Science / Mathematics Strand
Science

Unit SM: Teaching Constructively

Module SM 2 – Teaching Strategies
Module SM 3 – Planning Lessons

Student Support Material

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Unit outline

(Based on the National Curriculum Guidelines)

Unit	#	Modules
Unit SM **Teaching Constructively**	**SM 1**	**The Nature of Learning (Core)**
	SM 2	**Teaching Strategies (Core)**
	SM 3	**Planning Lessons (Core)**

Icons

Read or research

Write or summarise

Activity or discussion

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Unit Overview

This unit *Teaching Constructively: In Science, Health and Physical Education* is studied to provide students with the opportunity to engage children in science learning and teaching. The core module is The Nature of Learning (in science, health and physical education). The module is studied for the first five weeks to provide a foundation for the development of strategies to cater for children with different abilities and background knowledge. The basic principles are applicable to science, health and physical education. This unit should be studied in the second year of teacher training and before the first major practice teaching block.

Why study this unit?

This methods unit prepares trainee teachers to understand the nature of children learning in the subject areas of science, health and physical education. Through classroom observation and research, student teachers will become aware of the impact of prior knowledge and beliefs on learning. This understanding will be applied to the planning of lessons through a constructivist teaching approach. Students will gain experience in designing and implementing lesson plans that reflect the constructivist approach. The lesson plans will include clear objectives, logical sequencing of concepts, teaching strategies, questioning techniques, learning activities as well support materials such as teaching aids. This unit will guide and prepare trainee teachers to teach effectively and critically evaluate their teaching through both peer and self-evaluation techniques.

Aims and objectives

On completion of this unit you should be able to:

- Outline the aims of teaching in terms of knowledge acquisition processes
- Describe and apply constructivist methodology to the preparation of teaching sequences
- Plan lessons to cater for individual differences;
- Prepare and use resources for science, health and physical education lessons
- Implement lessons effectively
- Evaluate individual lessons
- Critically review your own and peers' teaching practices

Content (Modules)

Module SM1: The nature of learning

Nature of learning in science, health and physical education; Aims of education; attitudes, processes and knowledge.

Identifying children's ideas and misconceptions; contemporary perspectives on learning; constructivist teaching and learning models.

Module SM2: Teaching strategies

Mapping and sequencing concepts; selecting activities and resources; Teaching strategies: Questioning; co-operative inquiry; teacher and text centred teaching; catering for individual differences and gender in the science classroom; activity based teaching;

Module SM3: Planning lessons

Models for lesson plans; planning lessons for science, health and physical education; creating an efficient activity-based learning environment; micro-teaching and peer evaluation.

Approaches to teaching and learning

This unit will be presented through a course of lectures closely integrated with workshops, tutorials and teaching practice providing maximum opportunity for group discussion and peer interaction. A cooperative learning environment together with independent assignments will provide opportunity for development and reinforcement of effective teaching skills in science, health and physical education. Students will be given opportunities to apply fundamental concepts, processes and skills to teaching. Extra time is necessary to succeed in these studies. Students should make time to review the class work each day and to complete tutorials and other assigned exercises. Notes and readings will be provided for this unit.

Assessment

Three assessment tasks must be completed for this unit. The three modules are developmental therefore the major weight of the assessment will relate to Modules MS2 and MS3. The unit outline includes detailed criteria and weightings for each task. Students will be provided with formative feedback throughout the study of this unit. The assignment tasks will be summative. However, students who fail to satisfy the criteria will be able to resubmit Assignments 1 and 2 after consultation with the lecturer. Micro-teaching will be assessed by lecturer, peer and self evaluations.

Assignment 1 (Module SM1)

Prior beliefs in concepts in science, health and physical education

Assignment 2 (Modules SM1, SM2 and SM3)

Preparation of teaching sequences and lesson plans for topics from primary Syllabus

Assignment 3 (Modules SM1, SM2 and SM3)

Strategy micro-lesson presentation - in one chosen area (evaluation and reflection)

Generic skills

Throughout the teaching of this unit there will be an emphasis on methodologies relevant to primary teaching in PNG including application of knowledge to problem solving, the

importance of language transition within the subject area, gender sensitivity and inclusive approaches to teaching and materials, and the provision for access by students with learning difficulties and/or physical disabilities. Opportunities to experience and access current technological aids and instruments associated with the discipline area will also be provided wherever possible to increase technological literacy.

References

Support materials

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Module SM2: Teaching Strategies

Textbook or curriculum developers often adopt a single approach as the standard to teaching science. This approach ignores that:

1. Teachers operate differently because of the different capabilities and
2. Children learn in different ways and at different paces, and learn better when different teaching strategies are used.

There are different approaches to teaching science. Four types of teaching strategies are identified:

Teaching approach	How is this approach applied?
Expository	• The teacher exposes his/her knowledge and understanding to children in the class. This is sometimes referred to as the **transmission approach.**
Discovery	• The children are asked or given opportunities to discover for themselves, rather than be told facts about scientific phenomena. • The teacher predetermines or guides the answers so children come to a desired understanding.
Process	• Nearly all science experiments focus on science processes. • The primary objective of science activities is to develop the children's' competence in the use of science processes.
Interactive	• The teacher interacts with children by asking questions, answering children's' questions, helping children set up experiments, assisting and guiding children in various ways to make learning possible

☞ Activity 2.1 Identify teaching approaches

Try to identify types of teaching approaches in the sample lesson plans in Appendix 1.

Concept mapping

There are well documented steps in planning for and achieving a constructivist approach to classroom teaching.

A concept map is a visual illustration of the main ideas that provide insight into sequencing and planning instruction. A concept map shows hierarchical relationships and how the various subordinate (dependent) concepts are related to the superordinate (major) concepts.

Concept mapping is one of the most important steps to take while deciding what to include in a curriculum, unit or lesson plan. Clear concept mapping will help to predict and avoid possible student misunderstandings or misconceptions. Without concept maps, teachers choose to teach what they remember or what they prefer. A disadvantage in this teaching approach, without proper sequencing, is that learners fail to receive new meaning because they cannot link the new ideas or concepts with what they have previously learned. As a result learners may resort to memorising isolated facts and treating the experiences and ideas with less understanding than teachers intend.

