal tracking in game reserves. Some of the Khoi and San knowledge and relationships with animals and plants are recorded in their rock paintings or rock art.



Rock painting of an eland



Khoi and San rock paintings of animals



Tsamma melon (*Citrulus lanatus*)



Baobab (*Adansonia digitata*)

without food, the Khoi and San relied on eating the succulent (fleshy) stems of *ghaap* or *!!hoba* (*Hoodia currorii*) to suppress hunger. This plant has now been commercialised as a herb for dieting purposes as it suppress appetite and allows people to endure long periods without food, thereby enabling them to lose weight.

Knowledge of medicinal plants is common amongst indigenous communities. This includes the use of *umhlonyane* (Zulu, Xhosa) or wormwood (*Artemisia afra*) for cods and fever; the use of *ilebatheka* (Xhosa), *inkomfe* (Zulu) or the African potato (*Hypoxis hemerocallidea*) for wasting diseases; and the use of *ikhalo* (Zulu, Xhosa) or bitter aloe (*Aloe ferox*) for wounds, skin problems and stomach problems.

The Khoi and San also have accurate and in-depth knowledge of plants; they are able to identify edible fruits, roots and tubers. They can even dig up roots that most people would not be able to see in the desert in the dry season and use these as sources of water or as food. The Khoi and San harvest and eat wild fruits such as the *!nara* (*Acanthosicyos horridus*), the tsamma melon (*Citrulus lanatus*), the baobab (*Adansonia digitata*), the monkey apple (*Strychnos spinosa*) and the favoured mongongo nut (*Schnziophtyon rautanenii*). They also harvest root tubers such as the kambro (*Fockea angustifolia*), bi (*Raphionacm burkei*), and wild beans such as the marama bean (*Tylosema esculenta*). The knowledge of plants by indigenous people and their uses is referred to as **ethnobotany**.

Most indigenous communities harvest and eat indigenous vegetables (*imifino* in Xhosa/Zulu, *morogo* or *marogo* in Sotho). These include *imbuya* (Zulu) or *morogo* (Sotho) (*Amaranthus hybridus*), *ulude* (Zulu) or *lerotho* (*Cleome gynandra*). Where they have been forced to trek for long periods

Teacher Activity:

What indigenous knowledge of animals and plants do you know and can you get from the local communities around you? List the plants and animals using their local names, define their habitats and state their local uses. Design a comprehension activity for your class from the above text.

ACTIVITY 1 (Grade 4 Term 1)

COMMUNITY INDIGENOUS PLANT AND ANIMAL KNOWLEDGE SURVEY

Learning focus:

Communicating, raising questions, recording, interpreting information, sorting and classifying, developing writing skills

Resources:

Pen and paper, voice recorder (where available, e.g. voice recorder on a phone), elderly members of the community

Arrange to interview elderly community members on their knowledge of local plants and animals, their habits (where they are found) and their uses in your area. Make a table listing the local names of plants and another table listing the local names of animals, their habitats and their uses.

Indigenous housing structures

Key ideas:

Indigenous dwellings are constructed using locally available materials from the natural environment. These materials are biodegradable, making such dwellings environmentally friendly and non-permanent.

Indigenous communities in South Africa have used resources from the natural environment to building their dwellings. The materials used are locally available and have the advantage that they are biodegradable, returning into the soil as nutrients, thereby leaving behind a small ecological footprint (the measure of human demand on the Earth's ecosystems).

Zulu homelands are located in the province of KwaZulu-Natal. *Uguga* or *iQukwane* is the traditional beehive design Zulu hut. Men and women share the construction of a hut.



Men collect wooden saplings (such as *Acacia* species) and construct the frame by arranging them into a dome shaped framework leaving a low gap for the entrance (the purpose of the low gap was to force anyone entering the hut to stoop as a form of defence against intruders). A central wooden pole acts as the support. The women collect the grass thatch



Traditional beehive design Zulu huts

(from thatch grass *Hypertheca filipendula* and *Hypertheca hirta*) and arrange and bind it onto the frame using split reeds or tree bark. The women also make the floor from a mixture of termite mound soil and cow dung mixed into a thick semi-solid consistency and spread over the floor and allowed to set into a rock hard surface. The mixture is then smoothed and polished to a mirror-like finish using a polishing stone. The cow dung and clay mixture is also used to form a raised hearth (*iziko*) for cooking.

The materials used to construct the hut make it warm in winter and cool during summer. The smoke from the cooking fire escapes through the door and thatch. As the smoke penetrates through the thatch it fumigates and helps against insect attacks.

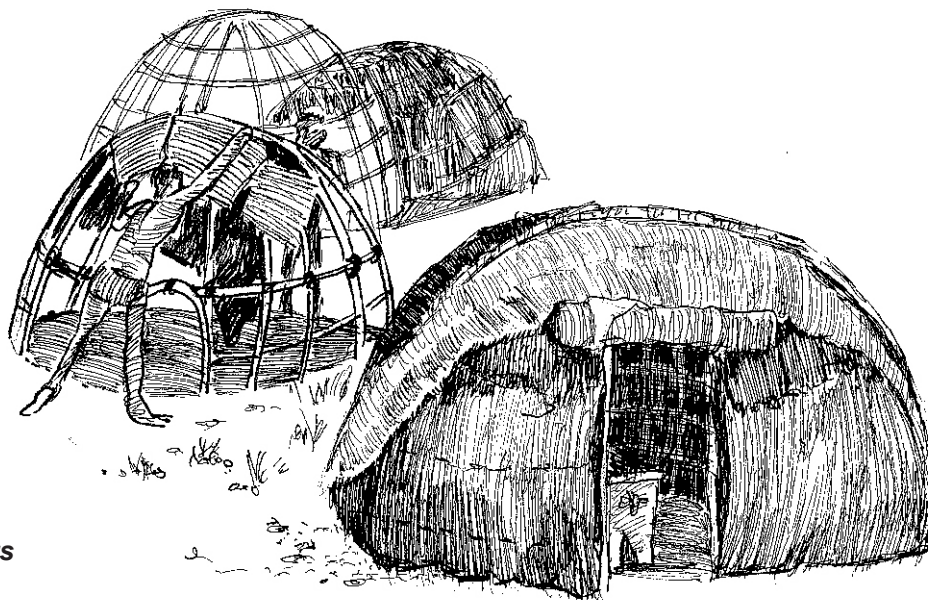
The Xhosa are mainly found in the Eastern Cape of South Africa. Similar to Zulu huts, traditional Xhosa huts were made from locally available materials. Traditional Xhosa huts were similar to Zulu huts: beehive shaped and made from thatch over a light, dome-shaped, sapling frame, with the floor made of dung and clay. This style is still used for the initiation boma for boys. However, in the homesteads, these have been replaced with Xhosa rondavel huts that are constructed from wooden poles stuck in the ground in a circle. The structure is filled with mud to form a solid wall and then roofed with a conical pole and grass thatch roof. The floor of the hut is made from clay and is smeared with cow dung, and the fireplace is in the centre.



