

K-6

Primary Science and Technology

Structure & Function



Teachers' Guide

Structure and Function

MODULE 1: K – 2

MODULE 2: 3– 4

MODULE 3: 5– 6

Preface

The development of learning outcomes for the core curriculum in OECS primary and lower secondary schools is an essential part of the harmonization of OECS educational systems. The curriculum harmonization process commenced seven years ago with discussions between the OECS Education Reform Unit (OERU) and educational personnel in all member countries (See *Eastern Caribbean Education Reform Project: Initiative on curriculum and remediation – Design Mission report, February 1998*).

The initiative in Primary Secondary Science and Technology commenced in 2001, with a meeting of science and technology educators in St. Vincent and the Grenadines. Time was spent initially on defining science and technology, mainly because the primary curriculum concentrated on science only. A working definition has been developed and has been used consistently throughout the development of the programme.

Draft learning outcomes were developed and circulated for comments throughout the curriculum units in the OECS. Subsequent meetings of the working group were held in St. Kitts and Nevis, St. Lucia and Antigua and Barbuda. At each of these meeting teacher educators, teachers and principals formed part of the discussion groups. After the learning outcomes were adopted by the curriculum officers, instructional modules to serve as teachers' guides were planned and developed by members of the working groups. The learning outcomes and modules were all reviewed and edited by the two consultants who worked through all phases of the project.

Time did not permit a formal piloting of the learning outcomes and modules. Since in most cases the same curriculum officer worked on the lower secondary curriculum also, there is the possibility of the primary curriculum benefiting from the experience gained in the piloting of the lower secondary programme.

The purpose of developing the learning outcomes and teachers' guide is to ensure that all children in OECS primary schools attain an acceptable level of knowledge, skills, and attitudes associated with science and technology. Each member country retains the right and responsibility for integrating these outcomes into the national primary science and technology curriculum. As usual, teachers will continue to use their initiative and resourcefulness in the implementation of the programme through the use of indigenous resources creating relevance.

The OERU is extremely grateful for the contribution made by all persons and institutions that have been involved in this developmental exercise. First, OERU expresses thanks to the Canadian International Development Agency (CIDA) for the high level of interest shown and the funding provided for the Eastern Caribbean Education Reform Project (ECERP). The Ministries and Departments of Education have contributed resource personnel, accommodation, refreshment, ground transportation, and some materials for workshops. Most important, however, have been the high level of cooperation and commitment to the reform effort displayed by both the administrative and professional sections of Ministries of Education.

The following science education professionals have made significant contributions over the four-year period.

Country	Participant	Designation
Anguilla	Mr. Worrell Brooks	Education Officer, Science
	Mrs. Maria Webster	Secondary School Teacher
Antigua and Barbuda	Mr. Earl Skerritt	Science Coordinator
	Ms. Kendra Thomas	Primary School Teacher
	Ms. Celia Frederick	Secondary School Teacher
	Ms. Gracelyn Ireland	Primary School Teacher
British Virgin Islands	Ms. Beverlie Brathwaite	Education Officer, Science
Dominica	Mr. Frank Newton	Education Officer Science
	Mr. Gerald Corbette	Lecturer, Dominica State College
Grenada	Mr. Jervis Viechweg	Curriculum Officer, Science
	Ms. Janis Henry	Lecturer, T. A. Marryshow Com. College
Montserrat	Mr. Gregory Julius	Primary school Principal

St. Kitts And Nevis	Mr. Hilton Clarke	Curriculum Officer, Science
	Dr. Lincoln Carty	Former Curriculum Officer, Science
St. Lucia	Mr. Winston Blanchard	Curriculum Officer, Science
	Ms. Imelda Polius	Former Primary School Teacher
St. Vincent and the Grenadines	Mrs. Arlene Keane-Browne	Former Curriculum Officer, Science
	Mrs. Amaala Muhammad	Curriculum Officer, Science
	Mr. Kenroy Johnson	Principal, Secondary School

The OERU also expresses gratitude to the dozens of teachers, principals and students who have participated in discussions and consultations.

The actual planning and subsequent developmental process for the learning outcomes and Teachers' Guide became the responsibility of Dr. Cheryl Remy, former Senior Lecturer at Arthur Lewis Community College, St. Lucia and Professor Winston King, Senior Lecturer, School of Education, UWI. to whom the OERU is very grateful. As a team, Dr. Remy and Professor King have encouraged workshop participants and module writers to think and to create ideas as the work progressed.

The staff at OERU together contributed in no small measure to these modules. Ms. Deborah Alphonse, Accounts/Administrative Assistant, Ms. Natasha Deterville, now Secretary to the Director of Economic Affairs in the OECS, and Ms. Cleotha Randolph, Documentation Officer, worked tirelessly arranging workshops and reproducing materials. Ms. Natalie Compton of Nagio Creations competently designed the layout of the modules and learning outcomes for printing and electronic reproduction.

Dr. Henry Hinds, former Curriculum Specialist at OERU was responsible for the curriculum project. Mrs. Lorna Callender and Ms. Candia Alleyne, both former Heads of OERU, have supported the project organizationally and morally. Mr. Johnson Cenac, ECERP Officer, made significant contributions in various ways and at various times throughout the development of this work.

The Primary Science and Technology modules provide an excellent example of the fusion of talent, creativity, rigorous science and technology and cooperation to develop a valuable resource for teachers.

The OERU hopes that principals and teachers will continue to play their roles in making the outcomes and modules come to life in classrooms throughout the OECS. The commitment and effort surely will contribute to the enhancement of knowledge, and skills and the development of positive attitudes towards science and technology.

Henry Hinds, Head, OERU

August, 2006

Structure and Function

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RATIONALE

Each part of an organism has a specialized function. Each part is important. It is a combination of these specialized functions that result in the organism carrying out its various life processes.

As children analyse the various parts of organisms they would come to appreciate the importance of each part of an organism. As they interact with organisms in the environment they would understand that each organism in a system has an important role to play in the effective functioning of that system, such as an ecosystem.

INTRODUCTION

The relationship between structure and function cannot be overemphasized. For an organism to function effectively, its body parts must be specially designed for their function.

This unit deals with the close relationship between structure and function of parts in living organisms. It focuses on those organisms in the students' environment and provides opportunities for them to interact with the organisms.

Children will be made aware of the role of technology in the life processes of animals and plants as humans constantly seek to modify and enhance these processes to their own uses and benefit.

