Inservice Units to Support the Implementation of the Primary Reform Curriculum

Unit 4:
Learning Areas: Mathematics and Science

Study Guide
The assessment and certification authority for academic credit is the
Papua New Guinea Education Institute
PO BOX 1791, BOROKO, NCD, PNG.

The In-service Units have been developed with the support of
AusAID under the Curriculum Reform Implementation Project.

For further information about the units contact the
Teacher Education and Staff Development Division.
# Inservice Units to Support the Implementation of the Primary Reform Curriculum

## Unit 4: Learning Areas: Mathematics and Science

<table>
<thead>
<tr>
<th>Contents</th>
<th>Page/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secretary’s Message</td>
<td>iv</td>
</tr>
<tr>
<td>How to use the study guide</td>
<td>1-4</td>
</tr>
<tr>
<td>Unit introduction</td>
<td>1-13</td>
</tr>
<tr>
<td>- The Context</td>
<td></td>
</tr>
<tr>
<td>- Duration</td>
<td></td>
</tr>
<tr>
<td>- Prerequisites</td>
<td></td>
</tr>
<tr>
<td>- Learning tips</td>
<td></td>
</tr>
<tr>
<td>- The learning model</td>
<td></td>
</tr>
<tr>
<td>- Resources</td>
<td></td>
</tr>
<tr>
<td>- About this unit</td>
<td></td>
</tr>
<tr>
<td>- The context</td>
<td></td>
</tr>
<tr>
<td>- Unit learning outcomes</td>
<td></td>
</tr>
<tr>
<td>- The modules</td>
<td></td>
</tr>
<tr>
<td>- References</td>
<td></td>
</tr>
<tr>
<td>Module 1: Introducing the Mathematics and Science Learning Area</td>
<td>1-34</td>
</tr>
<tr>
<td>Module 2: Learning outcomes, Indicators and Elaborations</td>
<td>1-20</td>
</tr>
<tr>
<td>Module 3: Teaching and Learning, Assessing and Reporting</td>
<td>1-26</td>
</tr>
<tr>
<td>Module 4: Applying your learning - developing a unit of work</td>
<td>1-22</td>
</tr>
<tr>
<td>Unit Summary</td>
<td>1-4</td>
</tr>
<tr>
<td>Where to go from here?</td>
<td>1</td>
</tr>
<tr>
<td>Accreditation and Certification</td>
<td>1-12</td>
</tr>
<tr>
<td>- The Context</td>
<td></td>
</tr>
<tr>
<td>- Some definitions</td>
<td></td>
</tr>
<tr>
<td>- Ways this unit can assist you</td>
<td></td>
</tr>
<tr>
<td>- Accreditation requirements</td>
<td></td>
</tr>
<tr>
<td>- Certification requirements</td>
<td></td>
</tr>
<tr>
<td>- Self-assessment of progress</td>
<td></td>
</tr>
<tr>
<td>Learning Contract</td>
<td>1-8</td>
</tr>
<tr>
<td>Final Steps</td>
<td>1-2</td>
</tr>
</tbody>
</table>
Secretary’s message

The Papua New Guinea Department of Education In-service Management Plan 2001-2005 sets out the policies and practices for in-service to support the implementation of curriculum reform in basic education. The development of a culturally relevant curriculum and the provision of quality in-service for all elementary and primary teachers are fundamental components in the reform of basic education.

The provision of accessible, relevant and sustainable in-service training is critical for the effective implementation of the reform curriculum in Papua New Guinea schools. In particular, appropriately trained and skilled teachers, head teachers and support staff are the key.

These self-paced in-service units are being provided to assist teachers implement the primary reform curriculum materials distributed to schools in 2003 - 2005. They are quality materials designed to help each of you continue your professional learning at times to suit you and with the support of colleagues in your school and district. Significantly the units provide a means for all teachers to gain further qualifications through Papua New Guinea Education Institute and primary teachers colleges that may include these units as part of their in-service provision.

The units have been developed with the support of AusAID under the Curriculum Reform Implementation Project (CRIP).

I commend the units to you and invite you to take up the challenges provided by the availability of these units to continue your own learning so that we can be sure that our children receive the best possible education.

Dr. Joseph Pagelio
A/Secretary for Education
How to use the study guide

There are a number of ways you can use this study guide:
- As a source of information and activities for school-based, cluster or district learning and development (in-service), or
- As a study guide for self-improvement, or
- As a study guide to improve your qualifications

The decisions and choices you make as you work your way through this section of the study guide will determine the outcomes you achieve and the benefits you gain from your learning journey.

So be very clear about your purpose for studying this in-service unit.

Option 1. School-based, cluster or district learning and development
This unit can be used to establish a learning community of practitioners in schools or across a cluster of schools (that is, to promote the practice of teachers studying together to improve their knowledge and skills and encouraging each other to do so).

To use this unit for school-based, cluster or district learning and development (in-service), first organise a planning group to scan the unit and module content to determine the most suitable approach. The planning group could comprise any of the following - the Head Teacher, the inspector, the in-service coordinator, a trained assessor, classroom teachers.

There are many ways in-service sessions could be organised, for example one to two hours every week, or a half day every month, or during NIST week or any other arrangement that suits the needs of your school, cluster or district.

The planning group may organise for teachers to work through the whole unit over a period of time or may select particular modules, sections or activities that will best help teachers implement the primary curriculum.

Teachers can work through the unit or modules themselves in pairs or in small groups, or they can be guided through the unit or modules by trained assessors or teachers who have already studied the unit at PNGEI.

It is recommended that teachers do self-assessment of learning before and after each in-service activity. The self-assessment on page 13 of the Accreditation and Certification section can be used for this purpose.

Option 2. Self-improvement
You may study this unit for your own self-improvement to become a more effective and informed teacher, senior teacher, head teacher, inspector or education officer with responsibility for curriculum reform.

If this is your goal, track your pathway through the flow chart on the next page.
Study Pathway Planner for Self-improvement ....

Step 1
Read pages 1-13 of Unit Introduction

Step 2
How do you want to study? Choose your path - is it to be
at your own pace with or without a learning partner?

Step 3
Read page 9 of Accreditation and Certification to see how to apply for external assessment

Step 4
Read page 12 of Unit Introduction to decide which module to do first

Step 5
Complete self-assessment, pages 10-12 Accreditation and Certification

Step 6
Read Final Steps

Step 7
Do you have access to the resources on pages 4-7 of Unit Introduction?

Step 8
You are ready to start

Yes

No

You can apply for external assessment later

When you have them, go to Step 8

Your head teacher, inspector, inservice coordinator, reform coordinator or provincial materials supply officer may be able to help

Not sure

Yes

Are you sure you do not wish to be assessed?

in your group with a facilitator?

If you change your mind at a later date

You don't need to collect them all at once, but only as you need them

You don't need to collect them all at once, but only as you need them

Look for the documents, otherwise you cannot proceed with the unit

when you have them, go to Step 8

Your head teacher, inspector, inservice coordinator, reform coordinator or provincial materials supply officer may be able to help

Yes

Are you sure you do not wish to be assessed?

in your group with a facilitator?

You can apply for external assessment later

Not sure

Yes

at your own pace with or without a learning partner?

No
Option 3. Improve your qualifications
You may complete this unit to gain potential credit points to upgrade your qualifications through the DEP(I) or other programs offered by PNGEI such as Diploma in Special Education, Certificate of Elementary Teacher Training (CETT) or Diploma in Vocational Education (DOVET) or further education.

If this is your goal, track your pathway through the flow chart on the next page.
Unit Introduction

The Context

This set of nine in-service units has been developed specifically to help primary school teachers, grades 3 - 8 and the senior teachers, head teachers, education officers and inspectors who support them, to effectively implement primary reform curriculum.

All primary syllabuses contain the Secretary’s Message, Introduction, Rationale, Curriculum principles, Content overview, Course aims, Learning outcomes and Indicators and advice on assessment and reporting.

You are perhaps already familiar with terms such as introduction, rationale, curriculum principles and content overview and have an idea about what to expect. However, there is new information in all of these sections of the document.

The primary teacher guides explain to you, using examples, ways of planning and programming, ways of developing units of work and strategies and tools for assessment and reporting. They also provide information about the knowledge, skills, attitudes and values embedded in each of the outcomes through ‘elaborations’ of the outcomes. ‘Suggested activities’ are also to be found in this section.

The most significant aspect of the new syllabuses is that they describe student learning in terms of learning outcomes and indicators and not in terms of objectives as was the practice previously.

The learning outcomes specify what it is that students know, understand and are able to do as a result of their learning. Indicators list examples of the kinds of things students are able to do, know and understand if they are achieving an outcome. Teachers use indicators when they make judgements about student achievement of outcomes.

This set of in-service units uses an outcomes-based approach to help you become familiar with and to understand and experience learning based on specified outcomes. The in-service units introduce some new concepts and ideas based on effective principles of learning in an outcomes-oriented learning environment.

Learning outcomes are identified at two levels – unit learning outcomes and module learning outcomes. If academic credit is being sought through the study of a unit, the unit learning outcomes form the basis of assessment. If this is not the goal, then the unit learning outcomes may be used for checking own learning.

All units are developed through four modules. The modules are written in a ‘self-learning mode’. You are guided each step of the way. Follow the instructions and you will be able to complete the modules.
In the *module summary*, at the end of each module, we have repeated the *module learning outcomes*. Use the list of outcomes as a checklist of your learning progress through the module.

In the *unit summary* at the end of the unit, we have repeated the *unit learning outcomes*. Use this as a checklist for your readiness for assessment.

We have provided space throughout the Study Guide for you to write your responses and reflections. This means that your study guide is also your *workbook* and your *learning journal*. Also, at the end of each module, you will find some blank pages. Use them as extra space for your notes if you need it.

We have not given any model answers for the various tasks you will be completing. Instead we have provided ‘hints’ to prompt your thinking. This may also help you check and re-think your responses.

Throughout the Study Guide you are advised to work with a colleague. The term *colleague* is used to mean a learning partner, a critical friend or a mentor. (Further information in this area may be found on page 4 of *Accreditation and Certification* section of this Study Guide.)

**Prerequisites**
There are no academic prerequisites for this unit.

**Duration**
It is likely to take you around 48 hours to complete all the *Learn, Do, Share* and *Reflect* activities in a unit.

**Learning tips**
Each module includes *learning, doing, sharing* and *reflecting* activities. These are all designed to help you achieve the learning outcomes of the unit.

To complete the unit or modules you will need the resources with their pictures next to them listed on pages 4-7. All resources were sent to schools during 2003-2005.

**The learning model**
The activities in this unit, using the learning model of *Learn, Do, Share* and *Reflect*, are designed to give you an understanding of the reform and develop your knowledge and skills in implementing it. The four parts of the learning model represent ongoing learning processes that form an integral part of the learning journey.
Icons

An icon is a symbol used to show you what action to take in your learning journey. In this unit these icons represent this learning model.

<table>
<thead>
<tr>
<th>Learn (Lainim)</th>
<th>Do (Wokim)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Find out more about</td>
<td>• Do tasks</td>
</tr>
<tr>
<td>• Use information to create knowledge</td>
<td>• Practise skills</td>
</tr>
<tr>
<td>• Apply new knowledge</td>
<td>• Reflect (Tingim bek)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Share (Tok tok wantaim)</th>
<th>Reflect (Tingim bek)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Talk to others about what you are learning</td>
<td>• Think critically about what you have learnt, done and shared</td>
</tr>
<tr>
<td>• Discuss findings with a colleague, learning partner or group acting as a critical friend(s). Learning in cooperation increases the ability to learn. Discussing and exploring what has been learned with colleagues help in constructing knowledge through seeing, hearing, doing, talking, refining and reflecting.</td>
<td>• Think about changes to your practice</td>
</tr>
<tr>
<td></td>
<td>• Think about changes to your beliefs and attitudes</td>
</tr>
<tr>
<td></td>
<td>Reflection helps to make meaning from what is being done, develop shared meaning and challenge ways of thinking and doing things. Some reflective questions might be:</td>
</tr>
<tr>
<td></td>
<td>- what does this mean for my practice in my current position?</td>
</tr>
<tr>
<td></td>
<td>- what are the implications for the group?</td>
</tr>
<tr>
<td></td>
<td>- what are the implications for the school or my classroom?</td>
</tr>
</tbody>
</table>
Resources

Here is a list of resource texts for use with this study guide. If you are currently teaching in the lower primary years, you may think of focusing on the lower primary syllabuses and related documents only. If you are currently teaching in the upper primary years, you may think of focusing on the upper primary syllabuses and related documents only. However, it is important that you become familiar with both sets of documents to become an effective and competent primary school teacher.

You will need access to the relevant documents to successfully complete the unit. These documents were distributed to schools in 2000 – 2005.

At the beginning of each module, the resource books you will need for that module are identified.

2. National Assessment and Reporting Policy 2003, Department of Education, Papua New Guinea
Unit 1  Learning Areas: Mathematics and Science


11. Upper Primary Learning Outcomes for Grades 6, 7 and 8,
Department of Education, Papua New Guinea, 2003

12. Lower Primary Learning Outcomes for Grades 3, 4 and 5,
Department of Education, Papua New Guinea, 2004
About this unit

The context
As you know, basic education is currently being reformed throughout the PNG education system. This process began some years ago. You might also be aware that some provinces and schools have already done a great deal of work in implementing the reform, while some others have a long way to go.

This unit is one of a set of nine in-service units developed to help both primary school teachers and those officers who support their work, such as, the senior teachers, head teachers, inspectors and education officers to understand and implement the reform in their work situation.

The in-service units in the set are:
Unit 1: Philosophy of Curriculum Reform
Unit 2: Learning Area: Culture and Community
Unit 3: Learning Areas: Language and Personal Development
Unit 4: Learning Areas: Mathematics and Science
Unit 5: Outcomes-Based Planning and Programming
Unit 6: Learning and Teaching for Outcomes
Unit 7: Assessing and Reporting Achievement of Outcomes
Unit 8: Bridging to English
Unit 9: Vernacular Literacies

You can study one or more units and you can study them in any order.

This unit focuses on the primary curriculum learning areas of **Mathematics and Science** and involves a close study of the following syllabuses and teacher guides.

*Mathematics, Lower Primary Syllabus*
*Mathematics, Upper Primary Syllabus 2003*
*Environmental Studies, Lower Primary Syllabus*
*Science, Upper Primary Syllabus 2003*
*Mathematics Teacher Guide, Lower Primary 2004*
*Mathematics Teachers Guide, Upper Primary 2003*
*Environmental Studies Teacher Guide, Lower Primary 2004*
*Science Teachers Guide, Upper Primary 2003*

Through these documents and others DoE makes clear that it is shifting its curriculum focus from objectives to outcomes.

This unit helps you understand outcomes-based education (OBE) as both an educational philosophy and a system for managing student-centred planning, programming, teaching, learning, assessing and reporting student learning. The unit takes you through the Mathematics and Science syllabuses and teacher guides and shows you how OBE is applied in your teaching practice. In OBE the outcomes are the same for all students. However, there is flexibility in the way they learn and demonstrate the outcomes. This approach caters for differences among students.
The Mathematics Learning Area

The Mathematics learning area has a major responsibility for the development of students’ numeracy. Through a study of mathematics, students will learn to read, write and speak mathematics in a variety of contexts and forms. They will interpret and convey mathematical ideas, interpret texts containing mathematical forms and continue to use and learn mathematics. Every student needs to develop an awareness of the nature of mathematics, how it is created, used and communicated, for what purposes and how it influences and is influenced by what we believe and in the values we hold. New technologies have changed the level of complexity of mathematical problems encountered today as well as the methods that mathematicians use to investigate them. When students have opportunities to use technology, their growing curiosity can lead to richer mathematical invention. (National Curriculum Statement, 2002, page 37)

The following table shows the subjects from elementary to upper secondary associated with this learning area. The columns that are highlighted show where the syllabuses covered in this in-service unit fit.

<table>
<thead>
<tr>
<th>Learning Area</th>
<th>Elementary</th>
<th>Lower Primary</th>
<th>Upper Primary</th>
<th>Lower Secondary</th>
<th>Upper Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>Cultural Mathematics</td>
<td>Mathematics</td>
<td>Mathematics</td>
<td>Mathematics</td>
<td>Mathematics Extension (Maths A) Mathematics Core (Maths B) Life Maths</td>
</tr>
</tbody>
</table>

Table: Subjects included in the Mathematics Learning Area
(National Curriculum Statement, Page 38)

The Science Learning Area

The learning area of Science involves ways of exploring, knowing and understanding the underlying principles that shape our world. Science education assists students to make informed and responsible decisions about their lifestyles, environment and the kind of societies in which they choose to live. It does this by encouraging the use of evidence in decision making, a questioning attitude and an ability to look at the relationships between the information needed to solve the problems that confront people daily. (National Curriculum Statement, 2002, page 40)
### Table: Subjects included in the Science Learning Area
*(National Curriculum Statement, Page 41)*

<table>
<thead>
<tr>
<th>Learning Area</th>
<th>Elementary</th>
<th>Lower Primary</th>
<th>Upper Primary</th>
<th>Lower Secondary</th>
<th>Upper Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>Aspects of Science are covered under</td>
<td>Environmental Studies</td>
<td>Science</td>
<td>Science</td>
<td>Biology</td>
</tr>
<tr>
<td></td>
<td>Culture and Community</td>
<td></td>
<td></td>
<td>Environmental Science</td>
<td>Chemistry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Applied Science</td>
<td>Physics</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Applied Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Science</td>
</tr>
</tbody>
</table>
Unit learning outcomes

Learning outcomes are statements about the knowledge, understandings, and skills you have achieved and are able to demonstrate when you have worked through the unit. These statements are learner-centred and written in terms that enable them to be demonstrated, assessed or measured.

On successful completion of this unit, you, the learner, can (are able to)

1. describe the structure and contents of the syllabuses and teacher guides in the Mathematics and Science learning areas
2. identify links between the syllabuses and the corresponding teacher guides
3. make connections between the Mathematics and Science learning areas
4. describe and discuss ways progress from grade 3 to grade 8 is described in the Mathematics and Science learning areas
5. use the syllabuses and teacher guides to construct units of work based on learning outcomes
6. make links between the syllabuses and teacher guides and the *National Curriculum Statement (2002)* and the *National Assessment and Reporting Policy, 2003*
7. assist others to understand and use these syllabuses and teacher guides.
The Modules

In order to help you achieve the unit learning outcomes, *Unit 4: Learning Areas: Mathematics and Science* is developed through four modules.

The modules are linked. This means that you must do them in the order in which they are presented, starting with Module 1.

An overview of each of the modules follows:

**Module 1: Introducing the Mathematics and Science Learning Areas**
In this module you are introduced to introductory sections of the lower and upper primary syllabuses and teacher guides in the Mathematics and Science learning areas. The major focus of this module is the structure and the contents of the syllabuses and their relevant teacher guides. You consider how the syllabuses progress from lower primary to upper primary, identifying descriptions of progress. You make connections between the syllabuses, the teacher guides and the policy documents.

**Module 2: Learning Outcomes, Indicators and Elaborations**
In this module you are encouraged to explore the connections between the outcomes, indicators and elaborations in the syllabuses and teacher guides. Through the activities provided, you clarify their importance and apply them in various aspects of your practice as a teacher or one who supports and supervises teachers.