Xhosa huts

The Nama are a nomadic pastoralist group found in the desert area of the Northern Cape, mainly around the Richtersveld. They keep livestock, mainly sheep and goats, and they move from place to place with changing seasons, thereby avoiding overgrazing.

Similar to the Zulu hut, the traditional Nama hut (*matjieshuis*) is a beehive structure made from locally available resource materials. The frame is constructed from indigenous wood saplings. However, unlike the Zulu hut, the saplings are covered with woven reed mats and the entrance is covered with a door flap that can be rolled up during the day and pulled down and closed during the night. The men prepare the sapling frame while the women weave the reed mats (from the reed *Phragmites mauritianus*) and drape and fasten them over the frame. The mats can be removed and reused in a new location.



Nama huts

ACTIVITY 2
(Grade 4 Term 2)

TEACHER/LEARNER

Learning focus:

Observing, collecting, analysing and evaluating information, recording, interpreting information, sorting and classifying communicate effectively, accessing and recalling information, developing reading and writing skills

Resources:

Traditional housing structures, local community members

Identify traditional housing structures found in your area. To which community group do they belong? Discuss.

What materials are used in their construction?

What are the advantages of using locally available materials?

Teaching Practice

Indigenous knowledge learning methods employed here include:

- Observations;
- Investigations; and
- Deliberation/discussions.

These are discussed in detail in the teaching practice overview on page 31.

Assessment Practice

The assessment activities covered in this unit are summarised below. These are discussed in detail in the assessment practice summary section on page 34.

TOPICS	SUMMARY	ASSESSMENT ACTIVITIES	GRADE	KEY ASSESSMENT SKILLS (VERBS)
Habitats of animals	Indigenous knowledge of plant and animal habitats	1. Identify and make an inventory of different categories of living organisms	4	Communicating, raising questions, recording, interpreting information, sorting and classifying, developing writing skills
Indigenous structures	Indigenous housing structures	1. Observe and identify traditional housing structures in your area 2. Identify materials used in their construction 3. Explain advantages of using locally available construction materials	4	Investigating, observing, sorting and classifying, recording, communicating, discussing, interpreting, writing, presenting, designing

Energy and systems and control

Most indigenous communities in the past (and in the present for rural communities) have relied on nature for their energy. For cooking and heating, wood is the main energy source. This unit explores this use of energy.

A variety of instruments made from locally available materials have been used to make music in southern Africa. Traditional music and musical instruments are covered in this unit.

This unit therefore covers the following topics:

1. Traditional energy sources; and
2. Traditional musical instruments.

This is summarised in the table below.

THEME	TOPIC	CONTENT	CAPS NATURAL SCIENCES & TECHNOLOGY (INTERMEDIATE)	GRADE	TERM
Energy	Energy for life	Traditional energy sources and their uses	p.23 – Energy for life ◆ we use energy for everything we do ◆ we get our energy from food ◆ energy in our food comes from the Sun (plants use the energy from the Sun to make food for themselves and for animals and people)	4	3
			p.39 – ◆ everyday fuels that we use include coal, wood, petrol, paraffin, gas and candle wax	5	3
Systems and Control	Movement and musical instruments	Traditional musical instruments	p.24 – Movement and musical instruments ◆ many musical instruments (systems) use movement input energy (such as blowing, beating and plucking) to make them work ◆ many instruments have parts that can move or vibrate ◆ musical instruments produce sound as the main output energy	4	3