This Unit consists of the following strands:

- Plants -- Physical structures and functions (Stem, roots, leaves, Flowers and seeds)
Transport system

- Animals – Structure and function of Vertebrates and selected Invertebrates
Structure and function of Systems in humans (Digestive, Circulatory, Reproductive and Skeletal Systems).

The experiences in these modules will help the students to develop the following major ideas

STRUCTURE AND FUNCTION

- *Plants and animals have structures (e.g. organs and systems) which have specific functions (e.g. digestion).*
- *These structures are suited to their functions.*

TECHNOLOGY

- Technological methods involves the use of problem solving, technological processes and resources to find solutions to people's wants and needs.
- Technology is a human activity.
- Individuals can take part in Technological activity.
- Technology involves the uses of materials, energy, tools / machines and information.
- Technology processes include Biotechnology, Production Technology and Transportation .
- Technology changes over time.
- Technology is neither good nor bad, but the way we use it can have positive or negative effects on our lives.
- The use of technology has side effects.

SCIENCE TECHNOLOGY, SOCIETY AND THE ENVIRONMENT

- Science and Technology affect human life, the society and the environment.
- The impact of Science and Technology can be positive and negative, unplanned or planned, immediate or delayed.
- There should be sustainable use of resources and efforts should be made to minimize ecological disturbances.
- People's values, beliefs and attitudes influence Scientific and Technological activity and use.

S t r u c t u r e a n d f u n c t i o n

m o d u l e 1

g r a d e s k - 2

GENERAL OBJECTIVES

The students should be able to:

1. Identify the structure and function of the main external parts of plants in the environment.
2. Describe the function of the main external parts of plants and animals in their environment.
3. Appreciate that plants and animals undergo changes from earliest stages to maturity.

SPECIFIC OBJECTIVES

The students should be able to:

1. Name the main external parts of animals (vertebrates and selected invertebrates e.g. insects, spiders, crabs).
2. Identify the main external body parts of various animals and their functions (include sense organs).
3. Name the main external parts of plants (roots, stems, leaves, fruits, flowers).
4. Identify the roots, stems, leaves, fruits and flowers of plants.
5. Draw and label a diagram of the main external parts of a plant.
6. Name the external parts of a flower.
7. Compare the external parts of different flowers (shape, colour, size, texture).
8. State the role of each part of the flower.
9. Identify and name the different stages in the development of animals in their environment.
10. Identify and name the different stages in the development of plants in their environment.

**LEVELS OF ATTITUDES, SKILLS & TECHNOLOGY EXPECTED AT
GRADES K - 2**

ATTITUDES:

Students should be encouraged to:

Curiosity:	✓ Ask questions about objects and events. ✓ Find out more about events and objects on their own.
Inventiveness:	✓ Suggest new ways of doing things.
Respect For Evidence	✓ Explain their results and conclusions. ✓ Listen to other students' results and explanations.
Persistence	✓ Complete activities. ✓ Persist at tasks.
Respect For Living Things	✓ Show sensitivity to living things.
Cooperation	✓ Share with others. ✓ Work together with others.
Concern For Safety	✓ Observe safety instructions.

SKILLS:

In developing their skills of inquiry, problem solving and design, the student are expected to:

Observing	✓ Use as many senses as are appropriate and safe to gather information. ✓ Identify differences and similarities between objects and events. ✓ Identify sequence in events.
Measuring	✓ Use simple measuring instruments or models of measuring instruments. At first use comparative terms such as bigger, smaller and later use actual figures.
Manipulating	✓ Set up simple experiments to compare results. ✓ Manipulate simple equipment.
Recording	✓ Use pictures and charts to report results. ✓ Fill out simple tables to report results.
Classifying	✓ Group objects according to one or two criteria.
Communicating	✓ Talk freely about their activities and the ideas they have, with or without making a written record. ✓ Use appropriate vocabulary to describe their observations. ✓ Listen to others' ideas and look at their results. ✓ Report events by using demonstrations, role play, simple drawings, paintings and simple sentences.
Inferring	✓ Notice patterns in simple measurements and events.
Interpreting data	✓ Discuss what they find out in response to questions.
Experimenting	✓ Freely ask a variety of questions and suggest how they might be answered. ✓ Suggest how they could investigate to find out answers to questions.
Predicting	✓ Attempt to make predictions (even if not based on patterns).
Problem Solving	✓ Suggest solutions to simple problems.
Designing	✓ Construct models either by following instructions or by using their own designs. ✓ Select appropriate material to make models and gadgets.

TECHNOLOGY

Technological Methods	✓ Given problems, the students will be able to discuss and make simple gadgets.
Nature Of Technology	✓ Realize that people use natural things and also make other things from them. ✓ Realize that they can design and make things which may be different from what others make. ✓ Share information with others. ✓ Realize that safety is important in using tools and making things.
<u>Use Of Technology</u>	✓ Appreciate the use of devices, tools and structures made by humans in the home and community. ✓ Appreciate the advantages of using these products. ✓ Realize that human-made things can pollute the environment.

Unit: structure and function (grade k)

Topic: What are the Main External Parts of Plants and Animals?

Duration: 6 Lessons (30 minutes each)

Specific Objectives

Students should be able to:

1. Name the main external parts of animals (vertebrates and selected invertebrates such as insects, spiders, crabs).
2. Identify the main external body parts of various animals and their functions (include sense organs).
3. Name the main external parts of plants (roots, stems, roots leaves, fruits, flowers).
4. Identify the roots, stems, leaves, fruits and flowers of plants.

Process Skills

Observation
Communication

Materials

Pictures of plants
Pictures of animals
Live animals
Stuffed animals (toys)
Live plants
Story Books

Content Summary

- Our bodies have different parts. Each part has a special function.
- Animals also have different body parts. Body parts help these animals to carry out certain functions.
- Plants are made up of different parts

Activities

- Ask students to identify the parts of their bodies. Let them say the name of the parts. Encourage them to state the use(s) of each part they can identify and name.
- Show students live specimens/pictures/photographs/stuffed toys of different animals. (Use animals students should be familiar with). Let students talk about the animals and identify and name the different parts of the body.
- Take students outside. Let them identify the plants/trees in the school yard. Encourage them to talk about the parts of plants. Help them identify the external structures of plants.
- Read stories to children of animals and plants which look at body structures and their functions.