The steps for developing a concept map

A concept map can be developed for the entire course for a year, semester, for a single unit or even a single lesson. The following steps are recommended:

1. List on paper all the concepts that are related to a topic that you (the teacher) are going to teach. (Only the names are needed at this stage).
2. Note any specific prior knowledge or concepts that are essential for students to understand before studying the topic.
3. From the list of concepts choose the major concept and place it at the top of the paper.
4. Arrange the first level of dependent concepts underneath the major concept by using linking words, e.g., provide, are types of, contain, cause, etc, to develop appropriate meaningful connections between all concepts.
5. After the first level of concepts have been identified, start arranging other lesser concepts that are directly related to the level above.
6. Draw lines to show relationships amongst the concepts and add linking words to the lines or arrows.
7. After the entire map has been developed, mark or circle the concepts that are critical for your learners and are at the appropriate difficulty level.

Example of a concept map

This example shows the development of a concept map for the topic "Water". How can we construct a proper concept map of the idea that "water takes up the shape of the container" by taking into account the seven steps as mentioned above?

Step 1. Make a list of the prior concepts studied about water and then add the new concepts to be developed during the teaching of this new topic.

water	*solid*	*particle*	*gas*
liquid	*matter*	*container*	*shape*
size	*volume*	*density*	*weight*
light	*colour*	*flow*	*clarity*
container			

Step 2. Now select the concepts that are essential to the topic being taught.

For example:

water	*shape*	*liquid*	*volume*

☞ Activity 2.2 Linking concepts

In steps 3 to 6 you need to link the concepts in a logical way. The linking words should make a sensible statement btween two concepts.

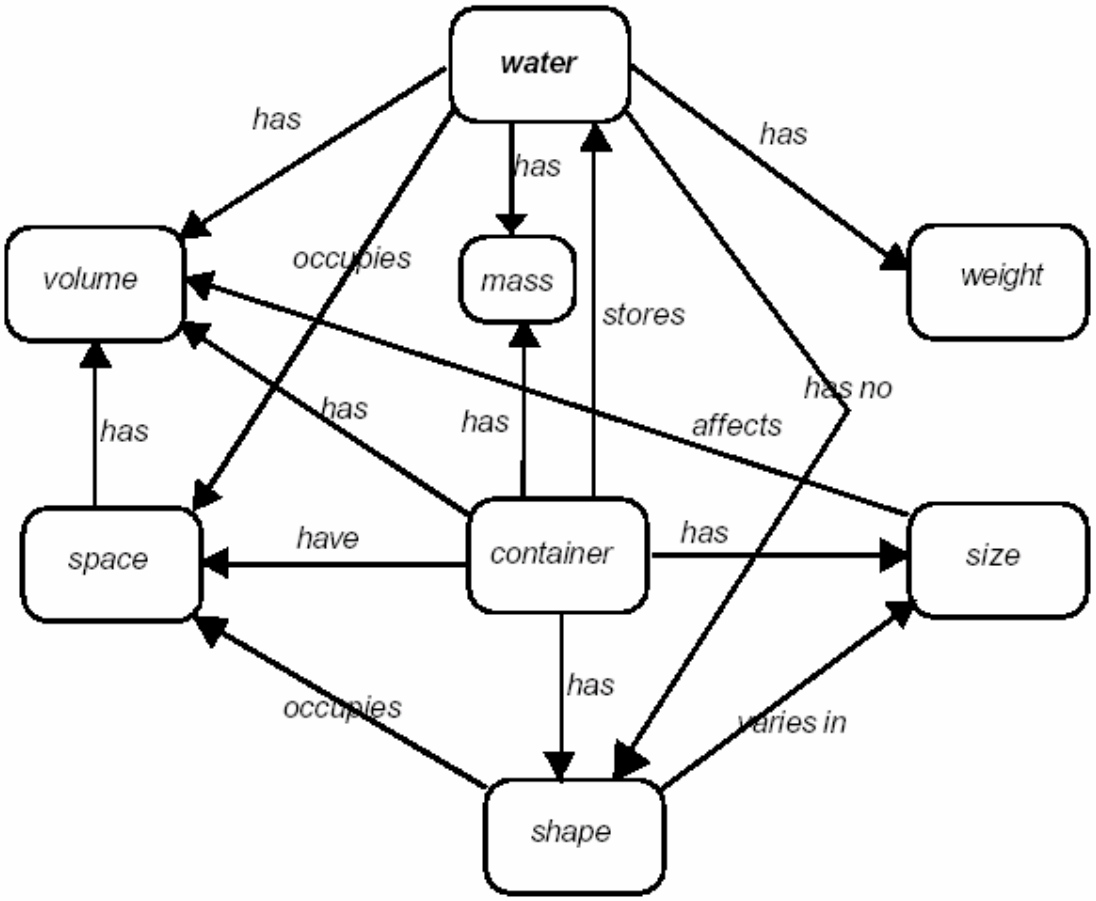
*Try to create suitable linking words to connect concepts in a logical way. For example: "Water **is a** liquid" would be the first.*

Liquid _____ container

Container _____ shape

Shape _____ volume

Steps 3 to 7. Arrange the concepts so that the most important or central concept is at the top of the page. Arrange the other selcted concepts in a logical heirarchial order under the superordinate one, in this case, **water**. Then assign a logical connection between each pair of concepts. Arrows may go either direction but the wording must make sense.



The teaching sequence

Now let's look a possible teaching sequence for the identified concepts and links. During a science lesson you might present the concepts and the links in the following way:

- Containers have empty space
- Containers vary in shape
- Water is stored in containers
- Water has no definite shape
- Water takes up the shape of containers
- The shape and size of the container affects the weight of water stored

The level or the degree of difficulty can be rearranged according to the level of the class. For higher grades, we might add **area** and **formula** to determine the **volume**.

Language skills

The construction of concept maps also provides an excellent opportunity for children to use language skills to develop sentences linking the concepts. Children may be given the concepts as cards and then asked to select two and construct a sentence to connect the two concepts.

☞ Activity 2.3 Developing a concept map.