Subject Content Knowledge

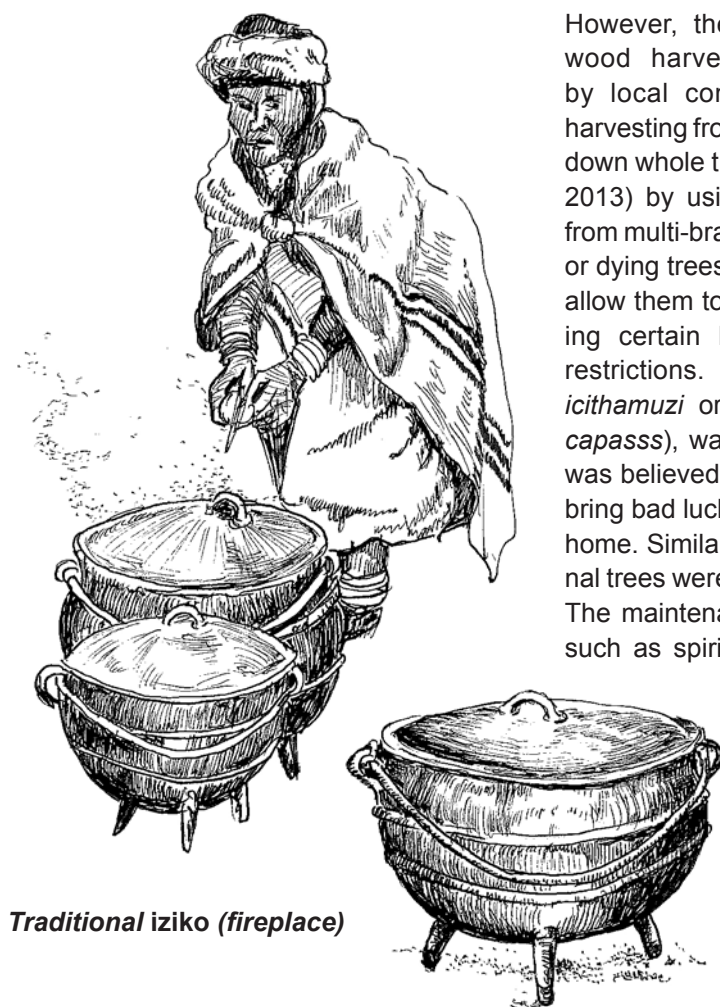
Traditional energy sources

Key idea:

Wood from the natural environment has been the primary source of energy for most indigenous communities. Its sustainable harvesting and use is essential for the sustainability of wood producing species.

Most indigenous communities in the past (and in the present for rural communities) have relied on nature for their energy provision. For cooking and heating purposes, wood has served as the main energy source. Slow burning wood species are preferred as they have longer lasting coals.

A reliance on wood biomass as a source of energy puts a stress on the natural vegetation, resulting in loss of preferred species, which then leads to less selective use of wood species in an area. The long term result of this is deforestation and environmental degradation. This then means women, who are traditionally responsible for collecting wood, have to go longer distances in order to access it.



Traditional iziko (fireplace)

However, there were some sustainable wood harvesting strategies employed by local communities. These included harvesting from trees (rather than chopping down whole trees) (see O'Donoghue et al., 2013) by using only branches and twigs from multi-branched trees, harvesting dead or dying trees, coppicing woody species to allow them to regenerate and not harvesting certain key species through taboo restrictions. For example, the rain tree, *icithamuzi* or *idungamuzi* (*Lonchocarpus capasss*), was not used for firewood as it was believed burning it in the home would bring bad luck and cause arguments in the home. Similarly wild fruit trees and medicinal trees were never cut down for firewood. The maintenance of sacred forest groves such as spiritual sites and graveyards in which nobody was allowed to cut trees was another way of conserving woody tree species. Modern day conservation efforts such as tree planting, woodlots and energy saving stoves also serve to conserve woody tree species (see O'Donoghue et al., 2013).

ACTIVITY 3
(Grade 5 Term 3)

GROUP ACTIVITY

Learning focus:

Observing, recording, collecting, analysing and evaluating information, interpreting information, communicating effectively, developing reading and writing skills

Resources:

Local community context

What local energy sources are used by local communities in your area? Discuss.

How can local energy sources in your community be used sustainably?

What other affordable alternative energy sources are available for your community?

What measures can be taken to save energy by community members and by your school?

Traditional musical instruments

Key idea:

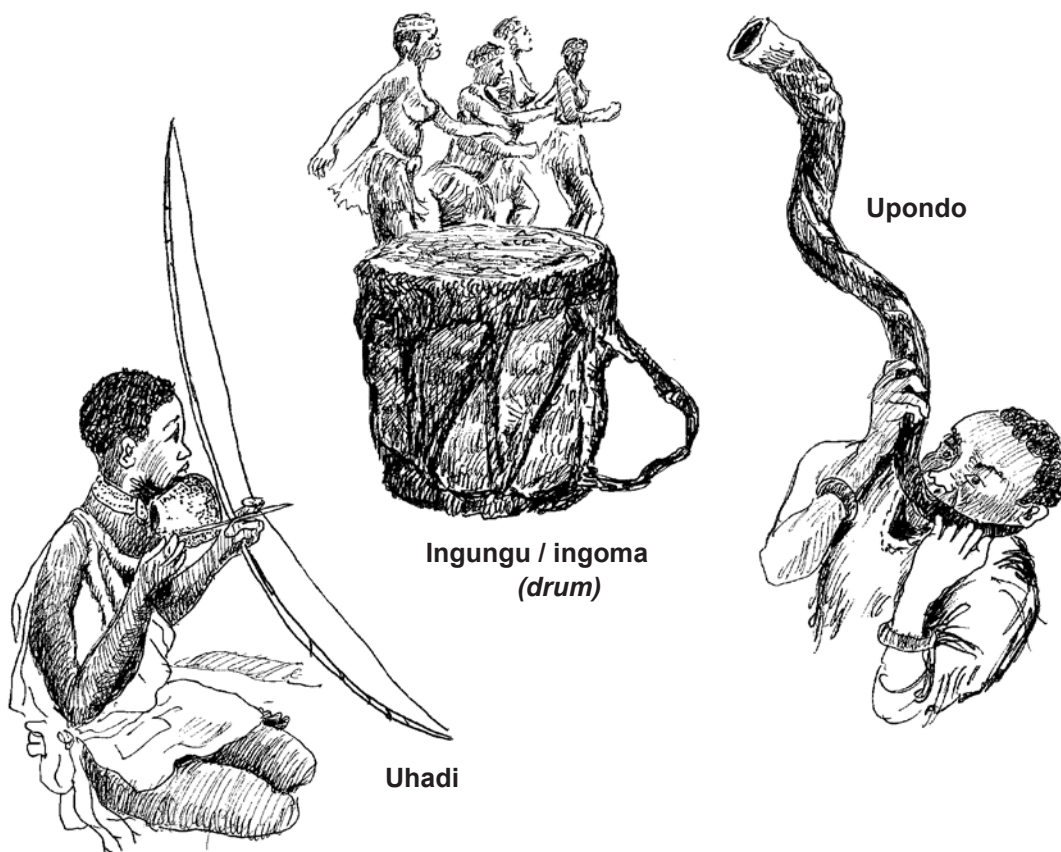
A variety of musical instruments made from locally available materials from nature have been used to produce music in southern Africa through displacement of air by vibration.