Sample Activity

- Look at Me. I can name the parts of my body (eyes, ears, nose, mouth, hand, arm leg, foot).
- I use my eyes to see things around me. (Repeat for structures listed above).
- Look at the dog. I can see (identify and name the external parts). (Repeat for other examples of vertebrates).
- Look at the butterfly. I can see the wings. (I can see the legs, I can see the eyes).
- The butterfly uses the wings to fly. (The legs for walking, etc) (Repeat for other selected invertebrates).
- Look at the Mango tree/coconut tree/ banana plant (or any other common plant). I can name the parts (roots, stem/trunk, leaves, flowers and fruits).

Assessment

- Orally, let students identify and name the parts of their body. Let them tell you the function of each part identified.
- Show students pictures of animals and let them tell you the names of the parts and the functions of the parts identified.
- Let students identify and name the parts of a plant.

Unit: structure and function (grade 1)

Topic: Some Plants have Flowers for Various Functions

Duration: 4 Lessons (30 minutes each)

Specific Objectives

Students should be able to:

1. Draw and label a diagram of the main external parts of a plant.
2. Name the external parts of a flower.
3. Compare the external parts of different flowers (shape, colour, size, texture).
4. State the role of each part of the flower.

Process Skills

Observation
Communication
Measuring
Classifying

Materials

Flowers –variety in shape, size, colour of sepals and petals, and texture (allamanda, hibiscus, banana, flamboyant, mango, breadfruit, pawpaw, pea, plumrose, grass, coconut, pumpkin, sweet potato, orange, guava, sour sop)
Chart with a labelled diagram of a flower.

Worksheets for students to compare external structures of flowers

Storybooks

Content Summary

- The main external parts of a plant are the leaves, stem, roots, flowers and fruits.
- Flowers are made up of several common parts. Sepals are found on the outside and are normally green in colour. They protect the flower when it is a bud. Petals are found just inside the sepals. They are usually brightly coloured. They attract insects or birds to the flowers.
- Inside the petals are the stamens. Stamens contain pollen grains at the top. The pollen is usually yellow in colour. Pollen is needed to help the plants make fruits. The part at the centre of the flower is called

the ovary. This is usually swollen and has a stalk at the top. The ovary is the part of the flower that forms the fruit.

- The external parts of different flowers vary in size, colour, shape and texture. Petals may be pink e.g. periwinkle and rose; red e.g. rose and flamboyant; yellow e.g. allamanda; white e.g. pawpaw and orange.
- Some flowers may be small and grouped together e.g. sunflower, zinnia, ixora, mango.

Activities

- Take students outside to observe and collect flowers found around the schoolyard.
- Let students bring flowers found at home/in the community.
- Prepare work sheets for students to complete to compare flowers.
- Let students look at flowers and talk about the different parts of the flower.
- Discuss with students the role of each part of the flower identified.
- Let students locate the flower on a plant and name the part of the plant that bears flowers.
- Read stories to students. Stories of flowers and their beauty will be appreciated.

Assessment

- Using specimens of flowers, let students identify and name the different parts of the flower.
- Encourage students to suggest the role of the different parts of the flower.
- Let students draw a flower (*My favourite flower*) and colour it.
- Let students draw a plant to show the parts of the plant, including the flowers.

Unit: s t r u c t u r e a n d f u n c t i o n (g r a d e 2)

Topic: Plants and Animals Develop in Different Ways

Duration: 6 Lessons (30 minutes each)

Objectives

Students should be able to:

1. Identify and name the different stages in the development of animals in their environment.
2. Identify and name the different stages in the development of plants in their environment

Process Skills

Observation
Communication
Classifying

Materials

Live specimens of animals at different stages of growth and development
Charts with pictures/diagrams depicting different stages of development in selected animals
Pictures of animals and their young
Plasticine/Play dough
Storybooks with stories of animals and their young

Content

Many plants begin their life as a seed. The seed develops and grows into a seedling. The seedling grows and develops into a mature plant bearing flowers.

Animals undergo changes as they grow and mature into adults.
Stages in development of:

Human	Baby	Infant	Child	Adolescent	Adult
Birds	Eggs	Chicken	Adult bird		
Fish	Egg	Fry	Adult		
Amphibians (Frogs)	Egg	Tadpole	Adult		

Insects (Butterfly)	Egg	Larva	Pupa	Adult
(Cockroach)	Egg	Young Adult (Nymph)	Adult	
Spiders	Egg	Young adult	Adult	

Activities

Activity 1

- Field trip to a farm/agricultural station/zoo to observe plants and animals at different stages of development.
- Collection of pictures depicting different stages of development of animals and plants at different stages of development.

Activity 2

- Let students collect plants at different stages of development.
- Allow students to arrange pictures from the seed stage to the mature plant.

Activity 3

- Let students collect animals at different stages of development e.g. leaves with insect eggs; caterpillars, cocoons, adult butterflies and moths; frog's eggs and tadpoles; Jack Spaniard nests: mosquito larvae, etc.

Activity 4

- Allow students to arrange pictures of animals from the youngest to the mature stage. Let them talk about the animals and let them name the different stages of development.

Activity 5

- Provide students with play dough and have them make models of different animals at different stages of development e.g. eggs, tadpoles, insects.

Activity 6

- Read stories/poems to students. Stories could involve animals and their young; a young animal growing up. N.B. *Stories must relate to the objectives.*

Assessment

- Let students match pictures of animals and their young.
- Let students look at pictures of animals and their young and identify which animals have young ones that look like their parents and which ones do not.

S t r u c t u r e a n d f u n c t i o n

M o d u l e 2

G r a d e s 3 - 4

GENERAL OBJECTIVES

The students should be able to:

1. Identify different methods of reproduction among plants in the environment.
2. Understand the importance of growth, development and reproduction in plants and animals.
3. Identify parts of plants and animals and relate them to their function.
4. Understand that technology can be utilized in growth and propagation of plants (grafting, fertilizers, pruning).
5. Appreciate the importance of plants to humans.

SPECIFIC OBJECTIVES

The students should be able to:

1. Describe the physical structures of the main parts of plants.
2. Relate the features of these external structures of plants to their function.
3. Discuss the uses of plants to humans.
4. State the conditions necessary for germination in plants.
5. Observe and describe the stages in the process of growth in plants.
6. Discuss the importance of growth, development and reproduction in plants and animals.
7. State the various ways in which technology is utilized in growth and propagation of plants.
8. Explain the effects of technology on growth and propagation in plants.
9. Describe the external structures of animals.
10. Relate the features of these structures to their function.