**Module 3: Learning and Teaching, Assessing and Reporting**
In this module you focus on the learning and teaching strategies identified in the Mathematics syllabuses and teacher guides and the Science syllabuses and teacher guides separately and then make connections between them.

Another focus of this module is the assessment and reporting ideas provided in the two sets of syllabuses and teachers guides. You look at them separately and then make connections between them.

**Module 4: Applying your learning – developing units of work**
In this module you consider implications for practice. Using selected outcomes, you plan a unit of work relevant to your work context and based on knowledge you have gained in the preceding modules.
References

These documents have been used in writing these units. You do not need to have access to these documents.

Curriculum Development Division (undated), *The Reform of Basic Education: Elementary and Primary School, Prep to Grade 8*.

Curriculum Reform Implementation Project, 2002, *Professional Reading Series No. 1, 2 and 3*, In-house documents.


1. Curriculum Reform and Lower primary Curriculum
2. Bridging to English in Lower primary
3. Planning and Programming
4. Teaching and Learning
5. Assessment and Reporting


1. Philosophy of Curriculum Reform
2. Curriculum Reform and Upper Primary Reform Curriculum
3. Outcomes-based Planning and Programming
4. Learning and Teaching for Outcomes
5. Assessing and Reporting Achievement of Outcomes


Unit 4:
Learning Areas: Mathematics
and Science

Module 1: Introducing the Mathematics
and Science Learning Areas

Contents

<table>
<thead>
<tr>
<th>Contents</th>
<th>Page/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module introduction</td>
<td>2</td>
</tr>
<tr>
<td>Module learning outcomes</td>
<td>3</td>
</tr>
<tr>
<td>Section 1: The Mathematics Learning Area</td>
<td>4</td>
</tr>
<tr>
<td>Section 2: The Science Learning Area</td>
<td>16</td>
</tr>
<tr>
<td>Section 3: Linking Mathematics and Science Learning Areas</td>
<td>28</td>
</tr>
<tr>
<td>Module Summary <em>(and additional space for your notes)</em></td>
<td>31</td>
</tr>
</tbody>
</table>

Name: ........................................................................ File №:.....................................................

Date commenced: ........................................ Date completed:............................................

I have sighted this study guide as evidence of completion of agreed tasks by

..............................................................................................................(insert name)

Assessor: ..................................................... Date: .......................................................
Module 1: Introducing the Mathematics and Science Learning Areas

Module Introduction

Welcome to Module 1: Introducing the Mathematics and Science Learning Areas

You need to have a sound appreciation of the contents and structure of the syllabuses and teacher guides that describe these two learning areas to understand the way reform curriculum documents are written, the way teachers are now expected to program and teach and the ways students in schools are expected to demonstrate their learning and be assessed.

This module begins with an exploration of the Mathematics Learning Area. It then takes you through both the mathematics syllabuses and teacher guides for lower and upper primary years.

Then the module provides an overview of the Science Learning Area through an exploration of the lower primary Environmental Studies syllabus and teacher guide and upper primary Science syllabus and teacher guide.

The structure of the curriculum documents carries many similarities. Their contents, however, identify knowledge, skills and attitudes important to each learning area.

Finally, this module helps you to make links between the lower and upper primary syllabuses within each learning area and then across the two areas.

To undertake this module you will need access to:

- Mathematics, Lower Primary Syllabus, 2004
- Mathematics Teacher Guide, Lower Primary, 2004
- Mathematics, Upper Primary Syllabus, 2003
- Environmental Studies, Lower Primary Syllabus, 2004
- Environmental Studies Teacher Guide, Lower Primary, 2004
- Science, Upper Primary Syllabus, 2003

These resources are already in your schools.

If you are seeking academic credit, make sure you have completed the self-assessment in the Accreditation and Certification section before you start this module. As you work through this module, keep a running record of sections, parts and pages of the module where you can identify evidence for particular unit outcomes. You may wish to record such information in your Learning Contract.
Module learning outcomes

When you have worked through this module, you, the learner, can (are able to):

1. compare the structure and contents of the Mathematics syllabuses with the Science syllabuses
2. identify the links between each Mathematics syllabus and the corresponding teacher guide
3. identify the links between the Science/Environmental Science syllabuses and the corresponding teacher guides
4. explain why these learning areas are included in the primary curriculum
5. describe the curriculum principles underlying the Mathematics and Science syllabuses
6. identify the focus areas in each syllabus and their links with each other
7. describe the way content is organised in each of the syllabuses
8. make links between the Mathematics and Science learning areas.
Section 1: The Mathematics Learning Area

The Mathematics learning area is developed through the Mathematics syllabuses and teacher guides. To complete this section you will need copies of the following documents.

Mathematics, Lower Primary Syllabus, 2004
Mathematics, Upper Primary Syllabus, 2003
Mathematics Teacher Guide, Lower Primary 2004
Mathematics Teacher Guide, Upper Primary, 2003

Part 1: The Mathematics Syllabuses

The best way to approach the activities in this section is to have the two Mathematics syllabuses open in front of you at the same section so you can quickly scan for similarities and differences.

Have both the lower primary and upper primary syllabuses open at the Secretary’s message. The message from the Secretary is very useful advice.

• Take a few minutes to skim read both of them.

• What do the messages say about the role of mathematics for ‘integral human development’?

• What do they say about how the first language of the students is to be used in the learning of mathematics?

Read the Introduction to the Upper Primary Mathematics Syllabus (pages 1-2) and make a list of the three ideas that link this Introduction to mathematics at other levels, and to other studies. An example is provided here.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>English is the main language of instruction, but the vernacular language will be useful in helping students gain an understanding of the mathematical concepts</td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

Hint: Consider the study of Mathematics as something that began in the elementary school and continues well beyond the upper primary years.
• Does the *Introduction* to the lower primary syllabus provide similar ideas? Make a comparative statement here.

• What is the time allocation recommended for mathematics in the lower primary and upper primary?
  - lower primary
  - upper primary

On page 1 of the lower primary syllabus, the strands of Mathematics are identified for elementary, lower primary and upper primary.

• What are the differences evident between lower and upper primary strands?

---

**Page 3 (upper primary) and page 2 (lower primary) provides the *rationale* for teaching of mathematics.**

There are two themes running through this statement in both syllabuses. They state that mathematical literacy is good for both the individual and for the nation of Papua New Guinea.

**Read these sections carefully. Summarise the *rationale* in this table for both lower and upper primary Mathematics.**

<table>
<thead>
<tr>
<th>For the individual student</th>
<th>For the nation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The curriculum principles are identified and elaborated upon on pages 3-8 (lower primary) and pages 4-6 (upper primary). Try to understand what they mean, because they are critical to the thinking and practices of the reform. To help you, have a discussion with a colleague about them.

Read pages 3-8 (lower primary) and 4-6 (upper primary) and prepare a mind map of the Curriculum Principles for either the upper primary syllabus or lower primary syllabus.

- Use the structure given here or one of your own. Add other concepts and links.

Discuss it with a colleague.

- List two significant points raised during this discussion.

Hint: Look for things that are new to your thinking or existing practices.

The Aims of the Mathematics curriculum comes next. It is interesting to note that the Aims are very similar.

- Read page 9 (lower primary syllabus) and page 7 (upper primary syllabus). Then answer the following questions:
  - Which aim indicates that learning in Mathematics is built upon earlier years of schooling?
Unit 4  Learning Areas: Mathematics and Science

- Upper primary has three additional aims.
- What are they?
- Why are they important?

Hint: The subject aims are linked to the aims of primary education in the National Curriculum Statement.

Now read the Mathematics strands as described in the Content Overview, pages 10-12 (lower primary syllabus) and pages 8 – 11 (upper primary syllabus).

For each content strand, a number of sub-strands are provided. These help organise and specify the learning outcomes.

List the sub-strands in the Number and Application Strand. (Grade 6)

1.  5.
2.  6.
3.  7.
4.

• When you look across grades 6-8, the sub-strands are seen to vary slightly.
- What are the differences?

- What explanation could there be for these differences? Write your explanation here.

- List the sub-strands for Space and Shape for grades 5 (lower primary) and grade 6 (upper primary).
• Identify any differences

• What explanation could there be for these differences? Write your explanation here.

**Learning outcomes** describe what it is that students know, can do and understand as a result of a learning experience, eg. a unit of work.

You’ll find the learning outcomes for lower primary on page 13 and for upper primary on pages 12-16.

Take a moment to skim read these pages.

The numbering system being used to code the outcomes is described at the top of page 13 in the lower primary syllabus and top of page 12 in the upper primary syllabus. Three digits are used. An example is 3.1.2. The first digit refers to the grade level. The second digit refers to the strand and the third digit refers to the outcome in the strand. Thus 3.1.2 refers to grade 3, Strand 1 (Number and Application), Outcome 2. Similarly Outcome 6.2.3 refers to Outcome 3, Strand 2 (Space and Shape), for grade 6. Note that the numbering system is consistent within all lower and upper primary syllabuses.

Read each of the outcomes for the Measurement strand for grade 4 on page 12 of the lower primary syllabus.

• Make a note of the sub-strand to which they relate. The first one is done for you.
Unit 4  Learning Areas: Mathematics and Science

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Sub-strand</th>
<th>Outcome</th>
<th>Sub-strand</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.1</td>
<td>Length</td>
<td>3.2.2</td>
<td></td>
</tr>
<tr>
<td>3.2.5</td>
<td></td>
<td>3.2.3</td>
<td></td>
</tr>
</tbody>
</table>

Hint: The table on page 11 can assist.

• What do you notice as you read across a row, for example, 3.3.1, 4.3.1 and 5.3.1? (page 13, lower primary) What is the importance of this information?

• What do you notice as you read down a column, for example, 3.1.1, 3.1.2, 3.1.3 and 3.1.4 (page 13, lower primary) What is the importance of this information?

Pages 15-16 list the learning outcomes for the Chance and Data Strand for upper primary.

• Read each of the outcomes for grade 6 and make a note of the sub-strand of Chance and Data to which they relate. The first one is done for you.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Sub-strand</th>
<th>Outcome</th>
<th>Sub-strand</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.4.1</td>
<td>Statistics</td>
<td>6.4.5</td>
<td></td>
</tr>
<tr>
<td>6.4.2</td>
<td></td>
<td>6.4.6</td>
<td></td>
</tr>
<tr>
<td>6.4.3</td>
<td></td>
<td>6.4.7</td>
<td></td>
</tr>
<tr>
<td>6.4.4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hint: The table on pages 10-11 can assist.

• What do you notice as you read across a row, for example, 6.4.6, 7.4.6 and 8.4.6? (page 16) What is the importance of this information?

• What do you notice as you read down a column, for example, 6.4.1, 6.4.2, 6.4.3……….? (pages 15-16) What is the importance of this information?

• What do you notice as you read across a row from lower primary to upper primary for a particular sub-strand? An example is provided below for Strand: Space and Shape, Sub-strand: Area.
• What are the ideas or concepts that show growth and progress?

• Make a comment on the overall progress from grade 3 to grade 8.

*Hint: One indicator of progression is that students are expected to progress from informal units to standard units. What are the other indicators?*

• Record the set of outcomes progressing from grade 3 to grade 8 for Strand: Patterns (and Algebra)

<table>
<thead>
<tr>
<th>3.2.2</th>
<th>4.2.2</th>
<th>5.2.2</th>
<th>6.2.4</th>
<th>7.2.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate and measure areas using informal regular units</td>
<td>Estimate and measure areas of surfaces using standard units of area</td>
<td>Use appropriate metric units to measure and calculate area</td>
<td>Find the area of composite shapes</td>
<td>Compare areas by estimation</td>
</tr>
<tr>
<td>6.2.5</td>
<td>7.2.5</td>
<td>8.2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigate and use area rules for triangles and rectangles</td>
<td>Investigate area rules for quadrilaterals</td>
<td>Investigate the area of circles</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

• What is the importance of this information? What are the implications for practice?

*Hint: Think of what the syllabuses are indicating to you. How may this affect the way you plan?*
You have explored the Secretary’s message and the first five sections of the Mathematics syllabuses.

- List the other sections of the syllabuses you are yet to explore, in the following table.

<table>
<thead>
<tr>
<th>Lower Primary Syllabus</th>
<th>Upper Primary Syllabus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These sections will be explored in Module 2 of this unit.

**Part 2: The Mathematics Teacher Guides**

To complete this section you will need a copy of the teacher guides listed below. The best way to approach the activities in this section is to have both teachers guides open in front of you at the same section so you can quickly scan for similarities and differences.

Mathematics Teachers Guide, Lower Primary, 2004*

- **Open both guides and browse through them, noting similarities and differences.**

Both guides contain information about the in-service units, the Secretary’s message and an introduction.

On page (iv) you will find some information about the ‘In-service units’ for lower primary and upper primary teachers and other practitioners. In recent times a decision was made to amalgamate the lower and upper primary in-service units into one set for primary schools. This unit you are working through is one of the amalgamated units.

Read the last two paragraphs of the Secretary’s message in both teacher guides.

- **Summarise the recommendations in these two paragraphs into 4-6 dot points.**

One example is provided – teachers should:

- read the guide carefully
- ……
- ……..
Read the *Introduction* in the lower primary teacher guide, pages 1-3 and upper primary teacher guide, pages 1-4.

The first part of the *Introduction* explains the purpose of the guides.

- What information would you highlight if you had to explain the purpose of the guides to a colleague who hasn’t seen them before?

*Using this teacher guide* section of the guides say: when you receive this book, you need to do a number of things.

- Read this section.
- Now rewrite these as a step-by-step guide on a chart, for either lower primary or upper primary, to put up in your staffroom or office.
- The common topics covered in the *Introduction* of both teacher guides are listed in the table below. They provide consistent information. Write a brief note about each one.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature of mathematics</td>
<td></td>
</tr>
<tr>
<td>Links with other subjects</td>
<td></td>
</tr>
<tr>
<td>Links with other levels</td>
<td></td>
</tr>
</tbody>
</table>
- Identify two occasions from your past practice when you integrated Mathematics learning with other subjects.
Use your examples to explain to a colleague how Mathematics can contribute to learning in other subjects and how the content of other subjects can be used for Mathematics topics.

The lower primary teacher guide identifies two additional topics. Write a brief note about each one. One is done for you.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilingual education</td>
<td>using two languages for instruction</td>
</tr>
<tr>
<td></td>
<td>bridging to English</td>
</tr>
<tr>
<td>Integration</td>
<td></td>
</tr>
</tbody>
</table>

Both teacher guides contain a section that outlines the key features of the subject. Find this section in both teacher guides – lower primary (pages 4-8); upper primary (pages 5-8).

- Skim read these sections.

Construct a mind map of the key features identified in one teacher guide.

- Now compare it with the key features in the other teacher guide.
- List any differences.

Both teacher guides contain a section that outlines the Teaching and learning strategies. Find this section in both teacher guides – lower primary, pages 10-17; upper primary, pages 9-11.

- Skim read both sections.
Complete the following table.

<table>
<thead>
<tr>
<th>Lower primary strategies</th>
<th>Upper primary strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Study your table and highlight any strategies that overlap (that is, are the same) in the teacher guides.

Reflect on the commonalities between the structure and contents of the two Mathematics teacher guides.

Other sections of the teacher guide are:
- Assessment and reporting (pages 18-29, lower primary; pages 12-21, upper primary)
- Programming (pages 30-34, lower primary; pages 22-25, upper primary)
- Units of work (pages 35-41, lower primary; pages 26-40, upper primary)
- Elaborations of learning outcomes (pages 42-60, lower primary; pages 41-47, upper primary)
- Resources, Glossary and Appendices (pages 61-72, lower primary; pages 48-61, upper primary)
Skim read these sections to get an overview of the teacher guides.

The above listed sections come into focus in modules 2, 3 and 4 of this in-service unit.

Assess your learning by reflecting on the following:

Can you now explain to someone else:
• the structure of the syllabuses and teacher guides?
• why curriculum principles are identified in each syllabus?
• how to use the teacher guides?
• the links between the teacher guides and the syllabuses?
• how the learning area of Mathematics is being developed for schools?

If you are not sure, you may wish to go back over the appropriate sections and reflect on the difficulties and/or seek help.
Section 2: The Science Learning Area

The Science Learning Area is developed through the subject Environmental Studies in the lower primary and Science in the upper primary.

To complete this section you will need copies of the syllabuses and teacher guides listed below.

*Environmental Studies, Lower Primary Syllabus, 2004*
*Science, Upper Primary Syllabus, 2003*
*Environmental Studies Teacher Guide, Lower Primary, 2004*
*Science Teachers Guide, Upper Primary, 2003*
*National Curriculum Statement (2002)*

Part 1: Science/Environmental Studies Syllabuses

The best way to approach the activities in this section is to have both the Environmental Studies Syllabus and the Science Syllabus open in front of you at the same section so you can quickly scan for similarities and differences.

Read the Secretary’s message on page iv (of both lower and upper primary)

Paragraphs 4 and 5 of this message highlight the importance of this subject in the overall curriculum for the primary years of schooling in Papua New Guinea.

- Read the *Introduction* on page 1 of both lower and upper primary syllabuses.

The Environmental Studies Syllabus talks about education in the environment, about the environment and for the environment (paragraphs 3, 4 and 5).

Write in your own words your understanding of:

- Education in the environment …. 

- Education about the environment …. 

- Education for the environment ….

The *Introduction* in the Upper Primary Science Syllabus talks about learning outcomes and indicators.
Write an explanation of outcomes-based education based on information provided here.

Share your explanation with a colleague. Write down what they think about it.

Hint: They may not be enthusiastic. They may be overwhelmed or confused. If they are, find out why they feel so.

Read the rationale, page 2 of both lower and upper primary syllabuses.

You will note that the place of science in the total curriculum for primary students has been challenged in the upper primary syllabus.

- Answer the following questions:
  
  - Why can it be argued that science should not be included? (upper primary)

- What justifications are given to have science/environmental studies included in the curriculum of primary schools?

- What is your own opinion on this matter?

- What are the challenges in linking science to real life situations (paragraph 3, upper primary)?
Read pages 3-7 (lower primary) and pages 3-6 (upper primary) on *curriculum principles*.

- With reference to the *curriculum principles* show whether the following statements are true or false. If they are false, give a brief explanation as to why you think it is so. Then correct the false statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>True/False and why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents should be involved with the school in the planning and implementation of the Science/Environmental of Studies syllabuses.</td>
<td></td>
</tr>
<tr>
<td>Environmental sustainability is so complex, difficult but important that it requires unique and additional attention.</td>
<td></td>
</tr>
<tr>
<td>All children will be naturally interested in science and apply themselves to it.</td>
<td></td>
</tr>
<tr>
<td>The differences between children, their range of prior experiences and their enthusiasm to learn will make the job of teaching science easy.</td>
<td></td>
</tr>
<tr>
<td>Students with special needs may need to be excluded from the Science Syllabus.</td>
<td></td>
</tr>
<tr>
<td>It is possible to link the teaching of Science with the teaching of language.</td>
<td></td>
</tr>
<tr>
<td>It is not wise to link Science with Mathematics.</td>
<td></td>
</tr>
<tr>
<td>A good source of learning in Science comes from the resources of the local community.</td>
<td></td>
</tr>
<tr>
<td>Schools without science laboratories will be disadvantaged in the teaching of Science.</td>
<td></td>
</tr>
<tr>
<td>Teachers of Science will need to be well prepared to spend lots of time in giving high quality demonstrations from which students will learn.</td>
<td></td>
</tr>
</tbody>
</table>

*Hint: Focus on the essence of lower and upper primary curriculum principles here, not your personal beliefs, values and feelings.*
The curriculum principles here include Teaching and Learning (lower primary, pages 6-7; upper primary, pages 5-6).