Select a topic form any grade in the Primary Syllabus for Science, Health or Physical Education and develop a simple concept map using the examples presented earlier.

Now write a number of sentences to represent the main ideas being developed. Look at the sample lesson in Appendix 2.

Questioning techniques

The universal teaching tool is **questioning**. Questions are used in planning, teaching, thinking and learning. A question is an interrogative sentence that asks for a response. A question must be expressed in simple, clear, straightforward language that students can understand. A good question stimulates thinking and should be suitable for the age, ability and interests of the students.

Questions are used to:

- · Emphasise a point
- · Help children organise thinking
- · Interpret meaning and etc…
- · Find out what is not known
- · Provide drill and practice
- · Show relationships
- · Establish cause and effect
- · Permit expression

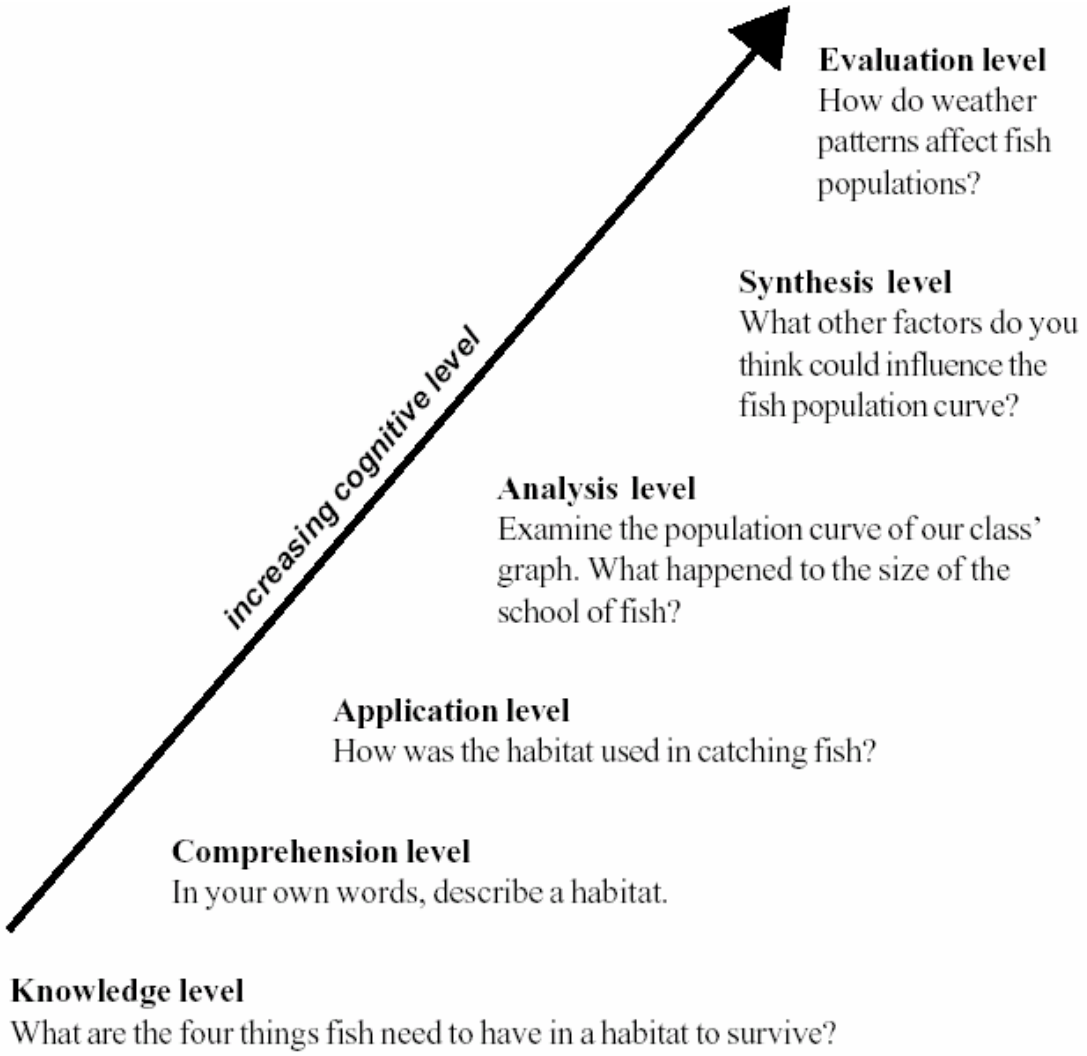
There are four types of questions:

Type of question	Explanation
1. Memory	Questions are asked to establish or review the prior knowledge or facts from previous experiences.
2. Convergent	Convergent questions have only one correct answer and require reasoning.
3. Divergent	Divergent questions have several answers and help promote lateral thinking and creativity.
4. Evaluative	Evaluative questions promote decision-making and defensive judgement.

The types of questions asked can require low-level or high-level thinking. The degree and level of thinking depends on the type of question posed. Close-ended questions usually always require a low level of thinking whereas open-ended questions require high-level thinking.

Type of questions	Level	Type of thinking expected
Close	Low	• Cognitive memory operations • Convergent operations
Open	High	• Divergent thinking operations • Evaluative operations

Even though there are different types of questions the organisation and level of difficulty at which questions could be posed is often difficult to identify and use appropriately on children. Bloom provides some insight into the cognitive levels of learners. The example below shows how the concepts of habitat and population may be treated at different cognitive levels.



☞ Activity 2.4 Questioning at different levels

Select a concept from a suitable topic and write a set of questions about that concept for each of the cognitive levels.

Teaching children who have special needs

There are many differences in the children that confront us in a classroom, whether it be gender, cultural background, disabilities or language. These factors affect the way in which individuals learn. We need to be familiar with these differences and ways to cater for them before we teach any class effectively. Some of the questions we need to ask yourselves as teachers are:

1. How can you use cultural differences to promote greater science understanding?

   What are the characteristics of children from different cultures?

   How can you help non- English speaking children?

2. Is gender equity a special need?

   How does culture affect females in learning?

   How do teachers contribute to gender problems in learning?

   How can teachers help female children attain high or similar marks/grades to boys?