**LEVELS OF ATTITUDES, SKILLS & TECHNOLOGY EXPECTED AT
GRADES 3 - 4**

ATTITUDES:

Students should be encouraged to:

Curiosity:	✓ Ask questions about objects and events. ✓ Find out more about events and objects on their own.
Inventiveness:	✓ Suggest new ways of doing things. ✓ Use equipment in novel ways.
Respect For Evidence	✓ Explain their results and conclusions using some evidence. ✓ Listen to other students' results and explanations. ✓ Begin to recognize when conclusions do not fit the evidence.
Persistence	✓ Complete activities. ✓ Persist at tasks.
Respect For Living Things	✓ Show sensitivity to living things.
Cooperation	✓ Share with others. ✓ Work together with others. ✓ Accept responsibilities.
Concern For Safety	✓ Observe safety instructions.

SKILLS

SKILLS: In developing their skills of inquiry, problem solving and design, the students are expected to:	
Observing	✓ Use as many senses as are appropriate and safe to gather information. ✓ Identify differences and similarities between objects and events. ✓ Identify sequence in events.
Measuring	✓ Use simple measuring instruments or models of measuring instruments. At first use comparative terms such as bigger, smaller and later use actual figures.
Manipulating	✓ Set up simple experiments to compare results. ✓ Manipulate simple equipment.
Recording	✓ Use pictures and charts to report results. ✓ Fill out simple tables to report results.
Classifying	✓ Group objects according to several criteria.
Communicating	✓ Talk freely about their activities and the ideas they have, with or without making a written record. ✓ Use appropriate vocabulary to describe their observations. ✓ Listen to others' ideas and look at their results. ✓ Report events by using demonstrations, role play, simple drawings, paintings and paragraphs. ✓ Use bar graphs, pictures, tables and charts to report results. ✓ Use books and other sources to find information.

SKILLS CONT'D

Inferring	✓ Notice patterns and relationships in simple measurements and events.
Interpreting data	✓ Discuss what they find out in response to questions. ✓ Compare their findings with their predictions. ✓ Notice changes when one variable is changed.
Experimenting	✓ Freely ask a variety of questions and suggest how they might be answered. ✓ Suggest how they could investigate to find out answers to questions. ✓ Have some idea of the variable that has to be changed or what different things are to be compared in an investigation. ✓ Suggest equipment, materials and procedure for conducting investigations.
Predicting	✓ Attempt to use evidence in making predictions
Hypothesizing	✓ Attempt to explain things that are consistent with evidence. ✓ Suggest how something may have happened.
Problem Solving	✓ Suggest solutions to simple problems.
Designing	✓ Construct models either by following instructions or by using their own designs. ✓ Select appropriate material to make models and gadgets. ✓ Formulate problems, do appropriate research, and devise solutions. ✓ Select appropriate material to make models and gadgets. ✓ Evaluate their own designs using simple criteria.

TECHNOLOGY

Technological Methods	✓ Students will be able to formulate problems, do appropriate research and devise solutions (e.g. construct gadgets).
Nature Of Technology	✓ Look at past inventions in their historical context. ✓ Understand that products are replicable. ✓ Understand that others may be working on the same idea. ✓ Realise that <i>they can use scientific knowledge in doing</i> technology and that technology helps to develop reliable scientific information. ✓ Understand the importance of precision and safety in developing new products. ✓ Understand that technology is novel and creative. ✓ Understand that if the people in a country are creative and innovative, their country can progress. ✓ Understand that people use processes involving living things (Biotechnology) and materials (Production Technology) to satisfy their needs.
<u>Use Of Technology</u>	✓ Appreciate the use of devices, tools and structures made by humans in the home and community. ✓ Appreciate the advantages of using these products. ✓ Realize that human-made things can pollute the environment. ✓ Look at advantages and disadvantages to help them make decisions of what is the best technology that can be used in a particular situation. ✓ Realize that people may abuse and misuse technology. ✓ Understand that technology may have unintended consequences.

Unit: structure and function (grade 3)

Topic: Plants: Their Structure and Uses

Duration: 10 Lessons (30 minutes each)

Specific Objectives

Students should be able to:

1. Describe the physical features of the main parts of plants.
2. Relate the features of these external structures of plants to their function.
3. Discuss the uses of plants to humans.

Processes

Observing
Communicating
Inferring
Classifying

Materials

Variety of leaves, flowers, fruits
Pictures of various plants
Charts showing a variety of leaves, flowers, fruits
Samples of modified roots and stems
Encyclopaedia
Storybooks
Worksheets

Content Summary

The main parts of a plant are the leaves, stem, root, flowers, and fruits.

Leaf Colour –green - to help the plant make food
Shape – thin and flat – large surface area to trap sunlight
Veins - numerous – to transport water and food

Stem Rigid – to support leaves and fruits. Large trees have large stems called trunks. Therefore, a large tree has a hard, woody stem

Stems are normally above the ground. Some stems are found underground. e.g. underground stems are dasheen, eddoes,

arrowroot, Irish potato, ginger, tannia, yam.

Root Branched, long and numerous – to provide support and anchor the plant firmly in the soil; roots absorb water from the soil. Some roots are swollen and serve as storage organs for food e.g. carrot, sweet potato, cassava.

Flowers Brightly coloured and scented – to attract birds and insects
They vary in size, shape, colour, texture and smell.
Flowers develop into fruits.

Fruits Vary in shape, size, texture, colour, scent; these features allow the fruits and seeds to be dispersed.
Fruits contain seeds.

Uses of Plants

Humans use plants in various ways:

- Food - for humans and other animals
- Shelter/buildings –e.g. lumber and branches
- Medicine – e.g. herbal/non-traditional and traditional
- Aesthetics (Decoration) e.g. ornamental flowers, shrubs, wood carvings
- Furniture
- Jewellery e.g. earrings and bracelets
- Art and craft – e.g. Banana art, baskets, mats,
- Clothing e.g. cotton
- Manufacture - paper and its products
- Fuel

Activities

- Take students on nature walks to observe the variety of plants and trees in the environment. Focus their observation on the physical appearance of the stem/trunk, leaves and flowers and fruits.
- Collect sample of plants, leaves, flowers and fruits.
- Encourage students to collect samples of plants, leaves, flowers, and fruits.
- Let students orally describe the physical structures of the leaves, stem, flowers, fruits, and roots.
- Prepare work sheets for students to record observations.
- Let students do a literature search to collect information on plants and parts of plants.
- Read stories which contain information on plants and plant parts

- Games
 - Guessing games/Riddles
 - E.g. *Who Am I ?*
Green and flat
Round or Long
I make food by day
And rest by night
- Trace the origin of items found around the home and in the classroom, e.g. baskets, mats. Students should be able to infer the different uses of plants to humans.
- Class discusses the uses of plants.
- Interview gardeners/farmers to obtain information on plants.
- Students do literature search to obtain information on 'Famous trees' e.g. the tallest tree, oldest tree, national trees, trees of historical significance (nationally, regionally or internationally).
- Visit a Botanical Garden to observe and collect information on plants/trees of national significance.
- Invite farmers/agricultural officers/gardeners to talk about trees/plants in the environment/on farms.