The upper primary syllabus (page 6) makes a special point in discussing four important issues for science education.

Read page 6 carefully.

- Make a comment about each of the following statements found on page 6:

  - We can teach a practical Science without a laboratory.

  - Learning Science is something that students do, not something that is done to them.

  - Science must be relevant to the purposes and interests of all students regardless of their age, sex, cultural background, disability, aspirations or interests.

  - The nature of working scientifically can involve risks.

Both the lower primary and the upper primary syllabuses focus on student-centred learning and language development across the curriculum.

With reference to language development across the curriculum, the syllabuses have this to say:

Science uses particular vocabulary and language forms. A conscious effort should therefore be made to use and teach the language of science. (Upper primary, page 5)

Do you agree? Do you practise this?

The lower primary syllabus says:

Specific subjects have different language requirements such as vocabulary and language features. The conventions and differences must be explicitly taught in relevant contexts across the curriculum. (page 7)

Do you agree? Do you practise this?

This is a much broader statement than the one above from the upper primary syllabus.
The two statements show how the Science in the upper primary becomes more differentiated as a discipline. It is important that you become aware of this and other differences particularly if you teach a multi-grade class.

Read the aims of the Science Syllabus, page 7 and those of Environmental Studies, page 8.

There are seven aims in each syllabus. All the aims for lower primary relate to the environment whereas only two aims in the upper primary relate to the environment and the others to the knowledge, processes and habits of science.

- Do you think these differences between the lower and upper primary aims are justified?

- Refer to the Aims of Primary Curriculum, page 12, National Curriculum Statement (2002). Write a statement about the match between the lower and upper primary aims and the aims of primary curriculum.

Hints: Do the aims of Science and Environmentat studies contribute to the achievement of the aims of primary curriculum?

Read the content overview on pages 8-10, upper primary, and pages 9-11, lower primary.

There are four stands and six sub-strands in upper primary Science. Working Scientifically is described as a process strand.

- What is meant by a process strand and how is it different to the other three strands?

There are two strands and five sub-strands in lower primary Environmental Studies. A process strand is not identified here. However, an Environmental Studies process is identified and explained in the teacher guide (page 7).

Use the table below to show the structure of the Science and Environmental Studies syllabuses.
Syllabus writers use process and/or content/concept strands and sub-strands to organise the scope of the subject. They take each of these organisers and then develop learning outcomes on the basis of which teachers derive their content – knowledge, skills and attitudes. Teachers use outcomes to develop the content of their lessons.

The Learning Outcomes for lower primary are found on page 12 and those for upper primary are found on pages 11-13.

- Without reading any further at this point, suggest some content that you imagine could be included in the following strands and sub-strands. What you are being asked here to do is to walk in the shoes of a syllabus writer. You have already explored the rationale, aims, curriculum principles and the content overview, even though you may not fully understand everything you have read yet.

<table>
<thead>
<tr>
<th>Strand: Living Things</th>
<th>Possible content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-strand: Nature of Living Things</td>
<td></td>
</tr>
<tr>
<td>Outcome: 8.2.1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand: Science in the Home</th>
<th>Possible content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-strand: Energy at Home</td>
<td></td>
</tr>
<tr>
<td>Outcome: 6.3.3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand: Earth and Beyond</th>
<th>Possible content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-strand: Space Exploration</td>
<td></td>
</tr>
<tr>
<td>Outcome: 7.4.2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand: What’s in my environment?</th>
<th>Possible content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-strand: Links in the environment</td>
<td></td>
</tr>
<tr>
<td>Outcome: 4.1.3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand: Caring for my environment</th>
<th>Possible content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-strand: Managing wastes</td>
<td></td>
</tr>
<tr>
<td>Outcome: 3.2.2</td>
<td></td>
</tr>
</tbody>
</table>
**Unit 4 Learning Areas: Mathematics and Science**

*Hint*: There are no right or wrong answers here. The area of science is so huge that almost anything can be included; however, a syllabus writer is restricted by a number of factors and makes decisions about what to include and what to exclude. When you turn the next few pages of the Science Syllabus it will be revealed. In doing this process, you will begin to understand the complex task of syllabus writers.

Read through the upper primary Learning Outcomes on pages 11-13 and the lower primary Learning Outcomes on page 12. Use the following checklist to ascertain whether you have noticed the following.

<table>
<thead>
<tr>
<th>Checklist</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Scientifically, as a process strand, impacts each of the other three strands for upper primary</td>
<td></td>
</tr>
<tr>
<td>Some learning outcomes are developed across the grades 6, 7, and 8 and some across the grades 3, 4 and 5. Give an example to support your answer.</td>
<td></td>
</tr>
<tr>
<td>Some learning outcomes are unique to grade 6, unique to grade 7 or unique to grade 8. Give an example to support your answer.</td>
<td></td>
</tr>
<tr>
<td>No process strand is evident in the Lower Primary Environmental Studies Syllabus</td>
<td></td>
</tr>
</tbody>
</table>

Remember *Working Scientifically* is a process strand and is not to be taught on its own (Science syllabus, page 8). Instead, it is suggested that the content/concept outcomes are to be taught, learned, applied and assessed through this process strand. However, you are expected to make judgements about student achievement of the *Working Scientifically* outcomes. There is one *Working Scientifically* outcome for each upper primary grade.

The numbering system for the Science outcomes (top of page 11) and Environmental Studies outcomes (top of page 12) follows the same pattern as all other syllabuses.

The rest of the sections in the syllabuses – Learning outcomes and Indicators, Assessment and Reporting, References and Appendix (in lower primary only) - will be dealt with in modules 2, 3 and 4.
Part 2: Science/Environmental Studies Teacher Guides

To complete this section you will need a copy of the teacher guides listed below. The best way to approach the activities in this section is to have both teachers guides open in front of you at the same section so you can quickly scan for similarities and differences.

*Environmental Studies Teacher Guide, Lower Primary, 2004*
*Science Teachers Guide, Upper Primary, 2003*

Open both guides and browse through them, noting similarities and differences.

Both guides contain information about the in-service units, the Secretary’s message and an introduction.

Read the last two paragraphs of the Secretary’s message in both teacher guides.

Working with a colleague, compare the message in these two documents with that in the Mathematics teacher guides.

- Are they the same?
- If not, identify the differences.


The purposes of the two teacher guides are very similar and also similar to the purposes of the Mathematics teacher guides.

Using *this teacher guide* section of the guides say: when you receive this book, you need to do the following.

- Read this section.
- The other topics covered in the *Introduction* of the teacher guides are listed in the table below. They provide useful information. Write a brief note about each of them.
<table>
<thead>
<tr>
<th>Science</th>
<th>Brief notes</th>
<th>Environmental Studies</th>
<th>Brief notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature of Science in the upper primary</td>
<td></td>
<td>Bilingual education - bridging to English</td>
<td></td>
</tr>
<tr>
<td>Links with different levels</td>
<td></td>
<td>Integration</td>
<td></td>
</tr>
<tr>
<td>Links with other subjects</td>
<td></td>
<td>Nature of Environmental Studies</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- links with other levels</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- links to other subjects</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- links across grades and strands</td>
<td></td>
</tr>
<tr>
<td>Links across the Science strands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Units of work from one outcome</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- What do you think are the reasons for these differences?
- Why are bilingual education, bridging to English and integration important at lower primary?
- Why does the Science Teacher Guide talk about ‘units of work from one outcome’?

**Both teacher guides contain a section that outlines the **key features of the subject.**
Find this section in both teacher guides – Environmental Studies (pages 5-7); Science (pages 4-7).**

- Skim read these sections.
**Unit 4 Learning Areas: Mathematics and Science**

**Construct a mind map of the key features identified in the Environmental Studies Teacher Guide.**

Below are the beginnings of the mind map. Complete it by adding more boxes and links as you need them.

- Environmental problems and issues
  - Strands and sub-strands
  - Key features
  - The Environmental Studies process
The key features in the Science Teacher Guide are quite different from those of Environmental Studies.

- Are these differences justified? If yes, how can the differences be justified?

On pages 5-6, you find information about ‘Science processes’ and ‘Science skills’. The skills-oriented strand of Science is Working scientifically.

- What are the components of this strand?

- Do you see any connection between the ‘investigating’ component of Working scientifically on page 6 and the ‘Science processes’ on page 5?

- Why is ‘Practical Science’ on page 7 a key feature of Science?

*Hint: You need to think deeply into the practical aspects of Science, however, it does not necessarily mean that you need a laboratory to teach Science.*

Both teacher guides contain a section that outlines the Teaching and learning strategies. Find this section in both teacher guides – upper primary (pages 8-17); upper primary (pages 8-18).

- Skim read both sections.

**What are the major differences you see here?**

- List them here.

- How does the Environmental Studies process (lower primary syllabus, pages 11-12) compare with the Science process (upper primary syllabus, page 5)?
Make a comprehensive list of all the learning and teaching strategies suggested in the teacher guides. Some are mentioned in both and the others only in one teacher guide or the other. Place one ‘tick’ (√) if found only in one teacher guide and two ‘ticks’ (√ √) if found in both. Use the table below. Two examples are provided.

<table>
<thead>
<tr>
<th>Learning and teaching strategies</th>
<th>In one teacher guide only or both teacher guides?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming</td>
<td>✓</td>
</tr>
<tr>
<td>Testing predictions</td>
<td>✓</td>
</tr>
<tr>
<td>Observation and collecting information</td>
<td>✓✓</td>
</tr>
</tbody>
</table>

You’ll find most of these strategies in the teacher guides for other subjects such as Social Science, Making a Living, etc. illustrating the universality of those strategies.

Reflect on the commonalities and the differences between the structure and contents of the two teacher guides you have explored so far.

Other sections of the teacher guide are:
- Assessment and reporting (pages 18-27, lower primary; pages 19-29, upper primary)
- Programming (pages 28-34, lower primary; pages 30-32, upper primary)
- Units of work (pages 35-59, lower primary; pages 48-61, upper primary)
- Elaborations of learning outcomes (pages 60-65, lower primary; pages 33-47, upper primary)
- Resources, Glossary and Appendices (pages 66-76, lower primary; pages 62-64, upper primary)
Skim read these sections to get an overview of the teacher guides.

The above listed sections come into focus in modules 2, 3 and 4 of this in-service unit.

Assess your learning by reflecting on the following questions:

Can you now explain to someone else:

• the structure of the syllabuses and teacher guides?
• why curriculum principles are identified in each syllabus?
• how to use the teacher guides?
• the links between the teacher guides and the syllabuses?
• how the learning area of Science (Environmental Studies/Science) is being developed through for schools?

*Hint: If you are not sure, you may wish to go back over the appropriate sections and/or seek help.*
Section 3: Linking Mathematics and Science Learning Areas

Mathematics and Science are developed in the primary school curriculum as two separate learning areas; however, they do share some common features – processes, knowledge and attitudes.

In the Unit Introduction (pages 9-10) you’ll find some extracts from the National Curriculum Statement (2002) about these two learning areas.

Re-visit pages 9-10 of Unit Introduction.

- Read also pages 37-38 and 40-41 of the National Curriculum Statement (2002).
- Take notes on some common features found in the descriptions of the two learning areas.
- One example is done for you. Find two more common features.

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through a study of mathematics, students will explore ways of solving problems and to conduct day-to-day dealings.</td>
<td>Science offers a system of thinking to solve problems.</td>
</tr>
</tbody>
</table>

- Re-visit pages 3-7 (lower primary) and pages 3-8 (upper primary).
- Take notes on how these learning areas are said to contribute to multiculturalism, integral human development and language development across the curriculum.
<table>
<thead>
<tr>
<th>Curriculum Principles</th>
<th>Mathematics</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiculturalism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integral human development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language development across the curriculum</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Do Mathematics and Science make different (from other learning areas) and significant contributions to Multiculturalism, Integral human development and Language development across the curriculum, in your view? Comment
- Read page 3 of the Science Teachers Guide and pages 2-3 of the Upper Primary Mathematics Teachers Guide. These pages feature two linking diagrams.

Both the Environmental Studies teacher guide and the Mathematics teacher guide provide advice on ‘links to other subjects’, but not necessarily with each other.

Now that you are familiar with the strands, sub-strands and outcomes of Mathematics and Science/Environmental Studies syllabuses, use the model on page 3 of Science teacher guide to:

- construct a diagram linking two mathematics and two science sub-strands for upper primary
- construct a diagram linking two mathematics and two environmental studies sub-strands for lower primary.

*Hint: In order to see links, read elaborative information provided in the teacher guides.*

The links you make here will be explored further in Module 4.
Module Summary

Congratulations! You have come to the end of this module. The focus here has been the preliminary sections of the Mathematics and Environmental/Science syllabuses and teacher guides for both lower and upper primary.

In the context of vernacular language development and bridging to English in the lower primary and the generalist and integrated approaches being recommended in the upper primary, it is important for practitioners to explore the subjects individually and in relation to each other.

You have seen how similar the four syllabuses are in their structure. The four teacher guides are also structured in similar ways.

Through the study of this module you would have developed some insights into and knowledge and skills in each of the learning areas and an understanding of how they are being shaped for the lower primary and upper primary years.

At this point let us review your progress by assessing the extent to which you can now demonstrate each outcome.

The outcomes of this module are copied here. For each of the outcomes how do you assess yourself - Yes, No or Not sure?

<table>
<thead>
<tr>
<th>Can you:</th>
<th>Yes/No/ Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. compare the structure and contents of the Mathematics syllabuses with the Science syllabuses?</td>
<td></td>
</tr>
<tr>
<td>2. identify the links between each Mathematics syllabus and the corresponding teacher guide?</td>
<td></td>
</tr>
<tr>
<td>3. identify the links between the Science/Environmental Science syllabuses and the corresponding teacher guides?</td>
<td></td>
</tr>
<tr>
<td>4. explain why these learning areas are included in the primary curriculum?</td>
<td></td>
</tr>
<tr>
<td>5. describe the curriculum principles underlying the Mathematics and Science syllabuses?</td>
<td></td>
</tr>
<tr>
<td>6. identify the focus areas in each syllabus and their links with each other?</td>
<td></td>
</tr>
<tr>
<td>7. describe the way content is organised in each of the syllabuses?</td>
<td></td>
</tr>
<tr>
<td>8. make links between the Mathematics and Science learning areas?</td>
<td></td>
</tr>
</tbody>
</table>
If you answered ‘Yes’ to all of them, then you have done very well. Think about the kinds of evidence that will support the achievement of each of the outcomes. If you have said ‘No’ or ‘Not sure’ to some, then it may be worth your while to go over the appropriate sections of the module again and have another go at repeating the tasks, and/or reflecting on your difficulties and seeking help.

Remember these modules outcomes help you achieve the outcomes of the unit. Refer back to the outcomes of the unit in the Unit Introduction and reflect on where you are in relation to those outcomes.

If you are seeking academic credit, you were advised to keep a running record of any evidence you may have for particular unit outcomes. If you have not been doing this go back over the module and jot down, in your Learning Contract, what you might consider to be evidence for the unit outcomes for which you have agreed to provide evidence.

Additional space for your notes
Additional space for your notes
Unit 4: Learning Areas: Mathematics and Science

Module 2: Learning outcomes, indicators and elaborations

Contents

<table>
<thead>
<tr>
<th>Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module introduction</td>
<td>2</td>
</tr>
<tr>
<td>Module learning outcomes</td>
<td>2</td>
</tr>
<tr>
<td>Section 1: Learning outcomes and indicators</td>
<td>3</td>
</tr>
<tr>
<td>Section 2: Elaborations of learning outcomes</td>
<td>15</td>
</tr>
<tr>
<td>Module Summary (and additional space for your notes)</td>
<td>19</td>
</tr>
</tbody>
</table>

Name: ........................................................ File No: .................................................

Date commenced: ...................................... Date completed: .......................................

I have sighted this study guide as evidence of completion of agreed tasks by

..................................................................................................................................................(insert name)

Assessor: ..................................................... Date: .....................................................
Module 2: Learning outcomes, indicators and elaborations

Module Introduction

Welcome to Module 2: Learning outcomes, indicators and elaborations.

This module focuses on the Mathematics and Science/Environmental Studies syllabuses and teacher guides and outcomes charts for lower and upper primary years.

Mathematics, Lower Primary Syllabus, 2004  
Mathematics, Upper Primary Syllabus, 2003  
Environmental Studies, Lower Primary Syllabus, 2004  
Science, Upper Primary Syllabus, 2003  
Upper Primary Learning Outcomes for Grade 6, 7 and 8  
Mathematics Teacher Guide, Lower Primary, 2004  
Mathematics Teacher Guide, Upper Primary, 2003  
Environmental Studies Teacher Guide, Lower Primary, 2003  
Lower Primary Learning Outcomes for Grade 3, 4 and 5

In this module we examine how the learning outcomes are expanded by looking at indicators in the syllabuses and elaborations in the teacher guides.

To do this module you will need access to all documents listed above. These are shown on pages 4-7 of the Unit Introduction. All activities in this module are based on these documents.

If you are seeking academic credit, make sure you do the self-assessment in the Accreditation and Certification section before you start this module. As you do this module, keep a running record of sections, parts and pages of the module where you can identify evidence for particular unit outcomes. You may wish to record such information in your Learning Contract.

Module learning outcomes

When you have worked through this module, you, the learner, can (are able to):

1. discuss the nature and purposes of indicators and elaborations
2. identify ways progress from grade 3 to grade 8 is indicated in these sections of the syllabuses and teacher guides
3. write additional indicators for outcomes
4. make judgements about the linkages between particular outcomes
Section 1: Learning outcomes and indicators

To complete this section you will need copies of both lower primary and upper primary Mathematics and Science/Environmental Studies syllabuses. The best way to approach the activities in this section is to have the documents open in front of you at the same section so you can quickly scan the information provided.

Part 2.1: Learning outcomes and indicators

Turn to page 12 of the Environmental Studies, Lower Primary Syllabus which lists the Learning Outcomes by strands and grades. You’ll notice that there are three outcomes for the first strand for each grade and two outcomes for the second strand for each grade.

To help you understand the learning outcomes, imagine they have the words
• ‘Students can.…’ or
• ‘students are able to ….’ or
• ‘students ….’

in front of the statements. For example, read outcome 3.1.1 as ‘Students can (or are able to) identify different species of plants and animals found in the environment’ or as ‘Students identify different species of plants and animals found in the environment’.

You are, by now, familiar with the numbering system for the outcomes.

Pages 13-17 give further information for the teacher.