3. What is a learning disability?

   Who are children with intellectual disability?

   How can you teach children who have intellectual handicaps?

4. What barriers do children with physical disabilities face?

   Why is science important for children who are physically disabled?

5. What does the term "visual impairments" mean?

   How can you teach children who are visually impaired?

   Give examples.

6. What does the term" hearing impairments" mean?

   How can you teach hearing-impaired children?

7. What are orthopaedic impairments?

   How can you teach children with orthopedic disabilities?

8. Who are gifted and talented learners?

   How can you teach learners who are gifted and talented?

☞ Activity 2.5

1. Answer the above eight questions individually.

2. Discuss the questions in groups.

3. Present the group findings to the class.

Equity in the classroom

How can you teach all children?

This may seem impossible because learning disabled children have difficulty getting along with one another in group situations. They are easily frustrated and tend to argue or become angry. They are said to be impulsive, distractible, frustrated, stubborn, disruptive, defiant, obstinate, and extremely disorganized.

The disability in children's learning may occur due to:

- Reading disabilities
- Inability to move around freely needing assistance to do so
- Poor functional knowledge of language of instruction
- Gender inequalities
- Cultural tambus

Possible strategies

Structure is the most important organisational skill when teaching children with learning disabilities. Ways to promote structure include class and study routines, limited choices, focused attention, memory clues, sequenced instruction, clear distinctions between instruction and testing, specific criticism and praise, time clues, conferences with special education teachers, and empathy and encouragement.

☞ Activity 2.6 Strategies for enhancing learning

Lists of possible strategies is given in Table 1 on pages 9 to 13.

- *Form pairs or groups of three and discuss the lists of strategies*
- *Elect a scribe and a facilitator for the discussion*
- *Discuss the questions as listed below and prepare a summary for presentation*
- *Present the findings to the whole class.*

Your presentation should refer to the following areas:

- *Special needs*
- *Environmental adaptation*
- *Material adaptation*
- *Teaching adaptations*
- *Assessment adaptations*

Questions

1. When we teach our lessons, what do we intend to achieve?

2. How do we know that we have achieved our objectives?

3. Do all children learn at the same time?

4. What could be some of the factors that hinder children's learning?

5. How can we as teachers cater for these learning difficulties?

Teaching children who have special needs

Cultural	*Environmental adaption*	• Carefully select visual and non-print materials for cultural inclusion. • Represent plural culture. • Maintain clear classroom organization. • Establish empathic relationships.
	Material adaption	• Use culturally representative materials. • Avoid cultural stereotypes. • Use broad themes to include all cultures.
	Teaching adaptation	• Set explicit instructions. • Use divergent questions to encourage pluralism and inclusion. • Challenge inaccurate statements. • Use experience-rich methods.
	Assessment adaptation	• Provide and accept diverse contexts for assessment activities.
Non English Speaking	*Environmental adaption*	• Be patient. • Use visual aids to help communicate. • Provide direct experience • Encourage high levels of activity.
	Material adaption	• Maintain a conceptual focus. • Enrich vocabulary development. • Use supplemental high interest materials.
	Teaching adaptation	• Be verbally clear. • Maintain written clarity; use outlines. • Emphasize concepts. • Link concepts to experience. • Use quest speakers and field trips. • Reduce text anxiety.
	Assessment adaptation	• Encourage the use of pocket translators and dictionaries. • Use pictorial assessment devices, puzzles, and performance tasks.

Gender	*Environmental adaption*	• Nurture independence and self-confidence. • Use hands on learning activities. • Use female role models in sciences and other subject areas.
	Material adaption	• Identify and eliminate gender bias in materials. • Use a wide variety of manipulatives.
	Teaching adaptation	• Experiment with heterogeneous and single sex grouping. • Use co-operatives learning techniques. • Maintain high but realistic expectations for all. • Provide frequent progress feedback.
	Assessment adaptation	• None
Learning disability	*Environmental adaption*	• Show empathy. • Focus attention. • Seat away from distractions.
	Material adaption	• Use concrete manipulatives. • Screen out irrelevant materials and distractions.
	Teaching adaptation	• Show clear expectation. • Simplify; give cues and specific praise. • Use dominant learning mode and multisensory activities. • Use concept analysis. • Provide specific criticism and praise.
	Assessment adaptation	• Try oral tests. • Modify readings and writing exercises if need • Provide specific criticism and praise. • Modify readings and writing exercise
Intellectual	*Environmental adaption*	• Limit visual and verbal distractions.
	Material adaption	• Select an appropriate reading level. • Use concrete, relevant manipulative.
	Teaching adaptation	• Use concept analysis. • Simplify. • Praise. • Uses repetition. • Maintain eye contact. • Engage in physical activity. • Feedback, use cues, cooperative learning. • Use examples and non-examples. • Use brief periods of direct instruction.
	Assessment adaptation	• Verbal tests. • Provide assistance with written tests. • Provide small step progress checks.

Visual	*Environmental adaption*	• Provide clear, predictable traffic pathways. • Maintain organized predictable locations for materials and storage. • Provide good lighting. • Seat student near activity. • Sighted child tutor can assist.
	Material adaption	• Use voice and audiotapes. • Print materials should be large, clear, and uncluttered with numerous colours and geometric designs. • Adapt materials to special equipment children may have to use.
	Teaching adaptation	• Emphasize uses of other senses. • Taped instructions or science information can be provided. • Pair with sighted child
	Assessment adaptation	• More verbal assessment. • Assist with written assessment. • Assist with physical manipulation of objects during performance assessment
Hearing	*Environmental adaption*	• Seat so vision is not obstructed. • Seat away from distracting background noises
	Material adaption	• Modify for making observations through other senses. • Use Captioned films and videos. • Use printed text to accompany audiotapes. • Model or illustrate spoken instructions
	Teaching adaptation	• Face the child when speaking. • Speak distinctively; do not shout. • Use written outlines. • Pair with non hearing- impaired children
	Assessment adaptation	• Avoid spoken forms of assessment
Orthopaedic	*Environmental adaption*	• Identify and remove physical barriers. • Provide adequate spaces for movement. • Seat near exists for safety. • Check tables and desks for proper height.
	Material adaption	• Identify devices that assist handling of objects, such as spring-loaded tongs; accounts pencil grips, test tube racks.
	Teaching adaptation	• Encourage physical manipulation of objects. • Pair with nonimpaired child. • Provide children training time with equipment prior to use
	Assessment adaptation	• Provide assistance with writing and manipulation of materials