Assessment

- Games - Guessing games; puzzles, Find-a-Word
- Paragraph writing e.g. *My Favourite tree, My Favourite flower*
- Matching items e.g. structure and function
- Completion-type items

Unit: s t r u c t u r e a n d f u n c t i o n (g r a d e 4)

Topic: Growth and Development in Plants and Animals

Duration: 15 Lessons (30 minutes each)

Objectives

Students should be able to:

1. State the conditions necessary for germination in plants.
2. Observe and describe the stages in the process of growth in plants.
3. Discuss the importance of growth, development and reproduction in plants and animals.
4. State the various ways in which technology is utilized in growth and propagation in plants.
5. Describe the external structure of animals.
6. Relate the features of these structures to their function.

Process Skills

Observing
Measuring
Communicating
Inferring

Content Summary

Conditions necessary for germination are suitable temperature/warmth, air/oxygen, moisture/water.

Stages in the process of growth:

Seed	Takes in water and becomes swollen and soft Young root (radicle) emerges and grows down Young shoot (plumule) emerges and grows up Cotyledons (food store) decrease in size as food is used up
Seedling	Young shoot elongates and develops new leaves Root system extends and roots become more numerous, more branched and longer

Mature plant stem increases in rigidity, branches develop

Leaves increase in size and numbers
Root system becomes fully developed
Flowers are produced

Growth and development in plants is a continuous process. Growth ensures the replacement of plant parts. (e.g. leaves and branches and storage organs and fruits).

Growth and development are essential to complete the life cycle of plants. Reproduction continues throughout the life of a mature plant. Reproduction is important for the production of new plants.

Technology is utilized in several ways in enhancing growth and propagation of plants.

- Addition of fertilizers Increase in size of parts (fruits, leaves, plant size)
- Greenhouses Ensure year-round supply of seasonal plants and fruits
 Allow for plant growth in otherwise unfavourable conditions
- Grafting Produces new and improved varieties
 Maintains quality control
 Increases yield of plant
- Pruning Reduces or eliminates parts and improves food production
- Tissue culture Increases volume and reduces growth time
 Controls undesirable traits
 Conserves food since less of the storage organs are used up to produce new plants
- Creating hybrids Produce new varieties of greater yield and that are disease resistant
- Irrigation Provide suitable growth conditions in otherwise unsuitable areas
- Mechanization Ploughing to increase aeration of soil
- Addition of plant growth hormones Speeds up growth and development of plants

External structures in animals

N.B. Objectives 5 & 6 deal with external features of animals that pertain to movement, response and feeding as the body parts/organs/tissues involved in other life processes are for the most part not visible externally.

Structures in Mammals (Humans)

- Limbs long; provide points for muscle attachment to bring about movement. The longer the bones, the greater the degree of movement.

- Feet Flat; enhances balance and is the area of contact with surface.
- Eyes Transparent at the front to allow light to pass through.
- Ears Pinna/ear lobe traps sound waves and directs them internally.
- Nose Lined with hairs to trap particles; openings allow for entry and emission of air.
Position of nose – aligned parallel to body. This prevents easy entry of foreign objects.
- Skin Continuous layer over entire body. It serves as a barrier between organism and its environment. It allows for direct contact of body with the surroundings. This allows for quick detection and response. (Heat and force).
- Mouth Opens and closes to allow for intake of food. Contains teeth.
- Teeth Bite and crush food; physically break down food.

Structures in Birds

- Wings Modified for flight.
- Feathers Light to allow for easy movement.
- Beak Various shapes and sizes. (Shape of beak and size of beak depend on diet).
- Legs With claws for gripping. Claws may be webbed for swimming. Length of leg on depends where the bird lives and how it feeds.
- Eyes Position depends on feeding habits and reaction time and the need to respond to events in the environment. (Compare the hawk and the pigeon).

Structures in Fish

- Scales Outer body covering; overlapping and waterproof. Provides protection against predators and environmental conditions.
- Eyes Positioned so as to allow for wide field of vision and quick response. Lidless. Flat and horny to avoid damage by objects in the water.
- Tail and fins For movement in water and for balance.
- Mouth Open and close – allow for intake of food and water.

Structures in Reptiles

- Scales Outer body covering for protection against predators and environmental conditions.

- Limbs With claws for gripping.
- Claws With sticky pads for clinging to surfaces.
- Tail For balance and defence.
- Fangs Present in some reptiles for defence and seizure of prey.
- Shell Present in reptiles such as turtles and tortoises – provides additional protection.
- Mouth Can open wide with teeth and tongue.
- Tongue Broad and sticky for easy capture of prey.
- Eyes Positioned to allow for wide field of vision.

Structures in Amphibians (Frogs and Toads)

- Limbs Hind limbs longer, more developed and larger than front limbs – modified for jumping.
- Eyes Positioned high on head providing wide field of vision to allow for quick detection of movement.
- Mouth Very wide with a long sticky tongue attached to front lower jaw ; allows for quick capture of food.
- Germination is the process in which a seed starts to develop into a young plant or seedling.
- The three main conditions for germination are air, moisture and a suitable temperature.
- A seedling undergoes changes and grows and develops into a mature seed bearing plant.
- Animals also undergo changes in size, mass and physical appearance as they mature into adults.
- Growth and development are important processes in the lives of plants and animals.
- Technology is being used in various ways to influence growth and development in plants. In all instances it is always for Man's benefit.
- There are a wide variety of physical structures among the five classes of vertebrates.
- These differences are related to differences in habitat, feeding habits and their types of movement.

Activities

Plants

- Teacher and students may set up experiments to investigate the conditions necessary for germination.
- Let students observe plant growth over an extended period of time e.g. wet and dry seasons.
- Let students observe growth in plants with short life cycles e.g. beans, corn, balsams, ochroses, sunflower, daisies.
- Let students observe a plant, e.g. coconut or corn, at various stages of development.

