Science

Upper primary

Syllabus 2003

Section 1

Curriculum Information

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Department of Education

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Secretary's Message

The current reforms in education have been in progress since 1992. The Education Reform has emphasised community-based schooling, the use of vernacular languages in schools, the introduction of Elementary schools and the expansion of Primary schooling to grade 8 and increased access to Grades 9 and 10.

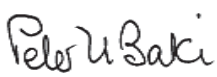
This syllabus is to be used by Upper Primary (Grades 6, 7 and 8) students in Primary schools throughout Papua New Guinea. This syllabus develops, extends, links and builds upon concepts, skills and attitudes flowing from Lower Primary (Grades 3, 4 and 5). This syllabus provides a sound foundation for further learning in the reformed school system.

Students' language abilities, already gained in their home environments and during the previous years of schooling, must be respected, built on and extended. Vernacular languages have a large part to play in our students' formative years and their first language should be used to promote a deeper understanding of difficult concepts when this is appropriate.

The study of Science encourages students to be curious and to actively search for new knowledge and understandings. Students do this by testing, playing with materials, exploring and questioning the world around them. Science education should nurture and promote an open-minded attitude to solving problems and to appreciating the opinions of others.

Papua New Guinea is unique in its biological diversity and richness of natural resources. This course of study encourages students and teachers to value and interact with their communities. Science encourages teachers to develop a student-centred approach with class activities promoting critical thinking, problem solving, and communication skills for all students.

I commend and approve this syllabus as the official curriculum for Science to be used in all Upper Primary schools throughout Papua New Guinea.



Peter M. Baki
Secretary for Education

Introduction

This syllabus makes explicit the knowledge, skills, attitudes and values that students should achieve for Grades 6, 7 and 8 in Science. These are expressed as learning outcomes and indicators.

The learning outcomes are student centred and written in terms that enable them to be demonstrated, assessed or measured. The outcomes are written to show a progression from one grade to the next.

Each learning outcome is illustrated with a list of examples of the kinds of things students should be able to do, know and understand if they are achieving an outcome. These are called indicators.

The learning outcomes and indicators will:

- give teachers individually or collaboratively, the flexibility to write programs and units of work—these can be developed to suit local conditions and individual student needs,
- help teachers assess and report students' achievements in relation to the learning outcomes,
- allow student achievement of the outcomes to be described in consistent ways,
- help teachers monitor student learning,
- help teachers plan their future teaching programs.

Science is to be timetabled for 180 minutes per week in all Upper Primary schools.

Rationale

Science helps students to explore, know and understand their world. Science education helps students to be able to make informed and responsible decisions about their lifestyle, their environment and the kind of society in which they wish to live. The nature of Science provides students with rich opportunities to solve problems using recognised scientific methods.

Science has a reputation for being exclusive to the academic world and as a consequence of little value to Primary school students. This type of thinking needs to change. The knowledge and intellectual resources of Papua New Guinea, practised here over thousands of years, are in danger of being lost as young people lose contact with their traditions and heritage. Science education has a role in encouraging students to learn about this rich source of knowledge, and its instrumental role in helping learners to better understand their own culture and those of others.

Science is best understood when it is linked to real life situations. It is important to present Science to students using authentic Papua New Guinean settings. Teaching with a local context heightens student awareness on how Science impacts on their everyday lives, both at the individual level, where it can inform personal choices, and at a social level where it can inform community and government decisions.

The knowledge, skills and attitudes developed by Science education will contribute to preparing students for subsequent studies, entry into the work force or value adding to the informal economy of their community. A practical, student-centred Science education encourages curiosity and a spirit of inquiry that is valuable in a country undergoing social, political, economical and technological change.

Curriculum Principles

Cultural relevance

Teachers need to be aware that some cultural and religious beliefs may exclude students from participating in planned Science activities. So as not to disadvantage students, discussion with parents should play an integral part in modifying or formulating alternative learning experiences.

Multiculturalism

Students come from different cultural backgrounds: they differ in where they live and the language, society and economic experiences that have influenced them in developing understandings about their world. This diversity is of benefit to the Science classroom because it encourages students to be aware of ideas and different ways of looking at the world.

Celebrating diversity helps to ensure social harmony and provides recognition for all students. It enriches learning experiences and improves the life chances and options for all students. It encourages students to respect and enjoy one another's cultural heritage.

Sustainability

When teaching Upper Primary Science, as many opportunities as possible should be taken to link what is being taught in Science to environmental issues impacting on life of the community and beyond.

It is now generally recognised that a coordinated approach to environmental sustainability is in itself problematic and that action through collaborative learning can help sustain the environment in a condition acceptable to present and future generations. This does not imply different or additional topic areas of study.

Environmental issues provide interesting and relevant contexts that can be used by teachers to develop learning experiences that incorporate Science skills and attitudes. This action on the part of teachers is essential if we are to have a scientifically knowledgeable population in the future who value their environment and are committed to protecting it.