Behaviour	*Environmental adaption*	• Seat away from distractions. • Provide well-lighted quiet space for study
	Material adaption	• Train in use prior to providing special equipment
	Teaching adaptation	• Use brief activities. • Give praise and cues. • Reinforce desired behaviours. • Obtain attention and establish eye contact prior to discussion and giving instructions
	Assessment adaptation	• None
Gifted and talented	*Environmental adaption*	• None
	Material adaption	• Advanced reading materials. • Greater application of technology
	Teaching adaptation	• Emphasize problem solving. • Accelerate pace. • Arrange mentorship. • Emphasize processes, mathematics, and uses of technology
	Assessment adaptation	• Increase expectations for analysis, application, and hypothesis. • Use open- ended assessment devises.

An activity based classroom

An activity-based classroom is one that is centred on activity. The important part in teaching is that materials are stored in an organised manner for easy accessibility by students.

Organising an activity based classroom

The most important and time-consuming tasks are completed before you, the teacher, lets the children into the classroom. The first task is for you to decide what is to be taught. This is more than just a matter of opening up the textbook and following the table of contents.

Points to remember

1. Deciding what should be taught in the long and short term.
2. Storing of equipment and materials
3. Distribution, taking care of, and inventorying those materials.
4. Establishing the physical surroundings and the rules that will maximize the learning experiences for all the children involved.

Module SM3. Planning Lessons

A ***lesson*** generally includes five logical stages. Within each stage there may be several options from which to choose. The stages are sequenced based on learning theories. A ***lesson*** may be more than a single period. In this model we will base the lesson plans on the five stages:

1. Settling
2. Motivation
3. Expansion
4. Application
5. Consolidation

1. Settling

S1 Students move into classroom and stand behind chairs. Teacher moves into class talking to individuals and hurrying stragglers along. When the students are quiet, greet them and tell them to sit down.

S2 As for S1 except that students sit down upon entry to the classroom.

Options S1 or S2 can be followed by:

- Enquiries about absentees
- Enquiries to individuals about topics of interest - sport, drama, health, etc

See how many names you can remember. Go around the class and try to say as many names as you can remember.

This is not a teaching time, but it is very important for your teaching. As teaching is a cooperative activity you must relate to your students and this is an ideal time for you to show that you are interested in them as individuals.

2. Motivation

For a new topic

M1 Carry out a demonstration. Ask students to watch and try to interpret what they see.

M2 Set up a short class activity. Ask students to carry out the activity and then explain or interpret the results they obtain from the activity.

M3 Tell a story that ends in a problem/question. Stories may be complete fiction or fact. Ask students for suggestions about how the problem could be solved.

M4 Read or show a topical article/cartoon from a newspaper, magazine, book, etc, preferably humorous or of special interest to students of that age. Ask students to comment.

M5 Show a short film/video/slides/posters of an interesting occurrence or topic. Ask students to comment.

For M1 to M5, do not use material from the textbook. Other sources are resource books for science teachers, UNESCO sourcebook, and activities in science, general science books or even other teachers' suggestions.

To continue a topic already started in a previous lesson

M6 Review homework by getting answers around the class. Make sure you use student names. Search out those children with difficulties. If many, revise the section before going on. If only a few, then organise some time where you can help them.

M7 Ask a few short questions about the last lesson and ask children to write the answers in their notebooks. Hurry these questions along. Call for answers around the class.

M8 Ask a few questions about the last lesson but allow children to answer orally. Be careful to distribute questions to all sections of the class and do not get tricked into asking only the same few all the time. Redirect answers back to the remainder of the class. Try to involve as many students as possible.

M9 Ask children to solve about 3 to 4 questions or problems you have written on the blackboard or O.H.T. These should be based on the previous lesson. Answers should be taken around the class and redirected to other students.

M10 Ask children to develop new questions based on previous lesson. Use this method as an extra to M9 for the faster children. Answers may be taken from volunteers by allowing them to write question on the board to see if the rest of the class can solve them.

Motivation time is designed to turn children's ***minds*** onto the topic of discussion in a manner in which they enjoy. It must be lively and interesting and have maximum children involvement. Do not allow this segment of the lesson to drag.

When children are responding by answering questions, commenting or interpreting, be sure to listen carefully and allow children to finish what they are saying. Do not cut in. This is where you learn just how much your children know about the topic you are going to teach. You may find that the ***new*** topic you have prepared is ***old hat*** to them.

Try to manipulate your questions and answers so that you can choose at least one point from all of the responses to lead into the next stage of your lesson. It is a good idea to note important points on the B/B as children make them, then you can pick out the ones which lead into the lesson by saying something like *`we are going to follow up this idea of .....today by .....'*

REMEMBER, it is the children's learning which is important, not the amount of talking you do!

3. Expansion

In this stage of a lesson new information is introduced to the children. The major decisions of planning to be made here are:

Where will the information come from?'

`What source can I use?'

Several sources are available and more than one should be used in each lesson. Be guided by your common sense and your knowledge of your class when choosing the source of information for each lesson.

Sources of information

E1 Yourself - the teacher

You need to be well read, beyond the textbook, and be able to digress into associated topics. Use charts, diagrams, models, demonstrations, OHT's and questions to break up your presentation. Try to tell a story (example or analogy) every so often when you see students starting to lose interest.