- Observe several different plants in nature at different stages of development. For each plant let students note differences in changes in size of parts, e.g. size of stem, presence or absence of flowers and fruits. Record observations and infer the importance of growth and development of a plant.
- Visit a farm to observe plants at different stages of development.
- Visit a market to identify different produce/items. Let students identify the source of these items.
- Visit to an agricultural/experimentation station and/or botanical gardens to observe plants and animals at different stages of development.
- Let students search to obtain information on growth and development in selected plants.
- Interview farmers/Agricultural officers/Forestry officers to obtain information on selected plants.

Animals

- Outdoor visits- school yard/farm/zoo/ rivers/ponds (places where animals can be found) for students to observe variety of animals.
- Let students record physical appearance and note external structures and let them state the functions of the structures observed.
- Have discussions to relate structure to function.
- Interview personnel on visits so as to obtain information on external features and their significance.
- Let students collect photographs/pictures of animals and have class discussions on prominent external features.
- Let students view videos/television programmes on animals looking at external features
- Let students search to obtain relevant information on external structures of selected animals.
- Storytelling/Poetry reading looking at animals.

Assessment

- Case Studies e.g. Let students observe an animal (e.g. parrot, lizard, frog, fish). Let students record observations. Let students relate observed structures to function in the animal.
- Short descriptive paragraphs on named animals.
- Poetry writing on chosen animals.
- Written report on visits made or interviews conducted.
- Record observations using drawings.
- Completion type items.
- Matching items e.g. matching body part to named animals.
- Sequencing diagrams of a germinating seedling in the correct order.

S t r u c t u r e a n d f u n c t i o n

M o d u l e 3

G r a d e s 5 - 6

GENERAL OBJECTIVES

The students should be able to:

1. Identify the structure and function of the major systems of plants and animals.
2. Describe the function of the major systems of plants and animals.
3. Appreciate the importance of technology in the function of the major systems in human beings.

SPECIFIC OBJECTIVES

The students should be able to:

1. State the major systems in animals (Digestive, Muscular, Circulatory/Transport, Reproductive, Excretory, Respiratory, Nervous, Endocrine and Skeletal).
2. Identify the functions of each major system in animals.
3. State that the Transport system is a major system in plants.
4. List the main parts of each system in animals.
5. Describe the function of each part of the i. Digestive ii. Circulatory iii. Reproductive iv. Skeletal systems in humans.
6. Construct models of the various systems in humans.
7. Name the main parts of the Transport system in plants.
8. Describe the function of the main parts of the Transport system in plants.
9. Identify technology utilized in the various systems in humans.
10. Construct models of technological devices that are used in the various systems in humans.

LEVELS OF ATTITUDES, SKILLS & TECHNOLOGY EXPECTED AT GRADES 5 - 6

ATTITUDES:

Students should be encouraged to:

Curiosity:	✓ Ask questions about objects and events. ✓ Find out more about events and objects on their own.
Inventiveness:	✓ Suggest new ways of doing things. ✓ Use equipment in novel ways.
Respect For Evidence	✓ Use evidence to justify their conclusions. ✓ Listen to other students' results and explanations. ✓ Recognize when conclusions do not fit the evidence. ✓ Change their ideas in response to evidence. ✓ Point out contradictions in reports by their classmates. ✓ Show a willingness to review procedures and evaluate their work.
Persistence	✓ Complete activities. ✓ Persist at tasks. ✓ Repeat experiments when previous attempts have failed.
Respect For Living Things	✓ Show sensitivity to living things.
Cooperation	✓ Share with others. ✓ Work together with others. ✓ Accept responsibilities.
Concern For Safety	✓ Observe safety instructions.

SKILLS

SKILLS: In developing their skills of inquiry, problem solving and design the students are expected to:	
Observing	✓ Use as many senses as are appropriate and safe to gather information. ✓ Identify differences and similarities between objects and events. ✓ Identify sequence in events. ✓ Distinguish from many observations those that are relevant to an investigation.
Measuring	✓ Use simple measuring instruments or models of measuring instruments. ✓ Use units in measurement.
Manipulating	✓ Set up simple experiments to compare results. ✓ Manipulate simple equipment.
Recording	✓ Use pictures and charts to report results ✓ Fill out simple tables to report results.
Classifying	✓ Group objects according to several criteria.
Communicating	✓ Talk freely about their activities and the ideas they have, with or without making a written record. ✓ Use appropriate vocabulary to describe their observations. ✓ Listen to others' ideas and look at their results. ✓ Write reports on their investigations. ✓ Use bar graphs, pictures, tables and charts to report results. ✓ Regularly and spontaneously use books and other sources to check or supplement investigations. ✓ Select appropriate methods to report events. Include drawings, reports and multi-media.

SKILLS CONT'D

Inferring	✓ Notice patterns in data. ✓ Draw reasonable conclusions from data.
Interpreting data	✓ Discuss what they find out in response to questions. ✓ Compare their findings with their predictions. ✓ Make associations with change in variables and results.
Experimenting	✓ Freely ask a variety of questions and suggest how they might be answered. ✓ Formulate problems to be investigated. ✓ Suggest how they could investigate to find out answers to questions. ✓ Plan to conduct investigations. Select equipment, materials and procedures for conducting investigations. ✓ Understand what is a fair test. ✓ Keep appropriate variables constant and vary the independent variable in experiments.
Predicting	✓ Use evidence in making predictions. ✓ Show how they have used evidence in making predictions.
Hypothesizing	✓ Attempt to explain things that are consistent with evidence. ✓ Suggest how something may have happened
Problem Solving	✓ Suggest solutions to simple problems. ✓ Identify needs, formulate questions, conduct research and design solutions to problems.
Designing	✓ Construct models either by following instructions or by using their own designs. ✓ Select appropriate material to make models and gadgets. ✓ Formulate problems, do appropriate research, and devise solutions. ✓ Select appropriate material to make models and gadgets. ✓ Evaluate their own designs and the designs of others using simple criteria.

TECHNOLOGY

Technological Methods	✓ Students will be able to formulate problems, do appropriate research and devise solutions (e.g. construct gadgets).
Nature Of Technology	✓ Look at past inventions in their historical context. ✓ Understand that products are replicable. ✓ Understand that others may be working on the same idea. ✓ Realise that <i>they can use scientific knowledge in doing technology</i> and that technology helps to develop reliable scientific information. ✓ Understand the importance of precision and safety in developing new products. ✓ Understand that technology is novel and creative. ✓ Understand that if the people in a country are creative and innovative, their country can progress. ✓ Understand that people use processes involving living things (Biotechnology) and materials (Production Technology) to satisfy their needs.
<u>Use Of Technology</u>	✓ Appreciate the use of devices, tools and structures made by humans in the home and community. ✓ Appreciate the advantages of using these products. ✓ Realize that human-made things can pollute the environment. ✓ Look at advantages and disadvantages to help them make decisions of what is the best technology that can be used in a particular situation. ✓ Realize that people may abuse and misuse technology. ✓ Understand that technology may have unintended consequences.