Catering for diversity—Gender

The equal valuing of girls and boys should be reflected in the school's Science program as it plays an important part in each student's learning. Providing equal access to resources and teaching time for girls and boys is important in ensuring gender equity

The interests and preferred styles of girls and boys need to be considered. For example, greater female participation in Science at all levels can be promoted through:

- cooperative and collaborative teaching and learning styles which consider the need for both single sex and mixed sex groupings in the classroom,
- the use of inclusive language,
- acknowledgment of both the diversity and similarity of the male and female experiences.

Catering for diversity—Students with special needs

Students learn in different ways. Individuals bring to their learning in Science unique experiences, interests, motivations, and capabilities. This syllabus places importance on Science education being student centred, thus teachers are faced with the challenge of ensuring that all students have equal access to learning and to the available resources. All students should be encouraged to participate in a range of activities, which allow them to experience both enjoyment and success.

For all students to reach their full potential, learning experiences: planned units of work, will incorporate an assortment of student learning styles. Those who learn slowly should be given sufficient time to achieve, and those with particular talents should be given opportunities that challenge their abilities.

Teaching and Learning

In Primary schools, generalist teachers often prefer to use an integrated approach to teaching and learning. The teacher creates a program that is meaningful, appropriate, engaging and motivating to the students. The use of learning outcomes provides opportunities to integrate the curriculum.

Teachers should map out the learning outcomes for those parts of the syllabus that they are intending to teach in the coming term or year. Where there is more than one teacher across a grade, this should be done as a small team.

Teachers in the school with leadership responsibilities should be invited to attend and support this planning process. While carrying out this process, links between learning outcomes for different subjects should be noted, as there is scope for combining and using these outcomes in an integrated approach to teaching.

For example, a Language learning outcome might refer to the use of questionnaires and holding discussions with community members and a Making a Living learning outcome may also do this. In this way evidence of the achievement of these outcomes can be provided in more than one subject.

Student-centred learning

The Science curriculum focuses on students acquiring a deeper understanding of working scientifically through skills-based, student-centred learning activities. Students and teachers are encouraged to use the resources that are readily available to them in their own surroundings. Local knowledge and situations become very important in this approach. This practical approach is important because students must be able to use the scientific ideas that they learn to progress with the increasingly scientific and technological world in which they live.

Language development across the curriculum

Science uses particular vocabulary and language forms. A conscious effort should therefore be made to use and teach the language of Science. This includes teaching recognised reporting formats when communicating results of investigations as well as scientific vocabulary. This is of great importance to students developing English language skills.

Science without a laboratory

We can teach practical Science without a laboratory. The learning of Science processes and procedures will happen in a regular classroom. It is important that teachers establish an area in their classroom for Science where relevant materials and equipment are made accessible to students for planned scientific activities. This will often be materials collected from home or readily available from local stores, such as jars, tins, newspapers, scrap material, cardboard, natural vegetation, wires and batteries.

Science as Inquiry

Learning Science is something that students do, not something that is done to them. Hands-on activities, while essential, are not enough, students must have minds-on experiences in which they become fully engaged in creative scientific thinking.

Science as inquiry refers to the many ways in which scientists study the natural world. When engaging in inquiry, students:

- make observations by describing objects and events,
- ask questions,
- plan their activities,
- test ideas and carry out investigations,
- gather information,
- come up with their own conclusions,
- communicate their understandings to others,
- consider alternative explanations.

Science for all students

This principle is one of equity and justice. Science must be relevant to the purposes and interests of all students regardless of their age, sex, cultural background, disability, aspirations, or interests.

To meet the needs of all learners, teachers should make use of a wide variety of approaches to cater for different types of learning and seek assistance from the community to enrich experiences of students where useful.

Safety in Science

The nature of working scientifically can involve risks. All teachers are obliged to take reasonable precautions and duty of care to ensure the safety of all students and co-workers in their care at all times.

Aims

Students:

- apply scientific knowledge to their everyday lives,
- gain the foundation skills and knowledge upon which further Science learning can be based,
- learn to understand Science as expressed in the four learning strands,
- demonstrate interest in and curiosity about the natural processes in their environment and seek a scientific explanation for these processes,
- develop an understanding and appreciation of their relationship to the environment,
- demonstrate an ability to interact with the environment in a responsible and caring attitude,
- develop critical thinking skills and base their opinions on supportable and reliable evidence.

Content Overview

The content for this syllabus is organised into four Strands and six Sub-strands. A Strand such as Living Things is a useful and convenient way of organising the learning outcomes for a subject.

Each Strand identifies a particular aspect of a subject or a particular theme such as a set of processes. Each Strand displays a typical progression of learning from one grade to the next.

Working Scientifically is a process strand, which outlines the inquiry skills students will need to develop through their study of Science. It will not be taught on its own. It is skills based and is identified in the outcomes and indicators. The other three strands are content based.

Some Strands are further organised into Sub-strands to allow the content to be specified and described as learning outcomes.

Science has the following Strands: Working Scientifically, Living Things, Science in the Home and Earth and Beyond.

Living Things has two Sub-strands: Nature of Living Things and Ecology, Relationships and Interactions.