Build up a summary of key points on the blackboard as you go along. Do not allow children to copy down this summary until it is complete as you can then add bits to it without cries of spoiling their notebooks. Allow a definite time for children to copy it into their notebooks. This will give you a break and allow you to manage the class more easily. Use questions around the class to sustain interest and manage the class. Look for cues of disinterest, restlessness and boredom and react immediately using any of the following:

- Question individuals
- Quicken the pace of the lesson
- Use an analogy/story
- Set students something to do
- Change source of information

E2 Text book or library resources

Check that the information presented in the book is satisfactory and the book suits the reading ability of your students before setting children exercises from a book. For example:

- Prepare a transparency or worksheet with a series of questions for which answers are to be found in a text or reference. Make sure that the answers are to be found in the reference. Do not make the questions trivial and if possible word them so that children cannot answer them by copying from a book. You could ask for descriptions, explanations, interpretations and predictions.
- Teach children how to:
    - (a) draw a concept map
    - (b) develop a flow diagram

Ask children to read material and then summarise it into a paragraph. Each child should then write out his/her paragraph leaving out some key words. When finished, children should exchange paragraphs and then try to fill in the blanks.

Do not use too large a section of written work. Directions must be clear and well structured. While children are busy, the teacher should look for children who are not on task and react immediately. Do not interrupt children who are reading.

E3 Childrens' activities - practical and field

Select activities carefully. Make sure it does supply information and is not just a `time-filler'.

Prepare:

1. All equipment and a technique for quick and easy dispersal of it to students
2. A set of procedures for students to follow - text book/ worksheet / OHT
3. A set of safety warnings about potential dangers and how to avoid them
4. A write up sequence
5. A set of procedures for the retrieval of gear and the cleaning of the laboratory

All children should know what they are doing and what is expected of them ***before*** the practical activity commences. Establish a procedure for getting students to immediately stop what they are doing and listen to you. When you go to the blackboard and tap it that is the signal for everyone to be quiet and listen. A hand clap will work or even a call for attention provided students know what to do when you give that particular signal.

During the activity be extremely watchful. Visit all groups. Do interrupt if necessary. Ask questions and push groups and individuals along. Set your standards of acceptable work and comment upon the work of individuals with respect to these standards.

E4 Film, video, filmstrip, slides, posters, overhead transparencies

Select audiovisual aids carefully. Do not use them simply because they are available. Ensure that children know what is expected of them ***before*** viewing a video or film and then insist that this is carried out after it has been shown. Do not show a video or film without some follow up exercise otherwise the film becomes entertainment and not a source of information.

Prepare:

1. In advance by previewing and selecting appropriate sections to use. Do not feel obliged to show a whole video if a section is not relevant for the topic you are teaching.
2. A worksheet on a handout, blackboard or overhead transparency with a set of questions and guidelines for discussion and written activities like E2 for the students

There are other sources of information. Develop as many as you can. Use different sources each day if possible. Try not to get into a rut of teaching every lesson in the same way.

4. Application

A1 Classroom questions and discussions

This is to allow students to apply knowledge gained. It is not a revision of the lesson's key points.

A2 Projects

Set a classroom or homework project where students have to design, build or carry out an experiment for themselves, for example, make a poster or collage, set up an experiment using kitchen chemicals and apparatus, suggest solutions to problems, design an investigation.

A3 Classroom activities

Select an activity, which extends content material covered. Students should be encouraged to write up investigations as science reports/papers. These could be presented to the rest of the class orally and could be included in assessment programs.

A4 Class quizes

Students can work in teams. Write questions and then be awarded marks for the questions, which they answer correctly, and for those, which they have written that the others in the class cannot answer

The importance of the Application stage is that the child gets the chance to try out his/her own perceptions of the information presented in the Explanation stage. The teacher should be able to identify any misconceptions, which the child has at this time before they become fixed. This will only occur if the child feels confident that he/she will not be punished for trying and coming up with an incorrect answer. That is, give your child the chance to fail in a supportive environment. It is a very powerful learning experience.

5. Consolidation

- **C1** Revision of Blackboard/OHT summary of lesson
- **C2** Work exercises in textbook, which revise concepts presented.
- **C3** Children activity in which no new information is presented.
- **C4** Children complete a crossword/quiz/fill-in-blanks type worksheet based on information presented in stage 4 Explanation.

All of the consolidation methods can be used for homework exercises provided resources and facilities are available.

Putting your lesson together

Objectives

Objectives are the most important part of a lesson plan. They are specific because they tell the teacher what the children need to achieve at the end of a lesson and must always be in measurable terms.

A very good objective should include the following:

1. When the teacher is going to achieve the lesson
2. What the teacher wants children to know
3. Type of activities that will enable children to understand
4. How the teacher will know whether the children have understood what s/he has taught

☞ Activity 3.1 Writing objectives

Listed below are three objectives. Identify the components of each objective.

By the end of the lesson, children should be able to:

1. state clearly/correctly that plants are divided into two major groups (flowering or non flowering plants) from experience/chart/displayed plants.

2 explain correctly that water goes around in a cycle from the teacher-demonstrated experiment.

3 draw accurately from the teacher's demonstration that water does not have any shape but takes up the shape of containers.

Study the lesson plans in Appendix 1 and write objectives for each lesson.

Stages

Once the lesson objectives have been decided and the content of the lesson has been sorted and activities sorted out, the rough plan of the stages to be used could look something like the following:

S1, 3

M1

E4 filmstrip - guidelines for poster, OHT
A2 poster - homework

C1

☞ Activity 3.2 A lesson sequence

1. *Look up the codes used for the sequence above and write out in full the stages of this lesson.*
2. *Now look at this sequence and write out the full stages.*

   S2 - M3 - E1 - A1 - C1
3. *Compare the two sequences and discuss in groups. What are the differences?*

Which sequence would be best? Why?

You should avoid combinations which effectively keep you talking for the whole lesson and do not allow your students to do any thinking or active work for themselves. Remember that it is what the students learn that is important in your classroom and learning is an active process, that is, the students must be involved.

However there may be times when a sequence such as S2 - M3 - E1 - A1 - C1 would be a perfectly acceptable plan. You have to use your common sense. Plan for a variety of teaching strategies and maximise student involvement and interest.

Plan well and prepare thoroughly.

Model lesson plans

Before lessons are taught they need to be prepared thoroughly. This means good planning. The three main areas of preparation are the content, teaching strategies and materials. These areas need to be put in a format to make it easier for the teacher to use.

There are different types of lesson plan formats that student teachers can use. The layouts shown on the next two pages are just two examples. Appendix 1 gives five full plans for various science topics based on the Primary Syllabus.