Unit: structure and function (grade 5)

Topic: How Plants and Animals Co-ordinate Internal Functions

Duration: 15 Lessons (30 minutes each)

Specific Objectives

1. State the major systems in animals (Digestive, Circulatory/Transport, Reproductive, Excretory, Respiratory, Skeletal, Nervous and Endocrine, Muscular).
2. Identify the functions of each major system in animals.
3. List the main parts of each system in animals.
4. Describe the function of each part of i. Digestive
ii. Circulatory/Transport iii. Reproductive iv. Skeletal systems in humans.
5. State that the Transport system is the major system in plants.
6. Name the main parts of the Transport system in plants.
7. Describe the function of the main parts of the Transport system in plants.

Process Skills

Observing
Communicating
Classifying
Inferring

Content Summary

Major systems in animals are:

- **Digestive System** - breaks down food into smaller particles that can be used by the body. It consists of a modified tube running from mouth to anus.
Food is taken in at the **Mouth**. The mouth contains specialized devices (teeth and/or fangs) for seizing and breaking/cutting food into smaller pieces. The **Stomach** is a sac-like structure containing chamber(s) where chemical substances are added to aid in the break down of food.
Additional chambers may be present where food substances are absorbed. Undigested food particles are egested through the anus.

- **Circulatory/Transport System** - moves substances around the body. It consists of tubes containing a fluid and pumping device. This device keeps the fluid circulating throughout the body.
- **Reproductive System** - enables the production of new offspring. It consists of specialized organs that produce special reproductive cells or gametes. (Female cells /Eggs/ova and male cells/spermatozoa). Specialized structures are present. These structures function to bring the two types of specialized eggs together in fertilization.
- **Excretory System** - this system gets rid of waste substances from the body.
- **Respiratory System** - this provides for the entry and exit of gases from the body.
- **Nervous and Endocrine Systems** - the Nervous system receives and responds to changes in the environment. The sense organs form part of the nervous system. The Endocrine system regulates the function of the body.
- **Muscular systems – the muscular system consist of all the muscles of the body. Muscles move bones and other parts.**
- **Skeletal System** - this system provides support for the body and enables movement of parts or of the whole organism. It also protects the body's internal organs. There are 3 major types of skeletal systems. These are **i. Hydrostatic skeleton, ii. Endoskeleton, iii. Exoskeleton.**

Hydrostatic skeletons are characteristic of soft bodied animals e.g. earthworms. They consist of fluid filled tube surrounded by muscles. The fluid in the tubes maintains body form.

Exoskeleton in invertebrates e.g. insects and crustaceans, consists of a material, **Chitin**. This material may be thick and hard over some parts and thin and flexible over other parts, e.g. joints. Muscles are attached to the inside of the skeleton. This type of covering can be distinguished from the shells of mollusks, e.g. snails, which only serve for protection.

Endoskeleton is situated internally. It consists of bones and cartilage to which muscles are attached.

Human beings

The longest bone in our bodies is the **femur** (thigh bone). The smallest bone is the stirrup bone in the middle ear. The skeletal system consists of the bones of the body. Some bones serve to protect internal organs e.g. the skull protects the brain, the rib encase the heart and lungs, the backbones protect the spinal cord.

Joint - place where two bones meet. There are moving joints and fixed ones. For example moving joints are elbow and knee. Fixed joints are skull.

Major Bones and Their Function in Humans

Skull

- ?Made of upper skull and jaw bone
- ?Protects the brain, eyes, ears, and nose
- ?Connected to the top of the spine

Spine

- ?33 linked bones separated by discs of cartilage (shock absorbers)
- ?Helps to keep you upright
- ?Tunnel runs down middle contains spinal cord that sends messages between the brain and the body.

Rib Cage

- ?Usually 12 pairs of ribs
- ?Linked to vertebrae and sternum
- ?Protects heart, lungs, and other internal organs

Arms and Hands

- ?Clavicle, shoulder blade
- ?Upper arm (humerus)
- ?Lower arm (radius, ulna)
- ?27 bones in wrist and hands

Pelvis

- ?Supports the spinal column.
- ?Acts as a tough ring of protection around parts of the digestive system, the urinarysystem, and parts of the reproductive system.

Legs

- ?Connected to pelvis
- ?Upper leg (femur)
- ?Kneecap (patella)
- ?Lower leg (tibia-shinbone, fibula)
- ?Help with movement

The **Transport** system is the only system in plants that is well developed. It consists of a series of tubes and vessels. The **Xylem** conducts water and dissolved minerals from roots to all other parts of the plant. The **Phloem** conducts food from the leaves (site of production) to all parts of the plants including storage organs.

Activities

Animals

- Present models of the various systems and have students identify and name the various parts.
- Present pictures/diagrams of the various systems using overhead projector or LCD projectors.
- Let students view various systems and/or parts of systems using Bioviewers.
- Present preserved specimens of systems and/or parts of systems and let students identify them.
- Discuss the structure and function of the various parts of the systems/parts identified.
- Let students draw and label diagrams of the various system and/or parts.
- Present charts with illustrations of the various systems and let students identify and name the various parts.
- Let students search to obtain information on the various systems and their functions.

Plants

- Perform activities using entire transparent plants e.g. balsam, to demonstrate movement of water in plants.
- Present charts illustrating transport system in plants and state the functions of the various systems identified.

Assessment

Let students label a given diagram of the various systems

- Construct clay models of various parts of given systems e.g. heart, tooth, bone, stomach.
- Let students assemble given parts of a system to make the system.
- Ask students to match items e.g. i. Structure to function
ii. System to function
iii. Parts to system.
- Let students write a short report/story on a given system.
- Games e.g. *Who Am I?* Looking at features of a system or parts of a system.

- List ten major bones in the body and state where they are found.
- Label a diagram of the skeleton.
- Explain the differences between moveable joints and fixed joints.

Unit: structure and function (grade 6)

Topic: Technology and Human Systems

Duration: 8 Lessons

Objective

Students should be able to:

1. Construct models of the various systems

Process skills

Observation, Communication, Space-time Relations

Materials needed

Play dough
Styrofoam
Plastic bottles
Twine or wire
Diagrams of the various systems
Bottle caps, cups, buttons, etc
Plastic bags

Content summary

Review content material covered in previous lessons re: the respiratory, digestive, reproductive and skeletal systems.