Page 13 is about the strand: What’s in my environment? The sub-strand here is Plants and Animals (see top of first column). Looking across the top of columns 2, 3 and 4, you will notice that for each grade there is an outcome for this sub-strand – 3.1.1, 4.1.1 and 5.1.1.

Further down the page, indicators are provided for each of the outcomes. Indicators are examples of the kind of things students should be able to do, know and understand if they have achieved an outcome. (page 10)

The key idea in the above definition of an indicator is that indicators are examples only. They show ways the achievement of an outcome can be demonstrated and help you, the teacher, decide whether your students have achieved an outcome.

Indicators are not necessarily learning or teaching or assessment activities.

An outcome can be interpreted and understood in different ways by different people; the indicators serve to set the standard expected for a particular grade.
Learning outcomes and indicators

Strand: What’s in my environment?

<table>
<thead>
<tr>
<th>Sub-strand</th>
<th>Grade 3</th>
<th>Grade 4</th>
<th>Grade 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants and Animals</td>
<td>3.1.1 identify different species of plants and animals found in the environment</td>
<td>4.1.1 Describe features of plants and animals that live in the environment</td>
<td>5.1.1 Investigate and apply ways of using, protecting and conserving certain plants and animals</td>
</tr>
</tbody>
</table>

Indicators
Students will be achieving the above learning outcomes in vernacular and/or English, when they, for example:

- Record different species of plants and animals they observe during visits to sites such as beaches, gardens
- Record types of features of plants and animals found in selected environments such as grasslands, forests, rivers, the ocean
- Gather information about certain plants and animals from a range of sources such as natural environment, library or from people

For Outcome 3.1.1, six indicators are provided to get you started (page 13). In time, you’ll be able to add to these. For Outcome 4.1.1 and 5.1.1 also six indicators are provided.

Some indicators deal with only particular aspects of an outcome. For example, the first indicator for Outcome 3.1.1 is about students recording different species, the second indicator is about talking about similarities and difference, and the third indicator is about discussing how to identify different species of animals and plants. These are important steps to achieving the outcome but none of them by themselves is sufficient to satisfy a teacher. So the demonstration of one or two of these indicators is not enough to indicate the achievement of an outcome. It is the demonstration of a range of them over a period of time that gives the teacher a sense of a student’s achievement.

Since indicators are examples only, there are other ways to find out and judge whether a student has achieved the outcome.

The outcome and its indicators together provide the standard at which that outcome is to be understood, taught and assessed.

At this point let us review what you know about the nature and function of indicators.
• Read the following statements and tick the ones with which you agree and correct those you think are incorrect. Explain your reasons.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Agree/do not agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicators are learning and teaching activities</td>
<td></td>
</tr>
<tr>
<td>Indicators are examples only</td>
<td></td>
</tr>
<tr>
<td>Indicators help teachers to understand an outcome as a standard</td>
<td></td>
</tr>
<tr>
<td>As a teacher I can write more indicators for an outcome, provided the standard is maintained</td>
<td></td>
</tr>
<tr>
<td>A student achieves an outcome when he or she can demonstrate all the indicators</td>
<td></td>
</tr>
<tr>
<td>A student achieves an outcome when he or she can demonstrate the kinds of things described in the indicators</td>
<td></td>
</tr>
</tbody>
</table>

Now let us explore the idea of progression.

When we are looking for words that indicate progress, firstly, we look at the action words. In the above example of outcomes 3.1.1, 4.1.1 and 5.1.1, they are *identify, describe* and *investigate and apply*. *Investigate and apply* are seen as a higher order process than *identify* and *describe*, according to Bloom’s taxonomy or six thinking levels (for information about Bloom’s Taxonomy, refer to Primary In-service Unit 6: Learning and Teaching for Outcomes).

However, these words by themselves are not enough to understand and identify progress.

Secondly, we look at the concepts of each outcome.

- What are students expected to be able to identify? *Different species of plants and animals*
- What are students expected to describe? *Features of plants and animals*
- What are they expected to investigate and apply? *Ways of using, protecting and conserving certain plants and animals*

Here you can see that investigating and applying ways of using, protecting and conserving certain plants and animals is more demanding of student time and effort than describing features of plants and animals or identifying different species of plants and animals.
Thirdly, we look at the context. The contexts for the three outcomes appear to be the same – the environment.

This way you can understand intended progress, facilitate student learning and identify it when students demonstrate aspects of it. This is particularly important if you teach in a multi-grade school.

Indicators also help you to understand progress.

Let us turn our attention to the indicators, on page 13 of the Environmental Studies Syllabus, for each of the outcomes.

- What are some words that indicate progress? List them here.

- Make a comment about what you see.

The Mathematics, Upper Primary Syllabus and the Science, Upper Primary Syllabus make clear that ‘the outcomes are written to show a progression from one grade to the next’. (page 1)

At this point let us explore one more set of outcomes from a different subject, Mathematics.

- Take outcomes 6.1.8, 7.1.8 and 8.1.8. (page 12 and page 24). These are copied below.

**Strand: Number and Application**

<table>
<thead>
<tr>
<th>Sub-strand</th>
<th>Grade 3</th>
<th>Grade 4</th>
<th>Grade 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.1.8 Use indices to the power of 2 and 3</td>
<td>7.1.8 Use positive indices greater than the power of 1</td>
<td>8.1.8 Use integer indices and fractional indices where the answers are rational</td>
</tr>
<tr>
<td></td>
<td>Students will be achieving this when they, for example - Calculate solutions to numbers such as $3^2$, $4^2$</td>
<td>Students will be achieving this when they, for example - Calculate numbers such as $2^5$, $3^4$</td>
<td>Students will be achieving this when they, for example, use whole number indices positive, negative and zero</td>
</tr>
</tbody>
</table>
The action words here are *use* for all three outcomes. So this word does not provide a sense of progress.

So we now look at the concepts of each outcome. The concepts are the same also: *indices*.

Thirdly, we look at the context. The context is different for each of the outcomes. From indices to the power of 2 and 3, the context progresses to indices greater that the power of 1 and then on to integer indices and fractional indices where the answers are rational.

Here you can see that the third context is more demanding in terms of student time and effort than the other two contexts and built on the achievement of 6.1.8. and 7.1.8.

Thus indicators also help you to understand progress.

Look at the action words, the concepts, the contexts of the indicators found on page 24 of the Upper Primary Mathematics Teachers Guide to understand and reflect on progress.

- What are some indicators of progress? List them here.

- Make a comment about what you see.

Look at outcomes 6.1.3, 7.1.3 and 8.1.3 on pages 12 and 19 of the Mathematics Syllabus. All of them begin with the action word ‘convert’.

- So identify the words that indicate progress in both the outcomes and the indicators.

- Look at outcomes 6.2.5, 7.2.5 and 8.2.5 on pages 13 and 29 of the Mathematics Syllabus. What are the indicators of progress here in both the outcomes and the indicators?
• Is the progress indicated by the outcomes and the corresponding indicators consistent with each other? Comment.

Now let us turn our attention to the Science Syllabus and teach guide.

**Pages 11-13 of the Science, Upper Primary Syllabus present the Learning Outcomes in a format with which you are now familiar.**

In addition to the content strands and sub-strands, a process strand has been identified—Working scientifically—on page 11. Go back and study the information about this strand on page 8.

• Read carefully the indicators of this strand for each of grades 6, 7 and 8.

• Now go to pages 34-38.

**Look at 6.2.1 from the Living things Strand (page 15). Then look at 6.1.1 from the Working Scientifically Strand (page 14).**

Remember the indicators will assist you to understand the learning outcomes.

• Plan a teaching and learning activity that will engage students with these two outcomes.

**Activity:**

• Plan another teaching and learning activity that will link Outcome 8.3.5 (a content outcome) with Outcome 8.1.1 (a process outcome).

**Activity:**

*Hint: The question here is how you will address a content strand through a process strand or a process strand through a content strand.*
Present this to another teacher in your school as a way of explaining to them how this syllabus is to be considered.

- Write down some comments about your colleague’s response.

Record your comments here:

On pages 14-23 are the outcomes, once again presented in the three stands, but subdivided into the sub-stands with suggested indicators.

Using pages 14-23 of Science Syllabus as a model, prepare a presentation to your staff about how to understand this part of the syllabus.

- Use the content of these pages of the Science, Upper Primary Syllabus to illustrate the format.

- Alternatively, use the chart: Upper Primary Learning Outcomes for grades 6, 7 and 8, to prepare the presentation.

- Show the plan for your presentation here.
Some learning outcomes are simple and direct, but often they are quite complex with two or more verbs and contexts.

Take, for example, 7.3.2 (Science). The components of this are:

<table>
<thead>
<tr>
<th>Action word(s) or verbs</th>
<th>Concept</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>compare</td>
<td>the properties of …… before and after physical and chemical changes patterns in the type of changes that take place in the ……. used</td>
<td>materials</td>
</tr>
<tr>
<td>and identify</td>
<td></td>
<td>materials</td>
</tr>
</tbody>
</table>

A learning outcome may include a number of such components that must all be considered in planning, programming, teaching and learning, and assessing before a student can be said to have achieved the outcome.

Read and analyse the following learning outcomes (from Science) carefully to determine the complexity of the outcome. This will help you plan your teaching activities and assessment methods.

- Draw up a table as above or another structure for your analyses.
- Learning outcome 6.3.2
- Learning outcome 8.3.2
- Learning outcome 8.1.1
As you are aware by now, indicators have been prepared to assist teachers understand the learning outcomes and to identify some contexts in which the achievement of the outcomes may be demonstrated by students.

Remember, indicators provided in the syllabus:
- are examples only
- are not the only way to demonstrate achievement
- illustrate the depth and breadth (ie. the standard) of an outcome
- are for the purpose of making judgements about student achievement of outcomes.

Turn to the Working scientifically outcomes, on page 14 of Science Syllabus.

- Make a list of the different verbs used to introduce the indicators in this section of the syllabus.

1 2 3
4 5 6
7 8 9
10 11 12
13 14

- Turn to Strand: Caring for my environment, Sub-strand: Managing wastes, on page 17 of Environmental Studies Syllabus.

- Make a list of the different verbs used to introduce the indicators in this section of the syllabus.

1 2 3
4 5 6
7 8 9
10 11 12

- Comment on why it is important to have a variety and range of indicators.
Pages 14-23 give examples of the contexts in which each outcome may be demonstrated through two to seven indicators. Let us look at Learning Outcome 6.1.1 for Working scientifically and its five indicators on page 14. The first four indicators are – formulate questions to guide investigation, conduct investigation, draw conclusions, suggest improvements. None of them by itself satisfies the achievement of the outcome. The fifth indicator is also important because it is part of ‘organising their experiences’. So the five indicators together can indicate the achievement of this outcome.

- Examine the indicators for Learning Outcome 7.1.1. What do you see here?

- Examine the indicators for Learning Outcome 8.1.1. What do you see here?

- Now look at the third indicator for each of the outcomes (page 14 of syllabus). The indicators are copied here.

Identify patterns and grouping in information to draw conclusions

Argue conclusions on the basis of collected information and personal experiences

Draw conclusions linked to the information gathered and the purpose of the investigation

Do you see any words or phrases that indicate progress from grades 6 to 8 consistent with the outcomes 6.1.1, 7.1.1 and 8.1.1? The indicator in the right hand box is more consistent with ‘scientific method’ than the other two indicators thereby showing progress. A student demonstrating the ability to ‘draw conclusions linked to the information gathered and the purpose of the investigation’ is seen to be able to draw conclusions free of personal views and feelings (ie. show some detachment from personal views and feelings). This is how a scientist is expected to work.

Now look at the five indicators for each outcome and think about what they represent together. Then think about the progress students will be making from grade 6 to grade 8.

- Read pages 14-23.

Think about ways outcomes and indicators describe progress in concepts as well as skills and attitudes.
• Write down two examples each of ways progress is described in concepts, skills and attitudes.

• Write an additional indicator for the following outcomes:

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Additional Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.1</td>
<td></td>
</tr>
<tr>
<td>5.1.1</td>
<td></td>
</tr>
<tr>
<td>7.3.2</td>
<td></td>
</tr>
<tr>
<td>6.3.1</td>
<td></td>
</tr>
</tbody>
</table>

Hint: In thinking through this activity, look at the action words (active verbs), the concepts and the contexts of outcomes and indicators.

Part 2.2 Summary

Meet with a colleague who is unfamiliar with outcomes-based education.

• Explain to the colleague the concepts of ‘learning outcomes’ and ‘indicators’.

In your explanation, you will need to mention the following:
- what an outcome is
- what an indicator is
- how outcomes are organised into strands and sub-strands
- how the development of outcomes can be viewed across the grades
- the numbering code for outcomes
- purpose of outcomes and indicators
• After the discussion write down how well you think your colleague understood your explanation.

*Hint: If there was confusion and worry, don’t be fearful about noting it down. Note also any positive matters. Be honest in your appraisal.*

You have looked through the ‘Learning outcomes and indicators’ section of Mathematics and Science/Environmental Studies syllabuses. You are now in a position to compare and contrast the syllabuses and understand how they are similar and different in this regard.

One way of doing this is to look at the ‘Lower Primary Learning Outcomes for Grade 3, 4 and 5’ and ‘Upper Primary Learning Outcomes for Grade 6, 7 and 8’ Charts. Here you see an overview of the learning areas, subjects, strands and outcomes at a glance. Notice that some subjects have more outcomes than others. Some have outcomes that are very specific, others have outcomes that are quite general. In some subjects the concepts and skills overlap with those of others. This provides opportunities for integration.

**Reflect on the following:**

• ways you may be able to use the charts with other teachers, students and the community

• ways the charts may contribute to integrating across subjects.
Section 2: Elaborations of learning outcomes

To complete this section you will need copies of all the Mathematics and Science/Environmental Studies teacher guides. The best way to approach the activities in this section is to have all the documents open in front of you at the same section so you can quickly scan for similarities and differences.

Let us recapitulate what we know about outcomes and indicators.
Learning outcomes for each subject describe specifically what students know and are able to do in each strand and grade. The outcomes are broad and can be achieved in many different contexts depending on available resources, school context and expertise of teacher.

The learning outcomes and indicators:
• give you the flexibility to write units of work and teaching programs to suit local conditions, available resources and individual student needs
• help you select appropriate assessment methods, tasks and assessment criteria
• help you plan and revise your teaching program.

Each learning outcome is numbered with three digits, such as 6.1.2. The first number refers to the Grade level, the second number to the strand and the third number to the sub-strand.

Indicators are instances or examples of how the achievement of an outcome can be demonstrated. They are elaborations of the outcomes. Indicators help set demonstrable contexts and standards for outcomes. They help develop an understanding of an outcome.

Now let us look at ‘elaborations of learning outcomes’. ‘Elaborations of learning outcomes’ is a major section of each of the teacher guides. Elaborations describe possible content (knowledge, skills and attitudes) and contexts (school environment, resources) that teachers will use to develop learning experiences and assessment. They are designed to help teachers understand the context of the outcomes.

They are there to assist you to choose suitable content and types of activities you might undertake with your students.

The elaborations describe for each learning outcome:
• recommended knowledge
• recommended processes and skills
• attitudes (in some syllabuses only)
• suggested activities.

The fact that the knowledge, processes, skills and activities are only recommendations, enables you to decide what is required for your students. You may wish to add to what you have selected from your professional experience, to suit your work context.
Page 60 of the *Environmental Studies Teacher Guide, Lower Primary* describes the purpose for providing elaborations of learning outcomes.

- Read this page carefully.

There is a reference to ‘attitudes’ on this page.

- Think about what it says.

Now read pages 33-34 of the *Science Teacher Guide, Upper Primary*.

Here you will find a long list of ‘attitudes’ to be encouraged through a science course. The ‘attitudes’ identified seem to relate to the ideas of ‘custodianship’, ‘conservation’, ‘sustainability’ as well as ‘scientific habits’. These are important considerations in the Science Learning Area.

**Share your understanding of the ‘attitudes’ on pages 33-34 with a colleague and probe what they really mean?**

**Reflect on the kinds of attitudes you have been actively promoting in your science classes.**

- How will you make a commitment to promoting any attitudes in the list that are new to you? Write down your ideas here.

*The Science Syllabus has an extensive section on the processes and skills related to working scientifically.*

Here the process strand of Science in the upper primary is made very explicit.

Read pages 34-38.

- What are the three major headings under which ‘Working scientifically’ is detailed?

- Are you familiar with the various skills (19 altogether) described on pages 34-38?

**Now read about the recommended processes and skills for Environmental Studies Teacher Guide (pages 61-65).**

- Re-visit the Environmental Studies processes described on pages 11-12 of the teacher guide.
Are the recommended processes and skills for Environmental Studies (pages 11-12 and 61-65) similar to those for Science?

The Mathematics syllabuses have not provided details of ‘attitudes’ in the elaborations of learning outcomes section.

However, there are references to ‘attitude’ on page 7 of both upper and lower primary teacher guides.

In the Upper Primary Mathematics Teacher Guide, (pages 41-47) the elaborations are provided in terms of the strands, not outcome by outcome. However, the document *Worked examples of Mathematics Outcomes* (Resource 13, Unit Introduction) provides numerous worked examples for teachers of upper primary.


The Lower Primary Mathematics Teacher Guide, pages 42-60, provides elaborations of learning outcomes.

Read pages 42-60 to familiarise yourself with the elaborations.

Let us now look at how Mrs Wop uses the *Science, Upper Primary Syllabus* and *Science Teachers Guide, Upper Primary* to explore two outcomes.

**Scenario**

Mrs Wop opens the syllabus at page 11 and reads the learning outcomes for the strands: ‘Ecology, relationships and interactions’ strand and ‘Working Scientifically’ strand. She decides to focus on Outcome 6.1.1: Investigate the immediate environment and using scientific methods, organise their experiences and communicate their ideas and Outcome 6.2.2: Using a diagram, describe how energy moves though the living and non-living community.

She then turns to pages 14 and 16 of the syllabus where she finds the indicators for these outcomes.

On page 14, there are five sample indicators listed. She reads: students will be achieving this outcome if they formulate questions..., conduct simple tests ..., identify patterns and groupings ..., cooperatively suggest ... improvements ..., describe and demonstrate ....

On page 16, there are two sample indicators listed. She reads: students will be achieving this outcome if they observe and collect data and make some generalisations ..., construct a food chain ....

Mrs Wop’s next step is to consult the *Science Teachers Guide, Upper Primary*. She finds the elaborations for Outcome 6.2.2 on page 40. The elaboration supplies her with recommended knowledge, processes, skills and suggested activities to help her plan the teaching program. She understands that the main concepts embedded in this outcome are: energy and relationships between animals and plants.

One suggested activity is to draw a poster to ... and a second strategy is to observe plants and animals .... and construct a food chain.

After thinking through what she had found out, Mrs Wop decides that for a few lessons her students will work in small groups to investigate simple forms of energy around them including food and the...
relationship between energy forms and sources and communicate their findings through diagrams and posters. They will then look at energy relationships such as that between plants and animals in the local environment before they identify such concepts as food chains, producers and different levels of consumers and the relationship between the living and the non-living world in this regard.

Mrs Wop remembered that she had read in a book that the idea of a food pyramid would help illustrate the energy pathway through the food web. She decided to construct one jointly with the students.