Southern Africa has been the source of vast and varied musical genres (types). Music accompanies many kinds of communal activities and events including weeding, harvesting, child nursing, weddings, collecting water, hunting, celebrations and funerals.

Each different type of music is usually associated with a particular dance form, lyrics and related musical instruments. Musical instruments that accompany traditional music include drums, rattles, horns and traditional string instruments. To produce sound, musical instruments have to be struck, blown or plucked. The mechanical process causes vibration (resonance) of air around the instrument, producing a sound or tone. The repeated rhythmical striking, blowing or plucking of the instrument produces the music.

South African traditional musical instruments include *uhadi* or *ugubhu* (a single string violin with the bow made of a curved twig, a string and a gourd) of the Xhosa, *upondo* or the horn of the Zulu and Xhosa, the *kwela* or traditional bamboo pan flute, the Zulu *ingungu* or drum, ankle rattles and calabash or gourd hand-held rattles.

All traditional musical instruments in the past were made from locally available materials. However, this has changed and some have been (partly or wholly) replaced with more modern varieties.



ACTIVITY 4 (Grade 4 Term 3)

GROUP ACTIVITY

Learning focus:

Observing, recording, interpreting information, collect, analyse and evaluate information, communicate effectively, designing, sorting and classifying, developing reading and writing skills

Resources:

Local community context

Identify some traditional musical instruments used (or that were used) by local communities in your area.

What materials are they made from?

Explain how these instruments are played and in what kind of ceremonies.

Design a simple traditional musical instrument of your choice.

Teaching Practice

The following teaching methods have been employed in this section:

- Observations;
- Deliberations;
- Investigations; and
- Learning by doing.

These are discussed in detail in the teaching practice overview on page 31.

Assessment Practice

The assessment activities covered in this unit are summarised below. These are discussed in detail in the assessment practice summary section on page 34.

TOPICS	SUMMARY	ASSESSMENT ACTIVITIES	GRADE	KEY ASSESSMENT SKILLS (VERBS)
Energy for life	Traditional energy sources and their uses	1. Identify local energy sources in your area 2. Suggest alternative sources of energy 3. Identify ways of conserving energy habitats	5	Observing, recording, collecting, analysing and evaluating information, interpreting information, communicating effectively, developing reading and writing skills
Movement and musical instruments	Traditional musical instruments	1. Identify traditional musical instruments in your area 2. Identify materials that they are made of 3. Explain how they are played 4. Design a traditional musical instrument from local materials	4	Observing, recording, interpreting information, collecting, analysing and evaluating information, communicating effectively, designing, sorting and classifying, developing reading and writing skills

Processing

Traditional processing involves the use of natural raw materials to make utensils and other goods for household and other uses. Indigenous people discovered, mined and used metals, mainly iron, before the colonial period (Hammel et al., 2000). Indigenous methods of processing metals are explored here. Indigenous people have relied on a diverse and balanced diet characterised by wide range of foods. At the end of this unit we consider various ways in which food has been processed and preserved using indigenous methods.

This unit therefore covers three topics:

- Traditional processing of raw materials;
- Metal processing; and
- Food processing.

These are summarised in the table below.

THEME	TOPIC	CONTENT	CAPS NATURAL SCIENCES & TECHNOLOGY (INTERMEDIATE)	GRADE	TERM
Processing	Traditional processing	Traditional processing of materials	p.38 – Traditional processing ◆ in Africa people have processed materials for hundreds of years to make ◆ clay pots and bricks ◆ baskets, hats, mats, thatched roofs made from plant fibre such as grasses and reeds	5	2
	Uses of metals	Traditional uses of metals	p.36 – Uses of metals ◆ metals are used to make things such as coins, wire, jewellery, furniture, buildings and bridges, motor cars, kitchen utensils, roofs	5	2
Food processing	Food groups	Traditional foods and food processing	p.48 – Food groups ◆ most natural foods contain a mixture of more than one nutrient group ◆ most processed (manufactured) foods have added salt, sugar, preservatives, flavourings and colourings p.49 – Balanced diet ◆ a balanced diet contains sufficient quantities of food from all four nutrient groups, as well as water and fibre ◆ some diseases can be related to diet p.49 – Methods for processing food ◆ there are many different methods (ways) to process food ◆ researching how to process food (raw material) by combining, cooking, freezing, pickling, fermenting, drying and salting to make a product, including indigenous ways of processing of food in different communities	6	1

Subject Content Knowledge

Traditional processing

Key idea:

Traditional processing involves the use of natural raw materials to make utensils and other goods for household and other uses.

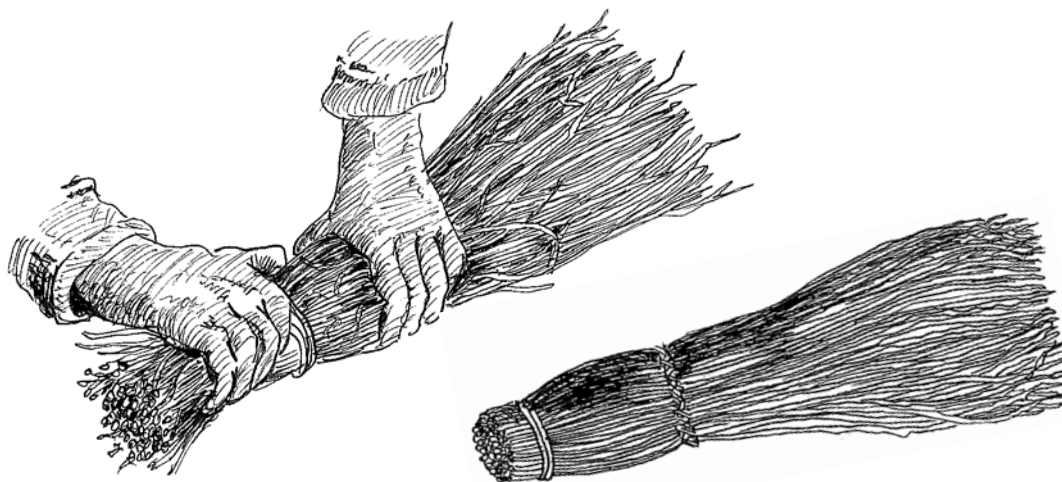
Local communities have relied on local raw materials from the natural environment to process (make) goods for household and other uses. Such goods were essential for everyday living. These include clay, wood, grass, gourds, fruits, skins, leather, beads and metal. Household and other utensils crafted by local communities were varied and made by both men and women.