Suggested Activities

Get students to create models of the various systems covered in previous lessons, using clay, play dough, styrofoam, recyclables, food, etc. Students can also be asked to create parts of a system. For example, students can create the digestive tract from play dough, tubing and plastic bags, using different coloured play dough to indicate different parts of the digestive system.

Before each model is made, review the function of the major parts of the respective system by placing a chart on the chalkboard and questioning the students.

Divide the class into groups; give each group a diagram of the respective system, materials and instructions on how to make the model of the system. Ensure that students do not waste a lot of time on each model. Students may label their models by sticking pins or toothpicks with labels attached to them.

Assessment

Marks may be awarded for each model made. Students may also be asked to explain how their models were made. In addition as a review exercise, students may be asked to state the function of each part of the system under review. To make the exercise more fun, students may be asked to write songs or poems about the various systems.

Objective

Students should be able to:

Identify technology utilized in the various systems in humans.

Process skills

Observation, Communication, Inference

Materials Needed

Actual example or pictures of a clinical thermometer, stethoscope, x-ray pictures, sonograph, digital blood pressure machine, and sphygmomanometer.

Content summary

Different technologies are utilized in studying the systems of the human body. Some of these technologies are listed below.

Stethoscopes are used to hear sounds generated from within the body. They are used to listen to the heart, lungs and intestinal tract. They are also used for measuring blood pressure.

The most common use of x-rays is in medicine and dentistry. X-rays are used to examine inside the body to try to see if there is anything abnormal. Broken bones, cancerous growths, and tooth decay are some of the problems that can be detected by an x-ray of a person.

Blood pressure can be measured either by using a machine called a sphygmomanometer or by using an automatic machine. A sphygmomanometer is an instrument that measures blood pressure using a column of mercury. There are also automatic digital machines that can measure blood pressure.

Ultrasound or sonography is a technique that uses sound waves to study and treat hard-to-reach body areas. In scanning with ultrasound, high-frequency sound waves are transmitted to the area of interest and the returning echoes recorded. Ultrasounds are used to study the development of the foetus, detect heart damage and to heat joints, relieving arthritic joint pain.

Clinical thermometers are used to measure body temperature. They tell us if our temperature is normal, above normal, or below normal.

An endoscope is an instrument that allows a doctor to view the inside of the body such as the stomach, without making any surgical incisions. A long, flexible, lighted tube with a camera at one end is put down the patient's throat. Images are then projected to a TV monitor.



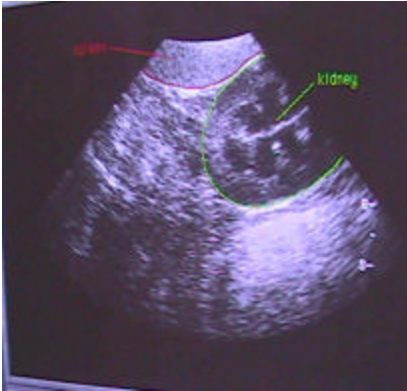
Digital blood pressure machines



Sphygmomanometer



Clinical thermometer



Sonograph of a fetus



X-ray of the ribs



Stethoscope

Suggested Activities

Have a round-robin display of pictures/actual specimens of different technology gadgets around the class. Walk the students through the different displays, by explaining what each is, what it is used for and why it is important.

Invite a health worker in to demonstrate the use of the sphygmomanometer, stethoscope and clinical thermometer.

Ask the health worker to take the blood pressure of some of the students.

Assessment

1. Word-find of the names of the various instruments studied.
2. Students match instruments with their use.
3. Students state the function of the various instruments.
4. Students demonstrate the use of the stethoscope/clinical thermometer.

Objective

Students should be able to:

Construct models of technological devices that are used in the various systems in human.

Process skills

Communication, Measurement, Inference.

Materials Needed

Sticks
Wire
Tape
Straws
Alcohol
Modelling clay
Plastic bottles
Red food colouring
Rubber tubing
Paper clips
Bottle caps
Cardboard tubes from a paper towel roll

Content summary

Review content material covered in previous lessons re: technology utilized in the various systems in human

Activities

Let students construct models of a stethoscope, a thermometer, an endoscope and a sphygmomanometer, using their previous knowledge and the materials listed above. These models do not have to be working models.

Before each model is made, review the function of the major parts of the respective system by placing a chart on the chalkboard and questioning the students.

Divide the class into groups; give each group a diagram of the respective device, materials and instructions on how to make the model of the device. Ensure that students do not waste a lot of time on each model.

Students can create the stethoscope from cardboard, tubes, and plastic bags, or they can construct a thermometer from a straw, alcohol, modelling clay and a plastic soft drink bottle.

Using the homemade stethoscope, let the students pair off and listen to their partner's heartbeat by placing the tube over the partner's heart. They then count the number of beats per minute. Let one partner run for one minute, and then listen again. Let the students write down what they hear and calculate the new beats per minute. After five minutes let the partners switch places and do the exercise again.

Assessment

Marks may be awarded for each model made. Ask students to demonstrate their models. Also students can explain how their models were made. In addition, as a review exercise, students may be asked to state the use of each device made. To make the exercise more fun, students may be asked to write instruction leaflets for use with their models.

Integration

Art and Craft – the actual making of the models

Music (songs about the devices)

Literacy – description of the various models made

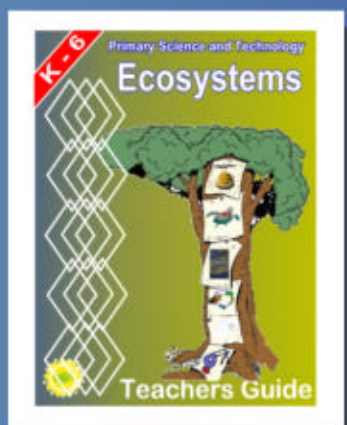
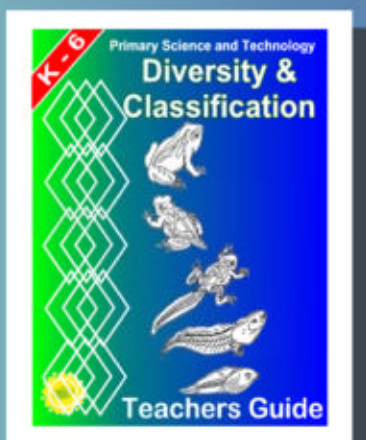
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