She decided to use diagrams extensively in the work the students do. This is a requirement of the outcome.

The ideas of investigating and communicating came from the elaborations of working scientifically on pages 34-38 of teacher guide. Some of the content ideas came from page 40 of the teacher guide.

Having explored the two outcomes Mrs Wop is now ready to plan a unit of work based on the two outcomes.

Now it is your turn to make use of a syllabus and teacher guide to explore two outcomes.

Select two outcomes for grade 8 from the Science Syllabus (one must be from ‘working scientifically’) and explore them using Mrs Wop’s approach.

As an alternative, select one outcome from Environmental Studies and the Environmental studies process (pages 11-12) and explore them together using Mrs Wop's approach.

• Record your plan here.
Module Summary

Congratulations! You have come to the end of this module! In doing so you have worked your way through the Science and Mathematics syllabuses and teacher guides and done the many tasks and activities designed to make it easy for you to learn and apply your learning.

The focus in this module has been the nature and purpose of indicators and elaborators.

You should have by now developed certain knowledge, understandings, insights and skills as they relate to reform curriculum in the context of your work. All this should help you to perform well in your work.

At this point let us review your progress by assessing the extent to which you can now demonstrate each outcome.

The outcomes for the module are copied here. For each of the outcomes how do you assess yourself - Yes, No or Not sure?

<table>
<thead>
<tr>
<th>Can you:</th>
<th>Yes/No/ Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. discuss the nature and purposes of indicators and elaborators?</td>
<td></td>
</tr>
<tr>
<td>2. identify ways progress from grade 3 to grade 8 is indicated</td>
<td></td>
</tr>
<tr>
<td>in these sections of the syllabuses and teacher guides?</td>
<td></td>
</tr>
<tr>
<td>3. write additional indicators for outcomes?</td>
<td></td>
</tr>
<tr>
<td>4. make judgements about the linkage between particular outcomes?</td>
<td></td>
</tr>
</tbody>
</table>

If you answered ‘Yes’ to all of them, then you have done very well. Think about the kinds of evidence that will support the achievement of each of the outcomes. If you have said ‘No’ or ‘Not sure’ to some, then it may be worth your while to go over the appropriate sections of the module again and have another go at repeating the tasks, and/or reflecting on your difficulties and seeking help.

Remember these module outcomes help you achieve the outcomes of the unit. Refer back to the outcomes of the unit in the Unit Introduction and reflect on where you are in relation to those outcomes.

If you are seeking academic credit you were advised to keep a running record of any evidence you may have for particular unit outcomes. If you have not been doing this go back over the module and jot down, in your Learning Contract, what you might consider to be evidence for the unit outcomes for which you have agreed to provide evidence.
Additional space for your notes
Unit 4: Learning Areas: Mathematics and Science

Module 3: Teaching and Learning, Assessing and Reporting

Contents

<table>
<thead>
<tr>
<th>Contents</th>
<th>Page/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module introduction</td>
<td>2</td>
</tr>
<tr>
<td>Module learning outcomes</td>
<td>3</td>
</tr>
<tr>
<td>Section 1: Teaching and learning</td>
<td>4</td>
</tr>
<tr>
<td>Section 2: Assessing, recording, reporting and evaluating</td>
<td>13</td>
</tr>
<tr>
<td>Module Summary (and additional space for your notes)</td>
<td>23</td>
</tr>
</tbody>
</table>

Name: ........................................................ File Nº: ....................................................
Date commenced: ...................................... Date completed: ....................................... 

I have sighted this study guide as evidence of completion of agreed tasks by ...........................................(insert name)
Assessor: ..................................................... Date: ....................................................
Module 3: Teaching and Learning, Assessing and Reporting

Module Introduction

Welcome to Module 3: Teaching and Learning, Assessing and Reporting.

This module focuses on Mathematics and Environmental Studies/Science syllabuses and teacher guides.

Mathematics, Lower Primary Syllabus
Mathematics, Upper Primary Syllabus, 2003
Environmental Studies, Lower Primary Syllabus
Science, Upper Primary Syllabus, 2003
Mathematics Teacher Guide, Lower Primary 2004
Mathematics Teacher Guide, Upper Primary 2004
Environmental Studies Teacher Guide, Lower Primary 2004
Science Teacher Guide, Upper Primary 2005

We look at the way the information in the subject syllabuses is expanded in the teacher guides to provide teachers with examples of strategies and approaches to assist with their planning, teaching and assessment needs.

To do this module you will need access to all documents listed above. These are shown on pages 4-7 of the Unit Introduction. All activities in this module are based on these documents.

If you are seeking academic credit, make sure you do the self-assessment in the Accreditation and Certification section before you start this module. As you do this module, keep a running record of sections, parts and pages of the module where you can identify evidence for particular unit outcomes. You may wish to record such information in your Learning Contract.
Module learning outcomes

When you have worked through this module, you, the learner, can (are able to):

1. explain the characteristics of and the approaches to student-centred learning
2. explain to a colleague the key features of the bilingual education approach and their implications for schools
3. describe and apply the different teaching and learning strategies and approaches recommended for Mathematics and Science learning areas
4. explain the meaning of words used to describe aspects of assessment and reporting
5. describe and apply the assessment, recording and reporting methods recommended for Mathematics and Science learning areas.
Section 1: Teaching and Learning

Part 1: Teaching and Learning in Lower Primary

Re-visit the section on Teaching and learning in both Mathematics and Environmental Studies lower primary syllabuses.

In both syllabuses Teaching and learning is part of the Curriculum Principles section. Teaching and learning principles can be found on the following pages.

Mathematics Lower Primary Syllabus: pages 5-8
Environmental Studies, Lower Primary Syllabus: pages 6-7

The focus in this part of the module is Teaching and Learning. However, it should not be considered apart from the other components of Curriculum Principles—Our way of life and Integral human development.

In the lower primary sector, bi-lingual education and bridging to English and integrated approaches across subjects underpin all learning and teaching.

Now read pages 5-8, Mathematics, Lower Primary Syllabus and pages 6-7, Environmental Studies, Lower Primary Syllabus more closely.

On page 5, the Mathematics syllabus says that it is based on three learning principles.

Do you support these principles in your current practices?

If yes, you are doing well.

If not, think about how you could make a commitment to these principles.

Make a list of all the key ideas discussed on pages 5-8 in the Mathematics syllabus. A table is provided.

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>Environmental Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Now read pages 6-7 of the Environmental Studies syllabus, identify the key areas discussed and list them also in the above table.

Write a comparative statement about the scope of the two syllabuses here.

Both syllabuses provide details of the requirements of inclusive curriculum.

Read these requirements in both syllabuses carefully and then write down a definition of inclusive curriculum in the box below.

Inclusive curriculum:

Do you meet these requirements in your current practices?

If yes, you are doing well. If not, reflect on how you could make a commitment to these requirements.

Part 2: Teaching and Learning in Upper Primary

Re-visit the section on ‘Teaching and learning’ in both upper primary Mathematics and Science syllabuses.

In some syllabuses ‘Teaching and learning’ is part of the ‘Curriculum Principles’ section and in other syllabuses it is a separate section. The section can be found on the following pages.

Mathematics, Upper Primary Syllabus: pages 5-6
Science, Upper Primary Syllabus: pages 5-6

The focus in this part of the module is again Teaching and Learning. However, it should not be considered apart from the other components of Curriculum Principles–Our way of life and Integral human development.

In the upper primary sector, first language maintenance is promoted over bi-lingual education and bridging to English. Integrated approaches across subjects and a generalist outlook on the part of the teacher underpin all learning and teaching in the upper primary.

- What do you notice about the focus of teaching and learning in these two syllabuses?

You should have noticed that there are suggestions for teachers and for students.

- List some of these suggestions in the table below. An example has been done for you.

<table>
<thead>
<tr>
<th>Teachers:</th>
<th>Students:</th>
</tr>
</thead>
<tbody>
<tr>
<td>map out learning outcomes (both syllabuses)</td>
<td>are encouraged to use the resources readily available to them in their own surroundings (science)</td>
</tr>
</tbody>
</table>

- On page 6, what does the Mathematics syllabus say about the use of first language in teaching and learning Mathematics?

- On the same page, what does the syllabus say about integration?

- On page 5, what advice does the Science syllabus give about the language of science?

- On page 6, what advice does the Science syllabus give about the nature of science?

The teacher guides contain far more information on teaching and learning than the syllabuses.
They describe a range of learning and teaching strategies and approaches, as well as learning styles and learning situations.

- Go to pages 9-11 of the Mathematics Teacher Guide and skim read those pages.

**List the four teaching and learning strategies discussed on pages 9-11. Make some summary notes.**

<table>
<thead>
<tr>
<th>Teaching and learning strategies</th>
<th>Summary notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On page 9, the teachers guide states: You are required to use some of these strategies, along with other strategies you know will work well in the teaching and learning of Mathematics.

**Reflect on what other strategies you may have been using in the teaching and learning of Mathematics. Record them here, if applicable.**

Now go to pages 8-18 of the Science Teachers Guide and skim read those pages.

Pay special attention to how a science project is described on page 13. It states: *Upper primary science projects should focus on practical work carried out by one or more students over a number of lessons.*
Several examples of possible projects are listed here.

- Have you set projects of this nature for your students, in the past?
- What other ideas can you add to the list?

Now go to page 14 of the Environmental Studies Teacher Guide. Pay special attention to the description and the example provided.

- Are the descriptions here similar to those presented in the Science Syllabus?

Let us move on to comparing the teaching and learning activities presented in the Mathematics and Science teacher guides. Understanding the differences and similarities can assist with planning integrated units of work.

- Compare the learning and teaching strategies and approaches discussed in the Science and Mathematics teacher guides. List them in the table below.

<table>
<thead>
<tr>
<th>Teaching and learning strategies</th>
<th>Science</th>
<th>Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teaching and learning approaches</th>
<th>Science</th>
<th>Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Can some of the strategies discussed in Science be used in Mathematics and vice versa?

• Can some of the approaches discussed in Science be used in Mathematics and vice versa?

Share, with a colleague, what you have found out about the teaching and learning strategies and approaches for Mathematics and Science in the upper primary.

• Together, identify all the strategies and approaches each is already applying.

Reflect on how you would make a commitment to applying those teaching and learning strategies and approaches you are not already using.

• Reflect on how you would assist your colleague to make a commitment to applying those teaching and learning strategies and approaches your colleague is not already using.

Share your thoughts with the colleague.

Work with a colleague or a group of teachers in your school to prepare a wall chart that lists and briefly describes as many teaching and learning strategies and approaches as possible, for Mathematics.

Your chart may look like this

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
<th>Example</th>
<th>Cross-curriculum uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Games</td>
<td>A strategy to deepen understanding and application of an idea or concept</td>
<td>Number games, eg. Fifteen word games</td>
<td>Environmental Studies, Science, Social Science, Personal Development</td>
</tr>
</tbody>
</table>
• Prepare another chart for Science.

• Place them side-by-side on the wall or another location and make links between them.
Consult these pages to prepare your chart.
  Mathematics Teacher Guide, Lower Primary: pages 9-17
  Mathematics Teachers Guide, Upper Primary: pages 9-11
  Environmental Studies Teacher Guide, Lower Primary: pages 8-17
  Science Teachers Guide, Upper Primary: pages 8-18

(For further information on these and other strategies refer to Primary In-service Unit 6: Learning and Teaching for Outcomes.)

The teacher guides contain far more information on teaching and learning than what we have explored. They describe a range of teaching strategies and methods, as well as learning styles and learning situations.

We can summarise the information provided under four main headings:
1. Student-centred learning
2. Bilingual education approaches
3. Integrated approaches
4. Inclusive approaches

• Do you agree? Explain.

1. Student-centred learning
This is a good time to revise your knowledge of the characteristics of student-centred learning.

Work with a colleague and identify at least five characteristics of student-centred learning.

(i)

(ii)

(iii)

(iv)

(v)

• Compare what you and your colleague have written with the information on page 12 of the Mathematics Teacher Guide, Lower Primary and the Environmental Studies processes described on pages 11-12 of the Environmental Studies Teacher Guide, Lower Primary.
• Add any of the key points you had forgotten.

(vi) ..

(vii) ..

(viii) ..

• Now re-visit the teaching and learning strategies—experience–based learning, problem-based learning, open-ended questions and cooperative learning—on pages 9-10, Mathematics Teachers Guide, Upper Primary. Are they examples of student-centred strategies?

• Now re-visit the teaching and learning approaches and strategies listed and described with examples on pages 8-15, Science Teachers Guide, Upper Primary.

• Look closely through the teaching and learning strategies listed and described on pages 13-15. Can these strategies and their processes and products be used for assessment purposes?

2. Bridging to English approaches

The lower primary teacher guides contain an additional section not detailed in the upper primary guides. Pages 8-9 of the Environmental Studies Teacher Guide, Lower Primary and pages 9-10 of the Mathematics Teacher Guide, Lower Primary contain identical information about Bridging to English.

On pages 11-12, the Mathematics teachers guide provides an example of how to bridge to English through Mathematics. Bridging to English strategies are critical in the lower primary years of schooling to enable students to make the transition to English with confidence.

In the Appendix of all Lower Primary syllabuses you’ll find the Ministerial Policy Statement “Language Policy in All Schools”.

If you are not familiar with this circular, take a few moments to read it.

Prepare a short presentation for lower primary teachers in your school in which you highlight the key features of the bilingual education approach.
Hint: Your presentation should include information about bridging to English through the five approaches—integrated planning and programming, whole language approach, using big books, using the full range of genres and programming separately for vernacular and English.

- Now re-visit your Mathematics and Science syllabuses and other documents and find out what the requirements are for vernacular usage in the Upper Primary.

- List the requirements here.

3. Integrated approach

Prepare a mind map or another structure to summarise the important ideas presented in the syllabuses and teacher guides. (Use space provided on page 25 to construct your mind map.)

4. Inclusive approaches

Read the appropriate sections of the syllabuses and teachers guide. Make a list of strategies you are already practising to make your lessons inclusive and a separate list of strategies you could introduce in your classroom.

If you are a non-school-based officer, make a list of indicators of inclusivity you would look for in a school you supervise. (Use space provided on page 26 to record your lists.)
Section 2: Assessing, recording, reporting and evaluating

Part 2.1: Assessing

As a starting point reflect on the following questions.

• How do you assess in the lower and/or upper primary Mathematics and Science learning areas?

• Why do you assess?

• How often do you assess?

• What is your basis for making judgements about students’ achievement?

Hint: List the main strategies you use for each subject. Write down your current practices and thinking. It is important that you compare ways you do it now with the advice provided in the syllabuses.

Before you study this section in more detail it is important that you are clear about the meanings of terms.

• Study the following definitions and write an example from your own practice to illustrate each one. Some examples have been done for you.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Example/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment method</td>
<td>how the teacher will assess in a broad sense, through, for example,</td>
<td>written responses, observation, student products, etc.</td>
</tr>
<tr>
<td>Assessment task</td>
<td>the activity the students actually do/complete to be assessed</td>
<td></td>
</tr>
<tr>
<td>Assessment criteria</td>
<td>standard, condition – the standards or conditions set to demonstrate what has been is to be achieved</td>
<td></td>
</tr>
</tbody>
</table>
Example 1:

The **assessment method** a teacher is planning to assess the students’ achievement is through a ‘written report’.

The **assessment task** is ‘students write a report summarizing natural and built changes and explaining their impact on the environment’.

The **criteria** set to judge or measure their achievement are that, in their report, they: ‘provide examples of at least 3 good and 3 bad examples of change; give reasons why they think these changes are good or bad; use words such as certain, possible and impossible to assess whether these changes will impact on the environment’.

The recording method is to ‘annotate (write comments on) reports students present and file these reports up’.

Example 2

The **assessment method** a teacher is thinking of is a ‘written, graphical response’.

The **assessment task** is ‘draw a bar graph showing different plants and animals in the community’.

The **criteria** to be used to judge their achievement is ‘what exactly the teacher wants to see in the graph such as labeled axes, scale, percentage of different varieties of plants and animals etc.’

The recording method is to ‘annotate (write comments on) graphs students present and file them up’.

The two examples below show the difference between assessment methods, assessment tasks and assessment criteria.
As you can see above, an assessment method is very broad; an assessment task is quite specific but fits into the method identified.

Assessment criteria are the specifications and instructions relating to the task. Here the teacher makes clear to students what she or he expects from them. Rather than leaving it to the imagination of the students, the teacher specifies or negotiates and priorities with students the important aspects of the task.

The recording method must be appropriate to the task. It may be the task itself with teacher’s comments written on it or specially devised by teacher or teacher and students for the purpose.

Skim the section on ‘Assessment and Reporting’ in each syllabus. The section can be found on the following pages.

- Mathematics, Lower Primary Syllabus: pages 28-31
- Mathematics, Upper Primary, Syllabus: pages 56-59
- Environmental Studies, Lower Primary Syllabus: pages 18-20
- Science, Upper Primary Syllabus: pages 24-26

In each document assessment is defined as the ‘the ongoing process of identifying, gathering and interpreting information about students’ progress towards achievement of the learning outcomes described in the subject syllabuses’.

A number of assessment methods are suggested on these pages. These include observation of processes, products, skills and performances written responses, projects, practical work, tests, portfolios, self and peer-assessment.

Compare this list with the list you made earlier in response to the question:

*How do you assess? on page 7.*

If your list includes all of the above methods, you are doing well.

- Meet with two or three of your colleagues and find out how they assess and how often they assess.

A table is provided below for you to record the results. First record which of the methods you have been using over the past three months and how often. Use words such as ‘never’ (N), ‘often’ (O), ‘sometimes’ (S), ‘rarely’ (R), daily (D) to record the frequency. Find out how often your colleagues assess in the following ways. C1 is Colleague 1, C2 is Colleague 2 and C3 Colleague 3. You may wish to add to the list methods that you and your colleagues use, but are not suggested in the syllabus.
### Assessment methods

<table>
<thead>
<tr>
<th>Assessment methods</th>
<th>Frequency (how often?)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>‘never’ (N), ‘often’ (O), ‘sometimes’ (S), ‘rarely’ (R), daily (D)</td>
</tr>
<tr>
<td></td>
<td>Self</td>
</tr>
<tr>
<td>Observation of processes and products</td>
<td></td>
</tr>
<tr>
<td>Observation of skills and performance</td>
<td></td>
</tr>
<tr>
<td>Listening to students explain (conferencing)</td>
<td></td>
</tr>
<tr>
<td>Projects</td>
<td></td>
</tr>
<tr>
<td>Practical work</td>
<td></td>
</tr>
<tr>
<td>Tests and examinations</td>
<td></td>
</tr>
<tr>
<td>Portfolios</td>
<td></td>
</tr>
<tr>
<td>Self-assessment</td>
<td></td>
</tr>
<tr>
<td>Peer assessment</td>
<td></td>
</tr>
<tr>
<td>Other (add)</td>
<td></td>
</tr>
<tr>
<td>Other (add)</td>
<td></td>
</tr>
</tbody>
</table>

### What conclusions can you draw from the data you have collected? What of the methods is the most popular? Which is the least popular? Why do you think this is the case?

- Check your understanding of the important points made about *assessment and reporting* in the *Mathematics, Lower Primary Syllabus* by identifying whether the following statements are true or false. Explain your answer. If a statement is false, correct it.