Men carved wood to make head rests (*izigqiki*), built kraals (*isibaya*) and tanned skins (*ukutshuka izikhumba*) for use in making clothing such as men's loin skins (*amabhethu*), women's leather skirts (*izidwaba*) and shields (*ihawu*). Men smelted metal such as iron to make spears, knives and hoes. They also made ornamental metal bangles and bracelets.

Women made pots (*imbiza*), eating and drinking utensils (*izitsha*), storage utensils, clothing (*imvunulo*), sieves (*isihluzo*), souring pots (*igula lamasi*), baskets (*ingcebethu*), ornaments (necklaces, anklets, wrist bands, head gear (*indlukula*, *isigqoko*), mats (*amancasi*) and blankets (*isembatho*). Zulu beadwork was done by women, who made love letters depicting their position, affection and relationships through shapes and colours as a way of communicating without being direct. The beadwork therefore had cultural significance within the Zulu communities.

In constructing the home, both men and women are involved and their different roles as well as materials used have been discussed in Unit 1.

Some traditional products are shown below (consider also the musical instruments in the previous section).



Traditional grass brooms (imitshawelo/imithanyelo)

**Traditional milk
fermenter (igula
or iselwa
lamasi)**



**Beer basket
(isitsha)**



**Zulu love letter
and beadwork**



**Traditional Zulu
child's doll (from a
maize cob and leaf
sheaths)**

ACTIVITY 5 (Grade 5 Term 2)

Learning focus:

Observing, recording, collecting, analysing and evaluating information, interpreting information, sorting and classifying, communicate effectively, accessing and recalling information, designing, developing reading and writing skills

Resources:

Local community context

Identify different traditional processing activities in your local community.

What materials are used during processing? What are the end products?

For what purpose are these processing activities done?

Design a product from local materials in your area.

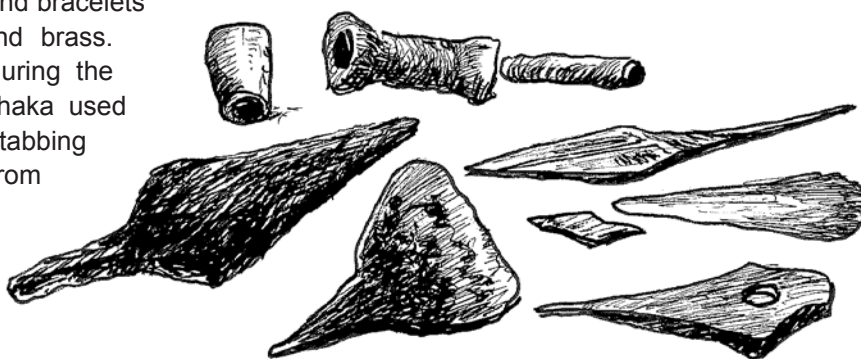
Traditional processing and uses of metals

Key ideas:

Iron and other metals have been mined and processed by people in southern Africa many years before the colonial period. Metals have been used for making tools as well as ornamental objects.

Indigenous people discovered, mined and used metals, mainly iron, before the colonial period (Hammel et al., 2000). Iron ore deposits were readily available in southern Africa. Traditional iron furnaces from the Iron Age are scattered all over southern Africa. They consist of clay furnaces in which the metal was smelted over a hot fire which was fanned using bellows made from skin. The refined traditional smelted metal was then forged into shape.

Intricate metal crafts include the golden rhino discovered in the ancient site of Mapungubwe. People smelted metal such as iron and processed it to make tools and implements such as spears for fighting and hunting, knives and hoes for cultivation. They also made ornamental metal bangles and bracelets from copper and brass. Zulu warriors during the time of King Shaka used throwing and stabbing spears made from metal attached to a wooden shaft.



Iron smelting tools

ACTIVITY 6 (Grade 5 Term 2, Grade 6 Term 1)

GROUP ACTIVITY

Learning focus:

Collecting, analysing and evaluating information, communicating effectively, accessing and recalling information, observing, recording, interpreting information, designing, sorting and classifying, developing reading and writing skills

Resources:

Local community, museum and/or Internet

Research traditional uses of metals in your local community. What traditional metallic objects are found and what are they made of?

What metals ores are found in South Africa?

How does modern mining, smelting and manufacturing of metal products in South Africa differ from that in the iron-age period?

Visit a nearby museum or library or access the Internet and find out about metal objects that were made by the local communities during the Iron Age.

Traditional foods and food processing

Indigenous people have relied on a diverse diet characterised by wide range of foods including indigenous cereals (e.g. amabele or sorghum), meat and other animal products (milk, eggs, etc.), insects, fruits, vegetables, nuts, roots and tubers eaten in season. These diverse foods enabled indigenous communities to have a balanced diet that led to better health compared to today's modern diet that is rich in sugars, fats and numerous disease-causing food additives.