Type A

Name: ..... **Class**: .....

School: ……..... **Grade**: …… **Week**: ……

Subject:…… **Lesson/Topic:** ……..... **Time**:……

Reference(s): ……

1. Objectives:

.....

.....

.....

2. Resources/teaching aids:

.....

.....

3. Introduction:

.....

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.....

4. Presentation:

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.....

.....

5. Conclusion:

.....

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.....

.....

Type B

Type B

Topic:.....
Reference:.....
Aim:.....

Name:.....
Class:.....
Lesson:.....
Date:.....
Time:.....

Objectives are specific and they tell the teacher what the children need to achieve at the end of a lesson and must be in measurable terms.		
Content (What to teach?)	**Method (How to teach?)**	**Preparation (What to use?)**
Introduction Content that will introduced (based on what the children already know)	Sequence of strategies that are used in introducing the lesson	List of materials that are going to be used in introducing the topic
Presentation The content you want children to know (usually what children don't know)	Sequence of strategies that are used in delivering the main concepts of the lesson	List of materials that are going to be used to teach the new concepts to children
Conclusion Pulling together of all information so that it makes sense to children	Sequence of strategies that are going to be used so that learning becomes meaningful to children	List of materials that are going to be used to make learning meaningful to children

Evaluation and reflection

Good teaching does not happen by accident and good fortune. It happens because of good planning, preparation, implementation and critical reflection. The catch word is **evaluation.** When we evaluate anything we compare the quality of the output and performance to known standards. In teaching we rely on students and peers as well ourselves to make judgements on the successfulness of our teaching. **Examinations and tests are not evaluation!**

As we teach a lesson we are the best judge of our own performance through observation of student behaviour. As good teachers we should recognise the strategies that do not work and change if need be. We should be flexible in our approach and be prepared to change mid-stream if a strategy is not working.

Peer evaluation is a valuable means of reflecting. We can discuss a lesson and how it went with colleagues in an informal way or we could ask a colleague to observe a lesson followed by one to one discussion afterwards. There are many ways of reflecting on our teaching and improving. No one method suits all.

The first stage in any reflection is to document what has happened in the classroom. This can in a formal way (using a prepared form) or with a series of hand written notes (action research). Let's start with reflecting on the stages of the lesson.

☞ Activity 3.3 Reflection on your teaching sequence

Think back to how your practice teaching went and summarise the stages you have used in a table using these headings:

Stage Description of what I do

Comment on your strategies. How could you improve your teaching? Suggest better stages and startegies.

Evaluation of teaching

The following form gives a possible set of criteria for evaluating teaching.

Evaluation of teaching

Name: _____ ***Self/Peer evaluation***: _____

Grade: _____ **Lesson Topic:** _____ **Date**: _____

Tick the boxes as appropriate and submit the completed sheet to the lecturer.

5 = excellent;4 = very good;3 = good; 2 = satisfactory; 1 = unsatisfactory

			5	4	3	2	1
1.	**Interest and motivation**	*a.Motivation of the class at the start of the lesson was … .* *b.Throughout the lesson student interest was … .* *c.Overall the lesson flow was.*					
2.	**Resources and strategies**	*a.The use of varied teaching strategies was … .* *b.The resources/demonstration used to explain the concept was…* *c.The teacher's awareness of safety precautions was …* *d.Student participation during the lesson was…*					
3.	**Questioning**	*a.The structuring of questioning was… .* *b.The teacher's ability to question at different levels was … .* *c.Sequencing of questions was… .* *d.Testing for understanding during the lesson was… .*					
4.	**Teacher**	*a.The teacher's confidence would be described as… .* *b.Teacher knowledge of subject matter was … .* *c.The teacher's ability to relate to students was … .* *d.The teacher's use of suitable body language was … .*					
5.	**Objectives**	*Overall, achievement of the lesson objectives was … .*					

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Appendix: Sample Lesson Plans

Topic: Let's get carbon by burning things

Reference: Grade 6 Teachers' Guide; pp. 32 -33

Aim: To teach children that carbon is produced when we burn things

Name: .....

Class: .....

Lesson: Science

Date: .....

Time: 30 min

Objective (s)

Content (What to teach?)	Method (How to teach?)	Preparation
Introduction (3 min) • The black stuff we see in batteries, pencil lead, under pots is carbon	• Get into groups of four • Tell children to look at the black stuff as displayed in front of them. • Ask: • What colour is all these stuff? • What do you think is the name of this black stuff? • Where do you think this black stuff came from?	• 4 batteries cut open • 4 lead pencils • 4 black mild tins
Presentation (24 min) • All living things contain carbon • More carbon is found in plants than in animals • Animals eat plants so their carbon content is less than that of plants. • Things like bread, wood, sugar, meat, dead insects and leaves turned black when burnt. • The black stuff as seen on burnt things is carbon.	• Tell children to start up the fire (while waiting for the flame to die down, children will be told to write the title "Let's get carbon by burning things" and then copy the table as shown under preparation into their exercise books) then put the rack over the fire. • Tell children to put each item on each tin lid provided. • Tell children to put the 5 tin lids on the fire rack and observe. • Record results on the table by ticking in the appropriate spaces.	• 26 clean tin lids • 4 fire racks • 4 pairs of tongs • Sugar • Bread • Meat • Dead insects • Dead leaves Chalkboard
Conclusion (3 min) Carbon when burnt in a very strong flame combines with oxygen in air and forms the gas called carbon dioxide.	• Tell children to copy chalkboard work and complete. • Correction done together in class. • Praise and encourage children.	• All living things contain _____ • _____ have more carbon than _____ • The black stuff we get from burning things is called _____ • Carbon when heated with a strong flame combines with oxygen in air to form the gas called _____

Things	Black	Really black	Gas given off
Sugar			
Bread			
Meat			
Dead insects			
Dead leaves			

Topic: Let's look at soil

Reference: Grade 5 Teachers' Guide, pp. 100 -101

Aim: To teach children that there are different kinds of soil

Name:.....

Class:.....

Lesson: Science.