<table>
<thead>
<tr>
<th>Statements</th>
<th>True/False? Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The overall purpose of assessment is to improve student learning.</td>
<td></td>
</tr>
<tr>
<td>When assessing students’ achievements, teachers should be clear about which language best enables students to demonstrate their learning.</td>
<td></td>
</tr>
<tr>
<td>Assessment is the end-of-unit process of finding out if students have achieved the learning outcomes.</td>
<td></td>
</tr>
</tbody>
</table>
Assessment should first and foremost be used for ranking students in the lower primary.

Student reports should be based on external examinations only.

Students should not be allowed to assess their own learning and the learning of their peers.

The Mathematics and Science/Environmental Studies teacher guides contain important information about ‘assessment and reporting’.

This information can be found on the following pages:

- *Mathematics Teacher Guide, Lower Primary*: pages 18-29
- *Mathematics Teachers Guide, Upper Primary*: pages 12-21
- *Environmental Studies Teacher Guide, Lower Primary*: pages 18-27

- Skim read the above sections of the teacher guides.

All four teacher guides provide advice on assessment and examples and illustrations of assessment methods and tasks. There is a wealth of information here which you can easily understand and emulate.

Later on in the teacher guides there are examples of units of work which illustrate that developing an assessment plan at the same as planning learning and teaching strategies and content is an important step. Assessment should never be an after thought.

There is much you can learn from these examples.

In an overall sense, the defining questions when planning for assessing student achievement of learning outcomes are:

- What is the best way to find out what the students know and can do?
- Are these ways fair to all students?
- Are all aspects of the outcome(s) being assessed?
- Are the tasks big enough for the students to demonstrate what they know and can do

The steps to planning for assessment can be found in Science/Environmental Studies teacher guides.

- *Environmental Studies Teacher Guide, Lower Primary*: pages 24-25

Skim read the information provided in the two teacher guides.
Now read the Environmental Studies Teacher Guide pages 18-27 and 24-25 carefully.

- Identify two assessment methods and for each method identify and design an assessment task for Outcome 3.2.1 in Environmental Studies. Remember to take into consideration the requirements for vernacular literacy (pages 8-9) and the Environmental Studies processes when designing your assessment tasks.

Outcome 3.2.1: identify useful resources in the environment and describe ways to use them wisely.

Hint: Pay special attention to the action words and the knowledge, skills and attitudes embedded in the outcome. For this go to the elaborations of learning outcomes on page 64 for this outcome. Think about the teaching and learning activities students may be engaging with. Also ask yourself the four questions listed above. (page 17).

Both the lower primary Environment Studies and Mathematics teacher guides have provided advice on "what to do with assessment information"

Page 26 of the Science Teachers Guide, Upper Primary, contains an example of ‘Focussed analysis’ as an assessment method.

The task set within this method is ‘a project’. The project involves ‘making a model of the earth’s structure and labelling it’.

On page 26 you also find the assessment criteria for this task.

Let us take a few moments to critique the criteria provided.

- Do you think the criteria relates directly to the expectations of the labelled model and through that to the outcome?
- Which part of the outcome does the model address?
- Which criterion relate to the model?
- Which part of the outcome do the other criteria relate to?
- Do you think another task should be set to assess the rest of Outcome 6.4.1?
Questions such as these help you to understand the process of developing criteria for the tasks you may be developing for yourself.

Be very focused when writing criteria. Criteria are task-specific and outcome-specific.

The Upper Primary Science Syllabus, on page 25, provides some advice on ‘Making judgements in Science’.

This is important information.

After having collected evidence of students’ ability to meet the requirements of the outcomes, the teacher will need to interpret and judge what the evidence means. This is fundamentally the teacher’s role in school-based assessment.

The teachers’ ability to do this can be enhanced by the kind of activities listed on page 26:

• shared understandings
• criteria sheets
• joint planning of programs and assessment items
• examination of students’ folios
• progress maps
• formal and informal moderation processes.

• What other activities, do you think, can assist you in this regard? List them here.

• How do you plan to get support for the above type of activities in your school or in the schools you supervise?

• What do you understand by ‘formal and informal moderation processes’?

_HINT: Seek help to explore the range of activities and support for their application._
You will find this information on pages 22-23 of both documents. The advice is identical in these documents.

The table on page 23 in both documents shows you how to track student progress for the whole year. It is a summary record. This kind of a record is sometimes called a student achievement profile.

If you wish to follow this suggestion, you will need to make enough copies of the table for every student in your class.

• In what other ways can you keep records of overall achievement of your students?

On collecting ‘enough’ evidence about student learning, you the teacher, interprets the information in relation to achievement of outcomes and records it appropriately.

If the purpose of assessment is to facilitate learning, feedback should be provided to students in the timely fashion and plans and programs adjusted accordingly.

If the purpose of assessment is summative, the next step would be to report this information to the stakeholders.

• Add a definition of recording to the table on pages 13-14 of this module. Cite one or two examples.

• Use the syllabuses and teacher guides to help.

<table>
<thead>
<tr>
<th>Environmental Studies/Science</th>
<th>Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Part 2.2: Recording and Reporting

A number of recording/reporting methods are suggested in each syllabus. However, ways of reporting student achievement to the community is left to the school to negotiate with the community.

Collect examples of school reports from your own school and other schools close by, if possible.

- Compare the reports. How does your school report to parents and the community? Do other schools report the same way?

- Read page 30 of the Environmental Studies Syllabus. Add the definition of reporting to your table on pages 13-14 of this module. Cite one or two ways of reporting your school or a school you supervise practise.

According to the National Assessment and Reporting Policy, what should written reports include?

- Compare the reports you have collected with the list. Do they reflect the requirements of the policy? If not, why?

Part 2.3: Evaluating

Each syllabus has a statement on evaluation including what it is, the role that assessment plays in evaluation and the purposes of evaluation.

Read the two paragraphs on evaluation in Arts, Lower Primary, Syllabus then write a paragraph that will help you explain to others what you believe evaluation is and how it informs you about what is going on.
• See if you can come up with a definition and examples to include in the table on pages 13-14 of this module.

**Go back to the wall chart of teaching strategies you designed with your colleague in Module 2.**

• Select four strategies from the chart and match them with an appropriate assessment task and a recording method. For example ‘a focussed analysis’ could be assessed using a checklist with criteria.

<table>
<thead>
<tr>
<th>Teaching strategy</th>
<th>Assessment task</th>
<th>Recording Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focussed analysis</td>
<td></td>
<td>checklist with criteria</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Module Summary

Congratulations! You have come to the end of this module! In doing so you have worked your way through the Science/Environmental Studies and Mathematics syllabuses and teacher guides and done the many tasks and activities designed to make it easy for you to learn and apply your learning.

The focuses in this module have been the pedagogical aspects of a teacher's craft.

You should have by now developed certain knowledge, understandings, insights and skills as they relate to reform curriculum in the context of your work. All this should help you to perform well in your work.

At this point let us review your progress by assessing the extent to which you can now demonstrate each outcome.

The outcomes for the module are copied here. For each of the outcomes how do you assess yourself - Yes, No or Not sure?

<table>
<thead>
<tr>
<th>Can you:</th>
<th>Yes/No/ Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. explain the characteristics of and the approaches to student-centred learning?</td>
<td></td>
</tr>
<tr>
<td>2. explain to a colleague, the key features of the bilingual education approach and their implications for schools?</td>
<td></td>
</tr>
<tr>
<td>3. describe and apply the different teaching and learning strategies recommended for the Mathematics and Science learning areas?</td>
<td></td>
</tr>
<tr>
<td>3. explain the meaning of words used to describe aspects of assessment and reporting?</td>
<td></td>
</tr>
<tr>
<td>4. describe and apply the assessment and reporting methods recommended for the Mathematics and Science learning areas?</td>
<td></td>
</tr>
</tbody>
</table>

If you answered ‘Yes’ to all of them, then you have done very well. Think about the kinds of evidence that will support the achievement of each of the outcomes. If you have said ‘No’ or ‘Not sure’ to some, then it may be worth your while to go over the appropriate sections of the module again and have another go at repeating the tasks, and/or reflecting on your difficulties and seeking help.

Remember these module outcomes help you achieve the outcomes of the unit. Refer back to the outcomes of the unit in the Unit Introduction and reflect on where you are in relation to those outcomes.
If you are seeking academic credit, you were advised to keep a running record of any evidence you may have for particular unit outcomes. If you have not been doing this go back over the module and jot down, in your Learning Contract, what you might consider to be evidence for the unit outcomes for which you have agreed to provide evidence.
Additional space for your notes
Unit 4:
Learning Areas: Mathematics and Science

Module 4: Applying your learning - developing units of work

Contents

<table>
<thead>
<tr>
<th>Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module introduction</td>
<td>2</td>
</tr>
<tr>
<td>Module learning outcomes</td>
<td>2</td>
</tr>
<tr>
<td>Section 1: What is a unit of work?</td>
<td>3</td>
</tr>
<tr>
<td>Section 2: Steps to developing a unit of work</td>
<td>6</td>
</tr>
<tr>
<td>Section 3: Assessing units of work</td>
<td>18</td>
</tr>
<tr>
<td>Module Summary (and additional space for your notes)</td>
<td>20</td>
</tr>
</tbody>
</table>

Name: ........................................................ File N°:....................................................

Date commenced: ........................................ Date completed:........................................

I have sighted this study guide as evidence of completion of agreed tasks by

...............................................................................................................................................................(insert name)

Assessor: ................................................... Date: ............................................................
Module 4: Applying your learning - developing units of work

Module Introduction

Welcome to Module 4: Applying your learning - developing units of work.

This module focuses on the Mathematics and Science/Environmental Studies syllabuses and teachers guides.

- Mathematics, Lower Primary Syllabus, 2004
- Mathematics Teacher Guide, Lower Primary, 2004
- Mathematics, Upper Primary Syllabus, 2003
- Mathematics Teacher Guide, Upper Primary, 2003
- Environmental Studies, Lower Primary Syllabus, 2004
- Environmental Studies Teacher Guide, Lower Primary, 2004
- Science, Upper Primary Syllabus, 2003

The implications for us is that we use syllabuses and teacher guides together to understand the way the learning outcomes, the indicators and elaborations of outcomes (in terms of knowledge, skills, attitudes, suggested activities) can be organised into integrated or subject-specific units of work.

To do this module you will need access to all documents listed above. These are shown on pages 4-6 of the Unit Introduction. All activities in this module are based on these documents.

If you are seeking academic credit, make sure you do the self-assessment in the Accreditation and Certification section before you start this module. As you do this module, keep a running record of sections, parts and pages of the module where you can identify evidence for particular unit outcomes. You may wish to record such information in your Learning Contract.

Module learning outcomes

When you have worked through this module, you, the learner, can (are able to):

1. develop a unit of work based on one outcome from a subject
2. develop an integrated unit of work based on two or more learning outcomes from more than one subject
3. develop an assessment plan for a unit of work
4. explain to others how to develop a unit of work
Section 1: What is a unit of work?

A unit of work is a series of sequenced teaching, learning and assessment activities that students do to achieve one or more learning outcomes within a specified period of time.

A unit of work is a medium-term plan. In an outcomes-based approach, the starting point for developing a unit of work is the learning outcomes.

A unit of work can be developed from:
- a single learning outcome from a subject (subject-based)
- a number of learning outcomes from one strand of a subject (subject-based)
- a number of learning outcomes from two or more strands in a subject (subject-based)
- a number of learning outcomes from two or more subjects for one grade (integrated)
- a number of learning outcomes from two or more subjects across a number of grade (integrated and multi-grade)

Units of work can be developed by individual teachers or a team of teachers. If there is more than one teacher in your school teaching the same grade then it is a good idea to collaborate on the development of units of work, brainstorming possible student activities and assessment tasks. The idea that links the selected outcomes provides focus for the unit of work. This idea may be called an organiser or a theme.

Browse through the following pages of your Mathematics and Science/Environmental Studies teacher guides to see how units of work are developed and structured.

- Mathematics Teacher Guide, Lower Primary – pages 35-41
- Mathematics Teacher Guide, Upper Primary – pages 26-40
- Environmental Studies Teacher Guide, Lower Primary – pages 35-49
- Science Teacher Guide, Upper Primary – pages 48-56

Considerations when planning a unit of work

The Lower Primary Mathematics Teacher Guide provides some advice in this regard on page 36.

- Read this section carefully and answer the following question.
- What does it say about:
  - the number of outcomes to be used in any unit of work and why?
  - how to choose the outcomes for a unit of work?
Components of a unit of work

The teacher guides provide some advice in this regard.

- Read the following pages and synthesise the essential components of a unit of work.
  - Upper primary Science Teacher Guide – page 50
  - Lower Primary Environmental Studies Teacher Guide – page 36

The lower and upper primary Mathematics teacher guides do not provide this information.

- Here is a comprehensive list. Identify the essential components.

<table>
<thead>
<tr>
<th>Components</th>
<th>Place a tick (✓) in this column to identify the essential components</th>
<th>Place an ✗ in this column to indicate if you do it now</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject(s), strand(s) and sub strand(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Title of unit or organiser or theme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning outcomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of weeks or lessons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purpose of the unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment methods, tasks and criteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning and teaching strategies Knowledge, skills and attitudes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resources</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The next steps in the development of a unit of work include weekly plans and daily programs (short-term).

- Make a list of steps you currently use to plan a unit of work and the list of steps suggested in a teacher guide.

<table>
<thead>
<tr>
<th>My current steps</th>
<th>Steps suggested in teacher guides</th>
</tr>
</thead>
</table>

Hints: Make a list of you steps in planning a unit of work. Then compare it with the steps suggested in the teacher guides.

- Identify any differences between how you plan now and what the teacher guides suggest.
Section 2: How to develop a unit of work

All four teacher guides you are dealing with provide a series of steps for developing a unit of work.

- Browse through the following pages to glean the steps to developing a unit of work.
  
  *Science Teachers Guide, Upper primary:* pages 51-53  
  *Mathematics Teachers Guide, Upper primary:* pages 34-36  
  *Environmental Studies Teacher Guide, Lower primary:* pages 35-36  
  *Mathematics Teacher Guide, Lower primary:* page 35  

Pages 37-41 provides an example of a unit of work based on the process for developing a unit of work (lower primary Mathematics).

- In this example four subjects are integrated by clustering four outcomes (page 37).

- The organiser or theme for the unit is: Making graphs of living things in my community

- Purpose of this unit is identified as: students use graphing skills and information relating to animal and plant species and people and they construct and interpret graphs in vernacular and English

- Then the knowledge, skills and attitudes relevant for the outcomes are identified from the elaborations of outcomes sections of the relevant teacher guides (page 37)

- The next step shown here is the identification of teaching and learning activities and assessment tasks (page 38)

- This is followed by a detailed assessment plan (page 39) and a sample weekly program (page 40)

- Resources needed are identified last (page 41).
The above steps may be presented in a table as follows.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Strands</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Mathematics – Chance and Data</td>
</tr>
<tr>
<td></td>
<td>Environmental Studies – What is in my environment?</td>
</tr>
<tr>
<td></td>
<td>Community living – Community</td>
</tr>
<tr>
<td></td>
<td>Language – writing</td>
</tr>
</tbody>
</table>

| Learning outcome | 3.4.2: Draw and interpret simple graphs                                    |
|                 | 3.1.1: Identify different species of plants and animals found in the environment |
|                 | 3.1.1: Explain changes in the community and family life and the effects on people |
|                 | 3.3.1: Plan and develop a range of text types to develop familiar ideas and information |

| Purpose | Students will use graphing skills and information relating to animals and plants species and people. They will construct and interpret graphs in vernacular and English. |

| Content – knowledge, skills and attitudes | Knowledge – Environmental Studies                                         |
|                                         | Different types of plants and animals                                    |
|                                         | Where animals and plants are found                                        |
|                                         | Skills – Environmental Studies                                            |
|                                         | Collect, display and sort plants and animals into groups                  |
|                                         | Attitudes - Environmental Studies                                         |
|                                         | Value their environment                                                   |
|                                         | Self-confidence                                                           |
|                                         | Cooperation                                                               |
|                                         | Sharing                                                                   |
|                                         | etc. for the other outcomes                                               |

| Teaching and learning activities and assessment tasks | Mathematics: |
|                                                      | Draw and interpret .. |
|                                                      | Collect and show … |
|                                                      | Draw simple graphs … |
|                                                      | Present graphs and ask and answer questions |
|                                                      | etc. for other subjects |

These are drawn from the elaborations of outcomes from the relevant syllabuses.
These are drawn from the elaborations of outcomes from the relevant syllabuses and professional knowledge of the teacher. Some of the learning activities are also seen as possible assessment tasks for ongoing assessment.

**Assessment methods, tasks and criteria**

- **Environment Studies**
  - **Method:** analysing students’ bar graphs
  - **Task:** draw a bar graph showing …
  - **Criteria:**
    - draw bar graph with …
    - names of animals at the bottom
    - shade in the number of animals found in the village

Three different methods and one task for each method are identified here for the unit. For each task assessment criteria are set and the language of assessment is identified. Recording strategies are also identified.

**Time**

- 2 weeks

**Weekly program**

- Includes timetable and analysis of time allocation

**Resources**

- Resources supplied, to be collected and to be borrowed for integration are listed

Now let us look at another sample unit of work for a single outcome from the Science area for upper primary (pages 50-53, teachers guide).

Let us summarise this into a table:

<table>
<thead>
<tr>
<th>Unit of work: Earth formation and structure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grade</strong></td>
</tr>
<tr>
<td><strong>Strand</strong></td>
</tr>
<tr>
<td><strong>Sub-strand</strong></td>
</tr>
<tr>
<td><strong>Learning outcome</strong></td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
</tr>
</tbody>
</table>
| **Content – knowledge, skills and attitudes** | Knowledge
  - Formation of earth
  - Structure and composition of the earth |
Soil formation  
Rock formation  
**Skills**  
Investigating  
Comprehending  
Communicating  

Knowledge is drawn from the *elaborations of outcomes* (page 46), the skills and attitudes are drawn from the *key features* section (pages 5 and 6) of the teacher guide. Attitudes are to be deduced from the *key features* in the teacher guide.

| Learning and teaching strategies and/or activities | Invite guest speakers  
Research and present evidence for …  
Make a model of the earth  
Describe ….  
Identify variations … |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment methods, tasks and criteria</td>
<td>One assessment task is suggested: make a model of the earth’s structure and label it. Assessment criteria are not provided.</td>
</tr>
</tbody>
</table>
| Resources | Local elders  
World map  
Samples of soil |
| Time | 1 week |
| Weekly program | To be done by reader |

An overview of a unit of work can be done and you may wish to do overviews of units before plunging into developing them fully. The steps are similar whether the unit you are planning is for a single outcome or a cluster of outcomes, but the sequence of steps could vary.

Now it is your turn to do a table yourself.