Traditional foods including millet, sorghum, melons and pumpkins

Food consumed in the home has to be prepared for the family. While some foods, such as most fruits and some roots and tubers, can be eaten raw, most food needs to be processed for consumption.

The majority of indigenous foods are eaten cooked (especially vegetables and cereals) in order for them to be edible. Cooking breaks down hard or poor tasting foods and makes them more suitable or palatable (tasteful) for consumption.

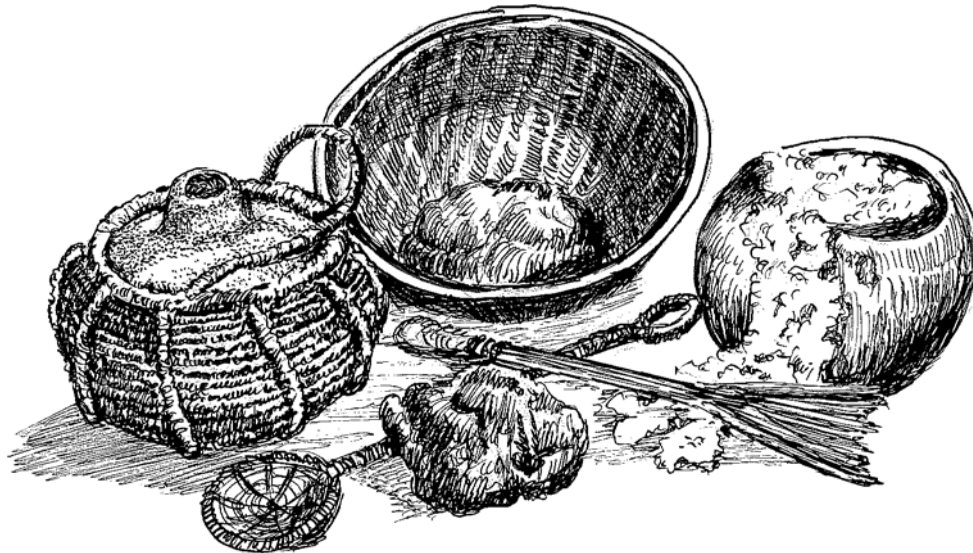
Most traditional meals are made up of starchy staple (e.g. maize), accompanied by a relish (of meat and /or vegetables). The combination of starch and a protein, mineral and vitamin rich relish ensures the provision of a balanced diet that has all the essential nutritional ingredients (energy and essential nutrients). Most traditional diets consist of a wide variety of foods and snacks, thereby ensuring a balanced diet.

As most indigenous communities lacked modern storage and preservation facilities, they had to find ways to process their foods to make them last longer. This includes crushing, pounding, drying, boiling and fermentation.

Crushing and pounding makes food more digestible by softening it and increasing the surface area for digestive enzymes to work. Boiled food can remain fresh for several hours,

fermented foods can last for several days and dried foods can be stored for even longer periods. Fermentation requires the adding of a fermenting agent such as yeast or bacteria (*Lactobacillus*). Processes such as fermentation can enhance the nutritional value of food by enabling the release of essential nutrients from the fermentation process (see O'Donoghue et al., 2013).

Some traditional fermented foods include *amarhewu*, traditional beer or *umqombothi*, *udombolo* (pot bread) and *amasi*.



Fermented foods

ACTIVITY 7
(Grade 6 Term 1)

GROUP ACTIVITY

Learning focus:

Observing, recording, interpreting information, collecting, analysing and evaluating information, communicating effectively, accessing and recalling information, designing, sorting and classifying, developing reading and writing skills

Resources:

Local community context, local food products

What fermented food products are found in your home? Who made them? Find out how they are made. Collect the necessary ingredients and make a fermented food in your group.

What are the benefits of processing food?

Teaching Practice

The following teaching approaches have been employed in this unit:

- Observations;
- Investigations;
- Deliberations; and
- Experiential learning.

A detailed overview of teaching practices used in all three units follows in the next section.

Assessment Practice

The assessment activities covered in this unit are summarised below. A detailed overview of assessment practices used in all three units can be found on page 34.

TOPICS	SUMMARY	ASSESSMENT ACTIVITIES	GRADE	KEY ASSESSMENT SKILLS (VERBS)
Traditional processing	Traditional processing of materials	<ol style="list-style-type: none"> 1. Identify traditional processing of materials in your area 2. Identify the materials used and end products 3. Design a product using local materials 	5	Observing, recording, collecting, analysing and evaluating information, interpreting information, sorting and classifying, communicating effectively, accessing and recalling information, designing, developing reading and writing skills
Uses of metals	Traditional uses of metals	<ol style="list-style-type: none"> 1. Identify local traditional uses of metals 2. Identify metal ores of south Africa 3. Explain the difference between modern and traditional metal processing 4. Identify traditional metal objects from your area 	5 & 6	Collecting, analysing and evaluating information, communicating effectively, accessing and recalling information, observing, recording, interpreting information, designing, sorting and classifying, developing reading and writing skills
Food groups	Traditional foods and food processing	<ol style="list-style-type: none"> 1. Identify fermented products in the home 2. Identify who made them 3. Explain the advantages of fermented foods 4. Make a fermented food product 	6	Observing, recording, interpreting information collecting, analysing and evaluating information, communicating effectively, accessing and recalling information, designing, sorting and classifying, developing reading and writing skills

Teaching Practices in these units

In units 1, 2 and 3 there are a range of possible **pedagogical approaches** (methods) for teaching and learning processes.

Indigenous knowledge is about **holistic, context-based, integrated people-environment interrelationships** and is therefore, to large extent, a **practice-oriented** discipline that draws on on-site **observations** and **investigations** of processes in real life contexts. However, this does not imply that theoretical as well as other classroom based activities are not possible. The explanation of indigenous knowledge aspects requires conceptual understanding. A mixture of practical action-oriented activities in real life contexts as well as classroom based activities can facilitate learning on this topic. These include **investigative, experiential, learning by doing** and **deliberative methods** as discussed in the Introductory *Core Text* and *Methods and Processes* booklet. Certain activities are suitable for group work while some are individual activities. Using a diverse range of teaching and learning approaches creates opportunities for learners to actively engage in the learning process.