Date:..... **Time:** 30 min

Objective (s)

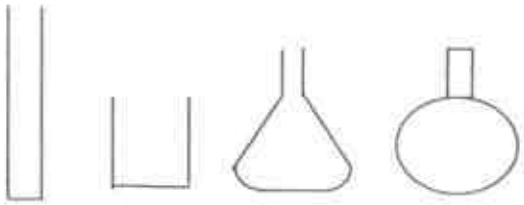
Content (What to teach?)	Method (How to teach?)	Preparation
Introduction (5 min) • There are different types of soil • They can vary in colour; the way soil holds together; how much water is there in the soil; what the soil feels like and if there is any animal present.	• Form groups of four • Ask: How many types of soil do we have? • Look at the chart and identify how many different types of soil you can see on the chart. • Ask: What kind of soil is good for gardening?	• A chart on the different types of soil

Presentation (22 min0
• **Sandy soil**
  ◦ Has large spaces in between particles
  ◦ Contains most air & has less water
• **Clayey soil**
  ◦ Is closely packed together & has smallest particles
  ◦ Contains little air & has more water
  ◦ Can become waterlogged
• **Garden spoil or loam soil**
  ◦ Has a mixture of small and large particles of soil
  ◦ Is well aired and drained
• **Swampy soil**
  ◦ Has smallest particles & is dark in colour
  ◦ Contains little air
  ◦ More water
	• Now look at the four types of soil that is placed in front of you.
	• Identify the four types of soil (sandy, clayey, swampy & garden)
	• Take note of their colours, how they feel, whether the soil particles hold together and whether there is plant and animal matter present.
	• Children draw table as shown and complete it.
		Blackboard
		
		Soil type | **Colour** | **Holds together** | **Plant matter** | **Animal matter**
		Sandy
		Clayey
		Swampy
		Garden

Conclusion (3 min)
The best soil to grow food is the garden soil. It is black in color because it contains plant and animal matter. It has soil particles that are in-between clayey and sandy and is therefore well aired and drained.
	• Correction of the table done together.
	• Ask:
	  ◦ Which soil feels the stickiest?
	  ◦ Which soil feels the driest?
	  ◦ Which soil is not held together and is most loosely?
	  ◦ Which soil has the darkest color? Why?
	• Which soil is good for gardening? Why?
	• Say the poem
		Poem
		I want to plant my food crops in the garden.
		A garden, which has fertile soil.
		What kind of soil is that?
		A soil that is rich in plant and animal mater, well aired and drained.
		Then what type of soil is that?
		The garden soil, the soil is what I'm talking about.

Topic: Let's make water into different shapes
Reference: Grade 1 Teachers' Guide; pp.84 - 85
Aim: To teach chn that water has no definite shape but takes up the shape of its container

Name: .....
Class: .....
Lesson: Science
Date: .....
Time: 30 min

Objective (s)		
Content (What to teach?)	**Method (How to teach?)**	**Preparation**
Introduction (3 min) • Water does not have any definite shape.	• Teacher fills a plastic bag with water and ties the top with a string/rope; then holds the bag by the neck and lets it hang; then puts it on the table and etc... • Ask: What do you notice about the shape of water in the plastic?	• A plastic bag filled with water • A piece of string or rope
Presentation (20min) • Water can readily change it's shape • The container gives water its shape • Water poured from one jar to the other changes its shape.	• Tell children to draw what they think would happen if the water was put into the following containers:  **All containers have the same volume**	• 100ml measuring cylinder • 100ml beaker • 100ml flat bottom flask • 100ml round bottom flask
Conclusion (7 min) • To give water it's shape it must be kept in container.	• Tell children to display their drawings • Class comment	

Topic: Let's make talk go along a string
Reference: Grade 4 Teachers' Guide; pp. 90 - 91
Aim: To teach children that sound waves travel along a string

Name: .....
Class: .....
Lesson: Science
Date: .....
Time: 30 min

Objective (s)

Content (What to teach?)	Method (How to teach?)	Preparation

Introduction (3 min)
• Stringed telephone can be used to send messages
	• Form children into groups of six.
	• Tell children that they are going to make homemade telephones using different types of strings to send messages.
	• Give out the materials and tell children to do the following:
	  ◦ Make a small hole in the center of the bottom of the tins using a hammer and a nail.
	  ◦ Each pair will use a string type by pulling the string through the hole in each tin. First by using a long string and then a short string.
	  ◦ Tie the knots on the ends of the string inside the tins.
		• 80 empty tins of fish
		• 3 balls of string
		  ◦ Wool
		  ◦ Nylon
		  ◦ Thread
		• Nails
		• Hammer

Presentation (23 min)
• Messages can be heard clearly if transmitted through short nylon strings
• Generally speaking, tight and /or short strings transmit messages clearly. Long and /or a slack string does not transmit messages clearly.
	• Tell children:
	• To copy the table as shown under preparation, the purpose of the activity
	• To predict:
	  ◦ What string type would allow talk to travel further (nylon, thread or wool)?
	  ◦ What types of strings (short, long, tight or slack) would allow talk to be heard well?
	• Go outside and try out the activities by using the longer string first and then the shorter string.
	• One child should put his/her tin over one ear while the other child speaks quietly into the other tin
	• They tighten and slacken the string while talking.
	• After they have tried out their stringed telephones the children should try to exchange with the other pairs and so on until they have tried out all the stringed telephones.
	• If the messages were heard clearly then ticks should be placed in appropriate boxes on the blackboard
		Chalkboard
		String type | **Short** | **Long** | **Slack** | **Tight**
		Nylon
		Thread
		Wool

Conclusion (5 min)
The best soil to grow food is the garden soil. It is black in color because it contains plant and animal matter, has soil particles that are
	• Correction on the table done together
	• Ask:
	  ◦ What type of string used was best in sending messages?
	  ◦ Did the long or short string used, send messages well?
	  ◦ Did the slack or tight string used send messages well?
	  ◦ Tell children to look at the board and complete the exercise orally.
		• Messages were sent through _____
		• _____ strings are best to use because they are strong.
		• Messages can be heard clearly when the strings are _____
		• Slack strings and very long strings do not send messages out clearly.