Go to page 44 of Environmental Studies teacher guide  (Sample 2: Grade 4) and extract information to fill in the blank table provided.
<table>
<thead>
<tr>
<th>Unit of work:</th>
<th>Grade:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td></td>
</tr>
<tr>
<td>Subjects</td>
<td></td>
</tr>
<tr>
<td>Strands</td>
<td></td>
</tr>
<tr>
<td>Sub-strands</td>
<td></td>
</tr>
<tr>
<td>Learning Outcomes</td>
<td></td>
</tr>
<tr>
<td>Content – knowledge, skills and attitudes</td>
<td></td>
</tr>
<tr>
<td>Teaching strategies and/or activities</td>
<td></td>
</tr>
<tr>
<td>Assessment methods, tasks and criteria</td>
<td></td>
</tr>
<tr>
<td>Programming in two languages</td>
<td></td>
</tr>
</tbody>
</table>
Having read the appropriate sections of the teacher guides and having done unit overviews, you are in a position to identify a logical sequence of steps that is likely to make sense to you.

Here is a series of steps. These steps are a guide and may look jumbled up. Some teachers will complete the steps in the process in a different order, but eventually all steps will be covered.

- Re-number these steps in the most logical sequence for you.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Study the content overview from the syllabus/es that shows the strands, sub-strands and learning outcomes. (if you are planning an integrated unit you need to look at most or all the syllabuses)</td>
</tr>
<tr>
<td>Step 2</td>
<td>Estimate how many lessons or weeks will be needed to complete the unit of work</td>
</tr>
<tr>
<td>Step 3</td>
<td>Identify the outcomes with similar concepts or processes (the links between subjects). It may be easier if you make links between sub-strands first. For both LP and UP you can cluster the outcomes – about 4 – from across the subjects that link naturally together and identify a theme that describes these links</td>
</tr>
<tr>
<td>Step 4</td>
<td>State the purpose of the unit, summarising in two or three sentences what students will learn/achieve during this unit. Refer to the learning outcomes.</td>
</tr>
<tr>
<td>Step 5</td>
<td>Identify the knowledge, skills and attitudes that underpin the outcomes that you want the students to demonstrate in the unit of work. (use outcomes and indicators from the syllabus/es and the elaborations from the teacher guides)</td>
</tr>
</tbody>
</table>
### Step 6
Develop and sequence teaching and learning activities that help students to learn and demonstrate the knowledge, skills and attitudes (read the elaborations in the teacher guides for some ideas on activities and/or use activities you have developed yourself).

### Step 7 (mainly for lower primary)
State the language of instruction for teaching and learning activities and assessment tasks (and develop activities for language learning outcomes in the unit of work that incorporate bridging approaches).

### Step 8
Develop an assessment plan which includes a schedule, tasks that allow students to demonstrate the knowledge, skills and attitudes in the outcomes, criteria with descriptors, and recording and reporting details.

### Step 9
Develop teaching programs for the unit of work by lessons, weeks or terms, (using your own programming format).

### Step 10
List relevant resources and materials, particularly local resources.

### Step 11
Think about how you will find evidence of student achievement of outcomes.

Now do an overview of a unit for outcome 4.1.3 (lower primary Mathematics) using the sequence you have identified above. Add more rows, if needed.

<table>
<thead>
<tr>
<th>Unit of work:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
So far we have been exploring the model for planning a unit of work provided in the Mathematics and Science teacher guides. Let us call this the teacher guide model.

There is an alternative way to develop a unit of work. Let us call this the designing down approach. This approach is based on four questions. These questions help you to think about and focus on the outcomes.

This approach shows you that you can use the steps in a different order.
<table>
<thead>
<tr>
<th>Questions:</th>
<th>Steps: from pages 11 and 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1: What is it that my students need to know and be able to do? (this question directs us to the learning outcomes in the syllabuses)</td>
<td>Steps 1 and 3 in the table on page 10</td>
</tr>
<tr>
<td>Question 2: What is the best way to find out if my students are achieving the outcomes? (this question directs us to assessment plans as the second important decision to make)</td>
<td>Steps 8 and 11</td>
</tr>
<tr>
<td>Question 3: What are the most appropriate learning and teaching strategies and activities to help my students achieve the outcomes? (this question directs us to the learning strategies most suitable for assisting students to achieve the outcomes)</td>
<td>Steps 6, 7 and 10</td>
</tr>
<tr>
<td>Question 4: What is the most appropriate content – knowledge, skills and attitudes – to help my students achieve the outcomes? (this question finally directs us to the most appropriate knowledge, skills, understandings and attitudes)</td>
<td>Step 5</td>
</tr>
</tbody>
</table>

The sequence above is called designing down (or working backwards) from the outcomes to the content – an essential characteristic of outcomes-based education.

What is important in the OBE environment is the achievement of outcomes. The outcomes do not exist in a vacuum. Each outcome has embedded in it knowledge, skills and attitudes in the contexts of – Science, Mathematics, Environmental studies, Language and so on.

The following scenario illustrates this alternative approach.

**Scenario**

Here is Mrs Kenehe’s rough draft of a unit of work for a single outcome.

Mrs Kenehe considered Question 1 of the ‘Alternative approach’. She selected an outcome from the Environmental Studies syllabus: 4.1.1 Students describe features of plants and animals that live in the environment.
Next Mrs Kenehe thought about the second question which is about developing an assessment plan. So she decided to read the indicators for this outcome (Environmental Studies syllabus, page 13) to get an idea about the standard at which the outcome is to be understood, taught and assessed.

On thinking about the outcome further, Mrs Kenehe focussed on the verb of the outcome: ‘describe’. Students can ‘describe’ in different ways – through a written piece of work, a talk, through a series of pictures or diagrams. Students are to describe the features of plants and animals that are found in the environment. So Mrs Kenehe decided to set a written/pictorial assignment and an oral presentation for assessment. She then discussed and negotiated with her students what she expects to find (assessment criteria) in the assignment and the oral presentation.

Next she went to the elaborations section of the Environmental Studies Teacher Guide, Lower Primary. Here she decided to focus on the following suggested activities 1, 2, 3, 5 and 6 (page 61) and selected the content.

- Content – types and features, habitat and features, physical features that aid survival and protection
- Processes and skills – gather information, summarise, record, discuss

Mrs Kenehe realised that the processes and skills she had selected were basically the Environmental Studies processes identified on pages 7 and elaborated upon on pages 11 and 12 of the Environmental Studies Teacher Guide.

Mrs Kenehe jotted down her ideas in a table, including learning/teaching strategies and assessment methods that would help students achieve the learning outcome.
Mrs Kenehe then checked each part of her plan for consistency with the selected learning outcome before she elaborated her plan into weekly programs and daily lessons.

Since the action word (verb) in the outcomes is ‘describe’, the questions she asked herself for checking consistency were: Are the selected assessment methods, tasks and criteria consistent with being able to ‘describe’? Will the learning activities and selected content allow my students to ‘describe’ …?  

Reflect on the steps for developing a unit of work provided in the teachers guides and Mrs Kenehe’s draft unit.

- Which model did she use?
- Which steps from the first model did she leave out?
- Are the steps she left out important at the overview stage?
- Are the steps she left out important when doing the weekly program and daily lessons?

Now it is your turn to develop an outline of a draft unit of work for one learning outcome using the alternative approach.

- You may work with a colleague for this activity.
- Use outcome 4.1.3 (lower primary mathematics) – Compare and represent common fractions - for your example.
- Use the alternative approach to develop a plan for a unit of work. Do not do detailed weekly and daily programs at this stage.
- Use the table below to guide your overview. The four questions have been filled in for you to prompt your thinking.

<table>
<thead>
<tr>
<th>Questions:</th>
<th>Ideas:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1: What is it that the students need to know and be able to do?</td>
<td></td>
</tr>
<tr>
<td>Question 2: What is the best way to find out whether the students are achieving the outcomes?</td>
<td></td>
</tr>
</tbody>
</table>
Both models of planning an overview are examples of planning holistically. Here the teacher thinks the whole unit through and checks for consistency between the components of the unit.

**Reflect on what you have learned from this section.**

- What would be the new sequence for you? List the steps here.
Section 3: Assessing units of work

Each of the teacher guides describes a process for developing an assessment plan. This is summarised below.

- Decide on the best assessment method to gather information you would like about the student’s learning for this unit of work: observation, analysing samples of work, etc. (refer to the assessment, recording and reporting section in the lower primary syllabuses). The selection of the methods would depend on the learning outcomes of the unit. The action words such as describe, discuss, investigate etc. provide ideas for assessment methods.

- Identify the assessment tasks consistent with the selected assessment methods. Ideally these could come from teaching and learning activities for the unit of work or specially constructed for a specific purpose.

- Identify the most appropriate person to conduct the assessment task – such as yourself, the student, student peers, a community resource person.

- Decide on the number of assessment tasks necessary to gather all the information you need.

- Design criteria for each assessment task. This may be negotiated with the students or jointly designed with the students. The criteria need to be known to the student well in advance of assessment. Criteria enable teachers to make consistent judgements about student achievement.

- Decide if you are going to conduct ongoing assessment.

- Keep the number and nature of the tasks manageable for yourself because you have to manage seven subjects and be fair to the students.

- Sequence the tasks to line up with your teaching and learning activities. Decide on the best time to assess students, remembering you have to give them time to learn and practise the knowledge and skills formatively.

- Include your assessment tasks within your unit plan.

Before you commence any of the following activities, go back to Module 3, pages 13-14 and re-read the definitions of terms relating to assessment.

You have found examples of units of work in

- Mathematics Teachers Guide, Lower Primary: pages 37-41
- Science Teachers Guide, Upper Primary: pages 50-56
- Environmental Studies Teachers Guide, Upper Primary: pages 35-59
Most of these units of work have included an assessment plan including assessment
methods, tasks, criteria and recording methods.

**Study the assessment plans and assessment tasks described in any two units of
work with one or more colleagues.**

Discuss how they are different from or similar to your current practice.

With the help of your colleague(s), prepare a presentation to explain to a group of
teachers how to do an assessment plan.

Use an example from the upper or lower primary Science/Environmental Studies
syllabuses to help with your explanation.

For the outcomes you selected on pages 9-10 of this module, elaborate on the
assessment plan. Think of other ways of assessing. Use the table below to identify
assessment methods, tasks, criteria and recording methods. Use this plan for your
explanation.

<table>
<thead>
<tr>
<th>Possible assessment methods</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible assessment tasks</td>
<td></td>
</tr>
<tr>
<td>Possible criteria for a task</td>
<td></td>
</tr>
<tr>
<td>Possible recording method(s)</td>
<td></td>
</tr>
</tbody>
</table>
Module Summary

Congratulations! You have come to the end of this module! In doing so you have worked your way through the Mathematics and Science/Environmental Studies syllabuses and teacher guides and done the many tasks and activities designed to make it easy for you to learn and apply your learning.

This module focused on exploring a subject-based unit of work based on one outcome and an integrated unit of work based on outcomes from two or more subjects. Two models for developing a unit of work were illustrated with examples and steps to planning assessment were identified.

You should have by now developed certain knowledge, understandings, insights and skills as they relate to reform curriculum in the context of your work. All this should help you to perform well in your work.

At this point let us review your progress by assessing the extent to which you can now demonstrate each outcome.

The outcomes for the module are copied here. For each of the outcomes how do you assess yourself - Yes, No or Not sure?

<table>
<thead>
<tr>
<th>Can you:</th>
<th>Yes/No/ Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. develop a unit of work based on one outcome from a subject?</td>
<td></td>
</tr>
<tr>
<td>2. develop an integrated unit of work based on one or more learning outcomes from more than one subject?</td>
<td></td>
</tr>
<tr>
<td>3. develop an assessment plan for a unit of work?</td>
<td></td>
</tr>
<tr>
<td>4. explain to others how to develop a unit of work?</td>
<td></td>
</tr>
</tbody>
</table>

If you answered ‘Yes’ to all of them, then you have done very well. Think about the kinds of evidence that will support the achievement of each of the outcomes. If you have said ‘No’ or ‘Not sure’ to some, then it may be worth your while to go over the appropriate sections of the module again and have another go at repeating the tasks, and/or reflecting on your difficulties and seeking help.

Remember these module outcomes help you achieve the outcomes of the unit. Refer back to the outcomes of the unit in the Unit Introduction and reflect on where you are in relation to those outcomes.

If you are seeking academic credit, you were advised to keep a running record of any evidence you may have for particular unit outcomes. If you have not been doing this go back over the module and jot down, in your Learning Contract, what you might consider to be evidence for the unit outcomes for which you have agreed to provide evidence.
Additional space for your notes
Additional space for your notes
Inservice Units to Support the Implementation of the Primary Reform Curriculum

Unit 4: Learning Areas: Mathematics and Science

Unit Summary
Unit Summary

Congratulations! You have completed this unit.

At this point, let us review your learning journey.

You may have studied the unit during school-based, cluster or district learning and development (in-service) for self-improvement or improving your qualifications.

If you were seeking academic credit, you commenced your learning by completing the self-assessment. Then you went on to negotiate your Learning Contract. You may or may not have gained any recognition of prior learning for your experience or previous study.

The modules within the unit are:

Module 1: Introducing the Mathematics and Science Learning Areas
Module 2: Learning outcomes, indicators and elaborations
Module 3: Teaching and Learning, Assessing and Reporting
Module 4: Applying your learning – developing units of work

In these modules you explored the links between the two Mathematics syllabuses and the two Science syllabuses (lower primary Environmental Studies and upper primary Science) and their respective teacher guides. You have also made links across the two learning areas. This will assist you in your planning, especially for integrated learning. You also explored how to use information from the syllabuses and teacher guides about outcomes, indicators and elaborations to design units of work.

During this unit, you explored two significant policy documents – the National Curriculum Statement (2002) and the National Assessment and Reporting Policy 2003, and the concept of outcomes-based education (OBE) in relation to the Mathematics and Science learning areas.

The focus throughout the unit required you to learn, do, share and reflect in the context of your work situation.

At this point let us review your progress. One way of doing this is by assessing the extent to which you can now demonstrate each outcome.

The outcomes for the unit are copied here. If you gained RPL for some of the outcomes, put a ‘tick’ in the right hand box in the table below for those outcomes.
For the other outcomes how do you assess yourself - Yes, No or Not sure?

<table>
<thead>
<tr>
<th>Can you:</th>
<th>Yes/No/ Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. describe the structure and contents of the syllabuses and teacher guides in the Mathematics and Science learning areas?</td>
<td></td>
</tr>
<tr>
<td>2. identify links between the syllabuses and the corresponding teacher guides?</td>
<td></td>
</tr>
<tr>
<td>3. make connections between the Mathematics and Science learning areas?</td>
<td></td>
</tr>
<tr>
<td>4. describe and discuss ways progress from grade 3 to grade 8 is described in the mathematics and science learning areas?</td>
<td></td>
</tr>
<tr>
<td>5. use the syllabuses and teacher guides to construct units of work based on learning outcomes?</td>
<td></td>
</tr>
<tr>
<td>6. make links between the syllabuses and teacher guides and the National Curriculum Statement (2002) and the National Assessment and Reporting Policy, 2003?</td>
<td></td>
</tr>
<tr>
<td>7. assist others to understand and use these primary syllabuses and teacher guides?</td>
<td></td>
</tr>
</tbody>
</table>

If you answered ‘yes’ to all of them, then you have done very well. If you are seeking academic credit, think about the kinds of evidence which will support the achievement of each of the outcomes.

If you have said ‘no’ or ‘not sure’ to some, then it may be worth your while to go over the appropriate sections of the module again and have another go at repeating the tasks, and/or reflecting on your difficulties and seeking help.

A second way of assessing your progress is by completing the self-assessment in the Accreditation and Certification section again. Use a different coloured pen to place a tick on each continuum to show what you know now.

Compare your assessment of your own knowledge and skills before and after you completed this unit.
- Where have you shown the most growth?
- In which areas might you need to consolidate your learning or seek further assistance?
- Are there other areas that have now become apparent as learning priorities for you?
If you are seeking academic credit and you are satisfied that you are ready for assessment, go to your assessor and start the processes of assessment. The demonstration of the negotiated unit outcomes through this Study Guide and any other negotiated materials form the basis for assessment.

If you have been studying on your own or with a colleague, then you may wish to consider enrolling with PNGEI for external assessment. Information regarding this is in the Accreditation and Certification section.

Good luck with the assessment processes and the assessment outcome.
Where to from here?

How can I build on what I have learnt?

If you want to learn more about the curriculum reform and what it means for teachers, think about these things:

- study one of the other primary in-service units
- try to help another teacher with their learning
- take on special school responsibilities
  - develop the school assessment schedule
  - become the community liaison officer
  - become the school in-service coordinator
  - team teach with a colleague
- look for opportunities beyond your school for supporting others
  - in a nearby school
  - at the cluster or district level
- develop resources
  - for your own use
  - for the use of others in your school
  - for others beyond the school.

It is important for all teachers to have some professional development plans. Remember you can improve your skills and understandings by learning, doing, sharing and reflecting.

What are you going to do?
Unit 4: 
Learning Areas: Mathematics 
and Science 

Accreditation and 
Certification 

Contents

<table>
<thead>
<tr>
<th>Contents</th>
<th>Page/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accreditation and Certification</td>
<td>1-12</td>
</tr>
<tr>
<td>❖ The Context</td>
<td>2</td>
</tr>
<tr>
<td>❖ Some definitions</td>
<td>4</td>
</tr>
<tr>
<td>❖ Ways this unit can assist you</td>
<td>5</td>
</tr>
<tr>
<td>❖ Accreditation requirements</td>
<td>7</td>
</tr>
<tr>
<td>❖ Certification requirements</td>
<td>8</td>
</tr>
<tr>
<td>❖ Self-assessment of progress</td>
<td>10</td>
</tr>
</tbody>
</table>
The Context

Duration
Each unit has four modules. It will take you around 48 hours to complete a unit. You will need to work through this study guide completing the Learn, Do, Share and Reflect activities, doing any extra reading and, if you choose to seek accreditation, meeting the assessment requirements.

If you receive Recognition of Prior Learning called RPL (see page 5 of Learning Contract) it may take you less than 48 hours to complete the unit. This is acceptable to PNGEI because you have already met some of the requirements through your previous studies or work. If you have not done any academic studies lately, it may take you somewhat longer.

If you seek accreditation, you need to negotiate an expected completion date, as part of your learning contract. By this date you should have completed all assessment requirements and be ready to be assessed. Your assessor may also have been assessing you on a regular basis.

Learning tips
The Study Guide helps you do each module. Each module includes learning, doing, sharing and reflecting activities. These are all designed to help you achieve the learning outcomes of the unit. The Study Guide is also your workbook and learning journal. If you seek accreditation, you will need to submit the completed study guide to your assessor.

If you are studying off campus
This unit lets you study at home. There are many advantages to studying off campus:
- you study close to your home
- you can plan your study time to fit in with work or family commitments
- you can relate your study to your present job, to improve your learning.

There are also challenges. Learning this way needs discipline and motivation. Here are some tips for studying off campus.

Plan
Give priority to study sessions with a colleague. Make sure you allow enough time to travel to your meeting place, if you have to travel.

Make a study schedule and stick to it. Set specific days and times each week for study and keep them free from other activities.

In your learning contract note due dates for particular tasks. In your study guide, for those activities where you are expected to work with others and share ideas, make note of appointments, your meeting place, time and so on, and plan for them.
Manage your time
Set aside a reasonable amount of time each week for your study program. If the bulk of the unit is done during NIST Week or PIST Week or another block of time, you may still have to complete certain activities in your own time.