Indigenous learning methods include the following:

Observations

Most indigenous knowledge activities are **embedded in real life everyday livelihood practices** of local communities. These include daily chores such as women preparing meals for their families, or occasional livelihood sustenance practices such as women making pots or mats and preparing umqombothi beer for a ceremony, or men making wooden crafts. There are also shared chores such as making a hut or cultivating a field. To understand such practices one needs to carefully observe and/or participate in them. Elderly members of the community can be invited to demonstrate some of these practices while the class observes.

Experiential learning/learning by doing

One way of finding out about indigenous practices is through participating in indigenous events, or requesting indigenous community members to demonstrate to you or your class how certain things are done. Indigenous community members can, for example, be used as resource persons to demonstrate how *umqombothi* or *amar/hewu* is brewed or how a traditional musical instrument is played or how a traditional dance is done. They can also be used to teach learners how to identify useful plants (e.g. food plants or medicinal plants) or to explain the habitat and habits of particular animals. You and the learners can then learn from the practice by being able to do it or repeat it as **indigenous knowing is linked to doing**. Such **formative experiential learning processes** can be employed in a formal learning context.

In the past most indigenous people learnt a trade or practice such as hunting, carving, gathering food plants, traditional medicinal practice, etc. from observing and doing what the more experienced practitioners were doing. This traditional apprenticeship process defines learning by doing.

Children of the same age group can learn from their peers through doing and playing. For example, young girls can learn chores from other girls such as collecting water, harvesting wild vegetable, etc. Similarly boys can learn to hunt, to fish, to collect fruit, herd livestock and to carve from observing and doing what their peers do. **Role play**, such as *amadlwane* (playing 'house'), can teach girls and boys their gendered roles in the family when they play the roles of mother, father and children. Similar **peer learning by doing** processes can be employed in a classroom context.

Investigations

Most indigenous knowledge is held within communities, with the elderly being the main **custodians** of such knowledge. Some of this knowledge is no longer implemented in practice. To find out about such knowledge, it will be necessary to inquire from them of this knowledge. This can be done through interviews (individual interviews or focus group discussions). Consent is however required from the informants (community elders) prior to carrying out such interviews and explanation on how such information is going to be used. Learners can also be tasked with carrying out such investigations and this restores the intergenerational knowledge transfer processes that existed in the past and **re-affirms the role of elders as knowledgeable educators in the community**. Investigations by learners enable the community elders to hand on to the younger generation their knowledge and wisdom that is necessary for the substance of the community.

Deliberations

Classroom discussions on particular indigenous knowledge topics or issues can reveal the wealth of knowledge about indigenous culture and practices that is held by learners as members of indigenous communities and practitioners in various cultural aspects. This can be a useful learning process of **learning from each other** and also enables the appreciation and valuation of indigenous knowledge by learners as their living heritage.

Storytelling

Elders have traditionally used stories and myths as a method to teach the young. They are used to chastise, admonish, advise, reconcile, counsel, inform, instruct and entertain the young. Stories usually involve mythical characters, usually animals personifying the characters or behaviours of humans. They teach both the habits of certain animals as well how people act (the characters of human beings). Most stories also employ proverbs (*izaga* or *amazwi ahlakaniphileyo* in Nguni languages), which are an important part of teaching wisdom as well as **improving and enriching the language vocabulary** amongst the young. The art and practice of storytelling is an important learning tool and elders can be used to tell stories to the class. Linked to storytelling is poetry and story writing, which can also be employed in formal learning processes.

Teaching and learning activities

Teacher and learner activities utilising some of the above methods have been interspersed into the different knowledge sections of the text (Subject Content Knowledge); these give suggestions for various methods for teaching indigenous knowledge.

The indigenous knowledge topics will require:

- i) the development of **language skills**, in this case with regard to indigenous scientific literacy on *key terms and concepts* employed in indigenous knowledge systems;
- ii) the development of **analytical skills** as employed in
 - a. appreciating the enormous variety of life and life systems in the local (and global) context(s) and the need to conserve it;
 - b. the classification of ecosystems;
 - c. the conceptualisation of how different living organisms are interrelated in nature and the natural processes within ecosystems;
 - d. recognising the different roles of ecosystems and relating this to society and to human well-being;
 - e. understanding the impacts of human activities on ecosystems, their interrelated nature and their implications to human well-being; and
 - f. appreciating the role of indigenous science in the development of the range of responses to ecosystem loss;
- iii) the development of mathematical skills and their application in real life contexts of ecosystems.

Assessment Practices in these units

Assessment activities will vary according to the content knowledge that is being assessed. Not all assessments have to be written, some can be practical, while some can be oral. The assessment activities tables in the three units illustrate some possible links between the content in the learning unit and assessment activities and skills. In the content knowledge topics, the activities have been aligned to the different grades in which they are applicable. The assessment practices for all the units are represented in the table below.