Work in productive ways; discuss these with a colleague, your learning group or assessor.

Be organised
For your study, you will need the resources listed on pages 4-8. Resource 1 was sent to provinces in 2000 for distribution to schools. All other resources were sent to schools during 2003-2005. If you cannot find them in your school, ask your head teacher or the district inspector. Without these resource documents you won’t be able to complete this unit. Once you have collected them, keep all your study materials organised in one place. Work through the unit systematically.

Find a good place to study
Most people need quiet and order to study effectively, so try to find a suitable place to do your work.

Ask for help if you need it
This is the most vital part of studying off campus. No matter what the difficulty is, ask for help straight away. Colleagues can help you in many ways. Some are described below.

Don’t give up
You can access this unit in different ways. Once you have chosen your pathway, you should set up your support network and start to use it. Seek help when you need it and don’t give up.
Some definitions

Colleagues, other teachers and education staff can help you in different ways. These include helping you by being a learning partner, a critical friend, a mentor, an imparter (facilitator) or an assessor.

A learning partner is a colleague with whom you have agreed to study. You may negotiate an arrangement to help you both to clarify ideas, brainstorm ideas and discuss plans and processes, and to generally support each other throughout your learning journey. This doesn’t mean that you provide joint responses to the tasks and activities with your learning partner. You should make your own responses and they should be based on your own experiences, needs and context of work.

A critical friend is a colleague you trust and with whom you can work well. Critical friends give constructive feedback, ask thought-provoking questions, help you look at issues from different perspectives and help support change actions.

A mentor is a person who has a professional interest in you, is so willing to be a friend, guide, counsellor and/or a sounding board (that is, listens and responds to your ideas, issues and so on). A mentor may or may not be a colleague.

An imparter facilitates learning and provides input into the learning process. An imparter may not be approved to assess on behalf of PNGEI or TE&SDD.

An assessor is a person trained and approved by an authority such as PNGEI or TE&SDD, to facilitate learning, assess achievement and recommend an achievement grade in the context of the provision of this unit.

See page 3 of the Learning Contract for more information about the assessor.
Ways this unit can assist you

• **If self-improvement is your main goal ……**
  If self-improvement is your main goal, you will be able to help yourself in the following ways:

  1. lainim yu yet or with a colleague
  2. lainim wantaim in groups, over time, as the need arises, or in a structured way with a facilitator.

There may be other ways too of meeting your needs.

The learning outcomes for the unit, the self-assessment of progress, the learning model – *Learn, Do, Share and Reflect* – you’ll use, as well as the learning outcomes for each module can all help to guide and direct your learning journey.

Later on, if you would like to do some formal learning and would like to claim credit points for the work you do through this unit, you can enrol with PNGEI for external assessment as determined by PNGEI. The external assessment will be a task set by PNGEI for you to complete, not an examination.

• **If furthering your qualifications while improving yourself is your main goal ……**
  If furthering your qualifications while improving yourself is your main goal, you will need to study the unit and meet the assessment and accreditation requirements of PNGEI. For this you must work with an assessor.

Three modes of learning are suggested here.

**Model 1: Self-learning for self-improvement**
This mode is described on page 8. You may wish to study by yourself or with the help of a colleague or in a group situation. If you wish to seek potential credit points, then you will need to enrol with PNGEI for external assessment. For this you will need to complete a task.

**Mode 2: Off Campus face-to-face (with an assessor)**
This means lainim wantaim in groups over a period of time to make up around 48 hours in a structured way:
- school-based or cluster-based (for example, 2 hours a week over a number of weeks)
- during NIST or PIST week as a one week course with follow up sessions
- as a one week course, including evening sessions.

**Mode 3: On Campus face-to-face (with an assessor)**
This means attending a PNGEI regional centre or a PNGEI Study Site, if they offer this unit as part of a course, and by meeting PNGEI assessment and accreditations requirements.
PNGEI regional centres are:

- Gaulim Teachers’ College - New Guinea Islands region
- Kabaleo Teachers’ College - New Guinea Islands region
- Madang Teachers’ College - Momase region
- Holy Trinity Teachers’ College - Highlands region
- PNGEI - Southern region

PNGEI Study Sites are located in Daru, Balimo, Suki, Kiunga, Alotau, Samarai, Bolubolu, Losuia, Rabaraba, Popendetta, Kupiano, Berina, Wau, Bulolo, Kerema, Kilion, Baimuru, Vanimo, Aitape, Wewak and Maprik and other places. Contact PNGEI for further information.

For Modes 2 and 3 above, you will need to negotiate a learning contract with the assessor who will:

- approve and oversee your learning contract and any learning plan
- assess your work
- recommend an achievement grade to PNGEI.
Accreditation Requirements

The following describes the accreditation arrangement that has been negotiated with PNGEI for potential credit points towards DEP(I) or other qualifications including Certificate in Elementary Teacher Training (CETT), Diploma in Vocational Education (DOVET), Diploma in Special Education or further education.

All modes of study – self-learning, off campus face-to-face learning and on campus face-to-face learning - are acceptable to PNGEI.

Mode 1: Self-learning
In the self-learning mode, you are eligible for credit points only if you do an external assessment through PNGEI. A learning contract is not required for this. If you don’t succeed the first time, you will have two more chances to enrol and pass the unit.

A pass means four (4) credit points for every unit you pass.

Mode 2: Off Campus face-to-face
If studying at a location away from PNGEI, but supervised by an assessor, then you must undertake assessment, if you are seeking academic credit.

Four (4) credit points are earned per unit for achievement of HD, D, C or P. A fail (F) or an unfulfilled (UF) grade means no credit points. However, you can present yourself for external assessment at a later stage. You will have two chances to pass the unit through external assessment.

Mode 3: On Campus face-to-face
If studying on campus at a PNGEI regional centre or a study site established by PNGEI supervised by an assessor, then you must undertake assessment.

Four (4) credit points are earned per unit for achievement of HD, D, C or P. A fail (F) or an unfulfilled (UF) grade means no credit points. However, you can re-enrol and attempt the course a second time.

Please note that any credit points earned are awarded only when you enrol for an appropriate course with PNGEI. Admission to courses will be according to PNGEI regulations. The higher your achievement grade (for example, HD, D) for a unit, the better your chances are for being admitted to PNGEI courses to further your qualifications.

If you complete all nine units successfully, you earn 36 credit points.
Certification requirements

The Certification Authority for academic credit is PNGEI. If you are seeking academic credit, you will need to:
- negotiate a learning contract
- enrol at PNGEI and pay course fees
- meet the assessment requirements.

Assessment requirements

Assessment has three components.

1. **Self-assessment - compulsory, but not for academic credit**
   Self-assessment allows you to assess what you know and what you do not. This is not designed to be a rigorous challenge for Recognition of Prior Learning (RPL), but rather to motivate and sustain your interest. You should do the self-assessment again once you have reached the end of the unit, to assess and appreciate for yourself the progress you have made.

   Self-assessment is compulsory in the sense that you will need to show your assessor that you have done it, at the beginning and at the end of the unit.

2. **The process of learning - compulsory, but not for academic credit**
   We ask you to complete various tasks throughout this unit. The tasks include learning, doing (eg. investigating, surveying, etc.), sharing findings and information with others, and reflecting on the implications of the new knowledge and skills you have gained for your practice. The learning contract that you’ll negotiate with your assessor will specify the range of tasks you will be expected to complete.

   This component of assessment is compulsory in the sense that you will need to show your assessor that you have done the tasks specified in the negotiated Learning Contract.

   If you want to, you can use the work you do on the tasks, as appropriate, as evidence that you can demonstrate the outcomes.

3. **The results of learning - evidence to demonstrate achievement of outcomes, required for academic credit**
   If you are seeking academic credit, you need to provide evidence that you can demonstrate the achievement of outcomes. Successful completion of the unit leads to an award of High Distinction (HD), Distinction (D), Credit (C) or Pass (P), based on the achievement of the outcomes. It is up to you to provide evidence that you have achieved the outcomes.

   Some of the evidence could come from your investigations and action. Some could come from your reflections. Wherever it comes from, however, you will need to identify the evidence and relate it to particular outcomes for your assessor.
The learning contract (see pages 1-8 of the next section)

We ask you to negotiate a learning contract with your assessor. This contract is designed to help you and the assessor to identify the knowledge and skills you already have and those that will need developing through the unit. It helps to personalize your learning. It also helps you to devise, with your assessor, ways you can demonstrate the learning outcomes you achieve.

You will find a blank copy of the learning contract for this unit in the next section, pages 1-8.

Enrolment and payment of fees

Mode 1: Self-learning
If you are seeking academic credit through external assessment, you should enrol directly with PNGEI at the beginning of a trimester. You can do this when you are ready to be assessed. There are three trimesters in a year. You must pay a course fee when you enrol. You can get information about course fees from PNGEI.

Mode 2: Off Campus face-to-face
If studying in your province with an assessor (that is, off campus face-to-face), you should enrol in the province with the assessor and pay the course fees to PNGEI account with Westpac Bank, Waigani, Account No. 007-00931201. You can get information about course fees from PNGEI.

Then, send your enrolment form and receipt of payment of the course fees to: Head, School of Education Studies, Primary Unit, PNGEI, PO Box 1791, Boroko, NCD, PNG.

Mode 3: On Campus face-to-face
If studying at a PNGEI regional centre or a PNGEI study site with an assessor (that is, on campus face-to-face), you should enrol with the regional centre or study site and pay the course fees to PNGEI account with Westpac Bank, Waigani, Account No. 007-00931201. You can get information about course fees from PNGEI.

You should then provide receipt of payment of the course fees to the course coordinator at the regional center or study site. The coordinator will then send your enrolment form and receipt of payment to: Head, School of Education Studies, Primary Unit, PNGEI, PO Box 1791, BOROKO, NCD, PNG.
Self-assessment of progress

Completing this task is a compulsory part of the assessment schedule. However, it will not contribute to the final grade.

Fifteen statements, numbered 1 to 15 are given below. Each statement is followed by a continuum with four markers identified on it. To assess yourself, mark where you are now, on each continuum, based on what you know at the beginning of the unit.

For example, look at Statement 1: *I am familiar with the structure and contents of the Mathematics syllabuses and teacher guides*. If you know a lot about the structure and contents of the Mathematics syllabuses and teacher guides, then you should make a tick close to ‘very well’, the third marker. If you know only a little bit about them, or are not sure yet, then put your tick close to ‘little’, the first marker. If you have been using the syllabuses and teacher guides, and are in a position to help others, then you should place the tick close to ‘can help others’, the fourth marker. Think about what evidence you could show to justify your self-assessment, if you were asked.

Now do this task as best as you can in order to maximise your learning.

1. I am familiar with the structure and contents of the Mathematics syllabuses and teacher guides.

   ![Continuum for Self-assessment](image1)

2. I am familiar with the structure and contents of the Environmental Studies syllabus and teacher guide.

   ![Continuum for Self-assessment](image2)

3. I am familiar with the structure and contents of the Science syllabus and teacher guide.

   ![Continuum for Self-assessment](image3)

4. My understanding of how the aims of the primary curriculum, described in the *National Curriculum Statement (2002)* are reflected in the primary syllabuses may be described as

   ![Continuum for Self-assessment](image4)

5. I understand why the Mathematics and Science syllabuses are structured the way they are.

   ![Continuum for Self-assessment](image5)
6. My understanding of how to use the Mathematics and Science syllabuses may be described as

| limited | moderate | extensive | can help others |

7. I am familiar with the curriculum principles discussed in the Mathematics and Science syllabuses.

| little | moderately | very well | can help others |

8. I am familiar with the suggested assessment and reporting advice in the Mathematics and Science syllabuses and its links with the National Assessment and Reporting Policy, 2003.

| little | moderately | very well | can help others |

9. I understand what I should do in my present capacity to fully implement the reform curriculum.

| little | moderately | very well | can help others |

10. My ability to look at the primary curriculum in a holistic way (that is, in an integrated way) is

| limited | adequate | very good | can help others |

11. My ability to understand and explain outcomes-based learning, teaching, assessing and reporting may be described as

| limited | adequate | very good | can help others |

12. My ability to understand the curriculum expectations through curriculum principles, aims, learning outcomes and indicators in the syllabuses may be described as

| limited | adequate | very good | can help others |

13. My ability to provide leadership in the implementation of reform curriculum may be described as

| limited | adequate | very good | can help others |

<table>
<thead>
<tr>
<th>little</th>
<th>moderately</th>
<th>very well</th>
<th>can help others</th>
</tr>
</thead>
</table>

15. I understand the links between elementary, lower primary and upper primary subjects in the learning areas of Mathematics and Science.

<table>
<thead>
<tr>
<th>little</th>
<th>moderately</th>
<th>very well</th>
<th>can help others</th>
</tr>
</thead>
</table>

On completing the unit, you need to do the *self-assessment* again to see for yourself what progress you have made by doing all the learning activities.
Unit 4: Learning Areas: Mathematics and Science

Learning Contract

The learning contract is only required if you seek academic credit through PNGEI in the off campus or on campus face-to-face modes.

The learning contract provided here is a sample for your information. Your assessor can provide a copy of the learning contract with PNGEI insignia on it, if you need one.
Learning Contract

The learning contract is only required if you seek academic credit through PNGEI in the off campus or on campus face-to-face modes.

The learning contract provided here is a sample for your information. Your assessor can provide a copy of the learning contract with PNGEI insignia on it, if you need one.

Use this learning contract as a basis for discussion with your assessor before you begin this unit. During this discussion, you and your assessor will negotiate

- the outcomes, if any, for which you may seek recognition of prior learning (RPL)
- the activities you will undertake on your own
- the activities you will undertake as part of a group or with a colleague
- the evidence you will show to prove that you have met the learning outcomes of the unit.

Complete the learning contract before you start your study. Give a copy of the agreed contract to your assessor.

Any later changes to the contract should be re-negotiated, agreed upon, and signed off by both you and the assessor.

**Learner:** Name: ___________________________ Sex: M/F ☐

File No. ___________________________

Position/Location: _______________________

**Assessor:** Name: ___________________________ Sex: M/F ☐

File No. ___________________________

Position/Location: _______________________

**Expected completion date:** _________________________
Assessor Information

Who is an assessor?

An assessor is
• a skilled, experienced educator with professional integrity and good communication skills
• acceptable to PNGEI as an assessor
• trained by TE&SD, PNGEI and Curriculum Reform Implementation Project (CRIP)
• nominated by the provinces, PNGEI and its regional centres.

What does the assessor do?

The assessor
• facilitates learning in the off-campus and on-campus face-to-face modes of delivery
• approves and overviews your learning contract and any learning plan
• checks that you have met all assessment requirements prior to assessment
• assesses your work
• recommends an achievement grade to PNGEI.

How do you find the nearest assessor?

• A list of assessors’ names, locations and contact details will be made available, as they are selected and trained. This list will come out in a PNGEI Circular to provincial education offices, district offices and head teachers of schools directly.
• This list will also be published in the PNGEI Handbook.

How are assessors paid?

• PNGEI-approved assessors trained to work in the off campus face-to-face mode (that is, external assessors) are paid an incentive as determined by the Governing Council of PNGEI.
• PNGEI staff trained as assessors to work in the on campus face-to-face mode (that is, internal assessors) work to PNGEI conditions.
Unit learning outcomes

On successful completion of this unit, you, the learner, can (are able to):

1. describe the structure and contents of the syllabuses and teacher guides in the Mathematics and Science learning areas
2. identify links between the syllabuses and the corresponding teacher guides
3. make connections between the Mathematics and Science learning areas
4. describe and discuss ways progress from grade 3 to grade 8 is described in the Mathematics and Science learning areas
5. use the syllabuses and teacher guides to construct units of work based on learning outcomes
6. make links between the syllabuses and teacher guides and the *National Curriculum Statement (2002)* and the *National Assessment and Reporting Policy, 2003*
7. assist others to understand and use these syllabuses and teacher guides.
Recognition of Prior Learning (RPL)

This is the evidence I will use to show which learning outcomes I can already meet (recognition of prior learning or RPL). In the table below, I’ll list the number of the outcomes for which I am seeking RPL and the evidence I can show.

*(For example, if you are claiming RPL for Outcome 1: describe the structure and contents of the syllabuses and teacher guides in the Mathematics and Science learning areas you must demonstrate your knowledge of the structure and contents of the Mathematics and Science syllabuses and teacher guides. This can be done in a number of ways such as a presentation to a group on this topic, an article you had written for publication on the topic, studies you have undertaken previously. You should discuss this with your assessor. If the evidence you submit is satisfactory to the assessor, you will be deemed to have achieved Outcome 1.)*

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<tr>
<th>Learning</th>
<th>Evidence</th>
<th>Satisfactory Outcome</th>
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We agree to the evidence to be provided as detailed above and we acknowledge RPL as certified above.

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<th>Learner</th>
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<th>Assessor</th>
<th>Date</th>
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Negotiated Tasks

Now that there is agreement about recognition of prior learning, I undertake to do the tasks as listed below.

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<tr>
<th>On my own</th>
<th>With others</th>
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We agree the tasks to be undertaken are as detailed above.

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<th>Learner</th>
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## Evidence for Assessment

This is the evidence I will use to show I have met the other learning outcomes when I have completed the unit. In the table below, I’ll list the number of the outcomes for which I am showing evidence (for example, Outcomes 1, 2, 3 and so on) and the kind of evidence I’ll use to show achievement of these outcomes.

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Evidence</th>
<th>Satisfactory</th>
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<tr>
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<td>(Assessor’s signature)</td>
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We agree that the evidence to be produced for assessment of learning outcomes is as detailed above.

Learner  
Date

Assessor  
Date
Declaration

I declare that the work I have provided as evidence of achieving outcomes is as negotiated with my assessor and is consistent with my learning contract.

I have acknowledged all sources of information that have contributed to my work.

Learner………………………………………… Date………………………………

Assessor………………………………………… Date………………………………

Sources of information (Human, print, other):

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Unit 4:
Learning Areas: Mathematics and Science

Final Steps
Final Steps ...

Now you are almost ready to start work. To make sure you’ve done all your preparation for seeking academic credit, check the following.

<table>
<thead>
<tr>
<th></th>
<th>Yes/No/</th>
<th>Not Applicable</th>
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<tbody>
<tr>
<td>I have done the initial self assessment</td>
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<tr>
<td>I have negotiated my learning contract</td>
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<td>I have access to the resource documents</td>
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<td>I understand what I should do to meet the assessment requirements</td>
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If you have said ‘yes’ or ‘not applicable’, as appropriate, to the above, then you are ready to get into the modules of this unit. If you have said ‘no’ to any of them, then you should re-consider why you are doing this unit.

The modules are written in a ‘self-learning mode’. You are guided each step of the way. Follow the instructions and you will be able to complete the modules.

If you are seeking academic credit, then remember that you must work with an assessor or enrol for external assessment. The colleague you work with can also be your learning partner, mentor, critical friend or facilitator (impartor).

**Gut lak long stadi bilong yu**
PRIMARY REFORM CURRICULUM
UNIT 4: LEARNING AREAS: MATHEMATICS AND SCIENCE