CONTENT KNOWLEDGE SECTION	SECTION SUMMARY	ASSESSMENT ACTIVITIES	GRADE	KEY ASSESSMENT SKILLS (VERBS)
Habitats of animals	Indigenous peoples knowledge of plant and animal habitats	1. Identifying and inventory different categories of living organisms	4	Communicating, raising questions, recording, interpreting information, sorting and classifying, developing writing skills
Indigenous structures	Indigenous housing structures	1. Observe and identify traditional housing structures in your area. 2. Identify materials uses in their construction 3. Explain advantages of using local available construction materials	4	Investigating, observing, sorting and classifying, recording, communicating, discussing, interpreting, writing, presenting, designing
Energy for life	Traditional energy sources and their uses	1. Identify local energy sources in your area 2. Suggest alternative sources of energy. 3. Identify ways of conserving energy habitats	5	Observing, recording, collect, analyse and evaluate information, interpreting information, communicate effectively, developing reading and writing skills
Movement and musical instruments	Traditional musical instruments	1. Identify traditional musical instruments in your area 2. Identify materials that they are made of 3. Explain how they are played 4. Design a traditional musical instrument from local materials	4	Observing, recording, interpreting information, collecting, analysing and evaluating information, communicating effectively, designing, sorting and classifying, developing reading and writing skills
Traditional processing	Traditional processing of materials	1. Identify traditional processing of materials in your area 2. Identify the materials used and end products 3. Design a product using local materials	5	Observing, recording, collect, analyse and evaluate information, interpreting information, sorting and classifying, communicate effectively, accessing and recalling information, designing, developing reading and writing skills

CONTENT KNOWLEDGE SECTION	SECTION SUMMARY	ASSESSMENT ACTIVITIES	GRADE	KEY ASSESSMENT SKILLS (VERBS)
Uses of metals	Traditional uses of metals	<ol style="list-style-type: none"> 1. Identify local traditional uses of metals 2. Identify metal ores of south Africa 3. Explain the difference between modern and traditional metal processing 4. Identify traditional metal objects from your area 	5 & 6	Collect, analyse and evaluate information, communicating effectively, accessing and recalling information, observing, recording, interpreting information, designing, sorting and classifying, developing reading and writing skills
Food groups	Traditional foods and food processing	<ol style="list-style-type: none"> 1. Identify fermented products in the home 2. Identify who made them 3. Explain the advantages of fermented foods 4. Make a fermented food product 	6	Observing, recording, interpreting information collecting, analysing and evaluating information, communicating effectively, accessing and recalling information, designing, sorting and classifying, developing reading and writing skills

CAPS Natural Science and Technology Intermediate Phase assessment focus

Below are the CAPS Natural Science and Technology Intermediate Phase Grades 4-6 specific aims and assessment foci:

Doing science and technology

This refers to the practical ability to carry out investigations and solve problems in relationship to the environment using indigenous knowledge. This includes respect and care for living things.

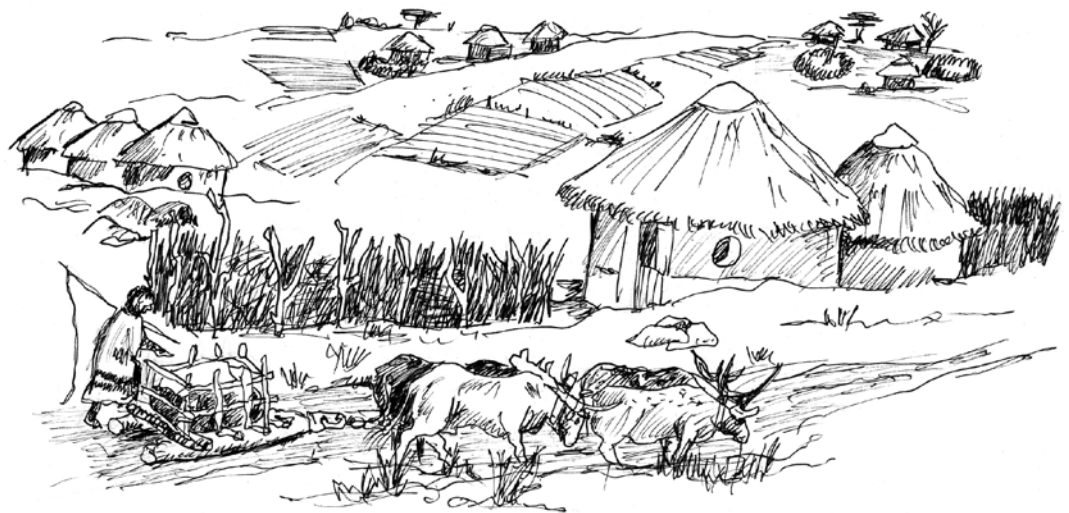
Understanding and connecting ideas

This refers the acquisition of knowledge, understanding and making links between ideas and concepts on indigenous knowledge systems as well as connection with previously acquired knowledge and experiences.

Science, technology and society

This refers to realising the relevance and application of indigenous scientific knowledge in real life contexts outside the school (improving water quality, growing food without damaging the environment, building energy efficient houses). It also includes realising that Indigenous Science and Technology can lead learners to a range of carrier and job possibilities in indigenous knowledge systems related fields.

The above aims can be linked to possible assessment activities as has been done in some of the activities in the three units here.



- Childs, S.T. 1991. Style, technology, and iron smelting furnaces in Bantu-speaking Africa. *Journal of Anthropological Archaeology*, 10, 332-339.
- Fundisa for Change Programme. 2013. *Introductory Core Text*. Environmental Learning Research Centre, Rhodes University, Grahamstown.
- Hammel, A., White, C., Pfeiffer, S. and Miller, D. 2000. Pre-colonial mining in southern Africa. *Journal of the South African Institute of Mining and Metallurgy*. January/February 2000, pp. 49 -56.
- O'Donoghue, R., Shava, S. and Zazu, C. 2013. *African heritage knowledge in the context of social innovation*. Yokohama: United Nation University – Institute of Advanced Studies (UNU-IAS). http://www.ias.unu.edu/resource_centre/UNU_Booklet_MB2013_FINAL_Links_v12.pdf
- Rosenberg, E., O'Donoghue, R. and Olvitt, L. 2008. *Methods and Processes to Support Change-Oriented Learning*. C.A.P.E. CEP, Rhodes University, Grahamstown. Distributed through Share-Net, Howick.
- Shava, S. 2013. The representation of indigenous knowledges. In Stevenson, R.B., Brody, M., Dillon, J. & Wals, A. (Eds.). *International Handbook of Research on Environmental Education*. New York: Routledge.

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