Science in the Home has two Sub-strands: Learning about Substances and Using Energy at Home.

Earth and Beyond has two Sub-strands: Our Earth and its Origin and Space Exploration.

Working Scientifically

This strand provides students with the opportunity to engage in the processes of Science and should complement learning in the three strands. Students learn to recognise and make adjustments to the factors that influence the processes.

There is a focus on analytical and creative approaches and students are encouraged to explore, question, test ideas and formulate conclusions. Also Science is put into practice in a socially responsible way. Working scientifically empowers students to implement problem-solving strategies when constructing understanding of the world around them.

Living Things

Nature of Living Things

It is important that learners appreciate and value their body and other living things. Our body is made up of a variety of tissues, organs and organ systems, which function in an integrated way. There needs to be an understanding of the structures and functions of each organ and organ system as it relates to the living form.

Ecology, Relationships and Interactions

Students are given opportunities to compare and contrast their learning in relation to other living organisms found living in their communities and formulate conclusions.

Understanding the basic processes and interrelationships associated with these systems will enable students to better understand how their own body functions and how they can care for themselves in terms of health and general wellbeing.

Science in the Home

Learning about Substances

The Science syllabus will enrich learning in Science that relates to the nutrition, health, socioeconomics, shelter and safety of students in their communities and homes. A scientific investigation using the home as a context will enable students and teachers to discover the principles behind familiar things that people use and their activities in carrying them out.

Energy at Home

The world we live in is shaped by forces, which influence the motion, shape, behaviour and energy of objects. The study of energy transfer and transformation is an integral part of the organisation and development of life. Students explore the effects of energy in their lives. They learn about methods of obtaining energy, how it is used and the social and environmental consequences of energy use.

Earth and Beyond

Our Earth and its Origin

Students explore ideas about the dynamic nature of the earth, solar system and universe, of which the earth is part. They investigate the earth's structure, the properties of materials, which determine the structure of the earth. They will be able to demonstrate the importance of care, respect and love for our land and its use. They will explore other environments and make comparisons in relation to what they already know.

Space Exploration

The universe of which the earth is part has many components. Students explore the relationship between the earth, solar system and the universe. They will also study things beyond our planet and gain insights into how they are similar or different to our own world. They investigate the many ways in which living things use the earth, solar system and the universe as resources and recognise the effects of this use.

Table of Strands and Sub Strands for Science

Strand	Grade 6	Grade 7	Grade 8
Working Scientifically	–	–	–
Living Things	• nature of living things • ecology, relationships and interactions	• nature of living things • ecology, relationships and interaction	• nature of living things • ecology, relationships and interactions
Science in the Home	• learning about substances • using energy at home	• learning about substances • using energy at home	• learning about substances • using energy at home
Earth and Beyond	• our earth and its origin • space exploration	• our earth and its origin • space exploration	• our earth and its origin • space exploration

Assessment and Reporting

Introduction

Assessment and reporting practices described here are detailed further in *The Assessment and Reporting Policy for Papua New Guinea* and in other support materials produced by the Department of Education.

Assessment

Assessment is the ongoing process of identifying, gathering and interpreting information about students' progress towards achievement of the learning outcomes described in the subject syllabuses.

Teachers record evidence of students' learning and use it to make judgements about students' achievements of the learning outcomes. To ensure that assessment is fair and balanced, teachers should use a range of assessment methods including:

- observing and recording details of students' demonstration of process skills and/or their performance on particular tasks,
- setting written assignments, projects and practical work,
- setting and marking written tests and/or examinations,
- keeping portfolios of students' work.

Teachers should provide opportunities for students to assess their own learning (self-assessment) and the learning of others (peer assessment) according to set negotiated criteria. The purpose of assessment is to improve student learning.

Science Assessment

In Science, assessment is an ongoing collection of information about the students' demonstration of learning in relation to the outcomes. It is expected that teachers will collect and use assessment information to monitor students' progress and to make judgements in order to:

- inform students, parents, carers and schools about demonstrations of learning outcomes,
- make decisions about students' needs, the learning and teaching processes and resource requirements,
- set learning goals with students and parents,
- guide the planning of school and class curriculum programs.

Principles of Assessment

Assessment focuses on learning outcomes. Students will be aware of what is being assessed, the assessment instruments being used and the criteria by which their demonstrations of the outcomes will be judged. The information collected by teachers will then be used to plan and direct students' further learning.

Using a comprehensive range of assessment techniques and tools will provide students with multiple opportunities to demonstrate the Science outcomes and will recognise that students have different learning styles.

Assessment tasks should be planned to address students' learning style, culture, ethnicity, gender, abilities, geographical location and socioeconomic status.

Assessment is an integral part of the learning process and should be factored into the learning experience from the unit planning stage and not left to the end. When selecting assessment strategies and instruments, teachers should consider prior student learning experiences and teaching methods used to address outcomes. Assessment tasks should be realistic and reflect real life situations, wherever possible.

Students must be taught to develop skills in self-monitoring and be critically reflective on the progress that they make towards demonstrating outcomes.

Students' demonstrations of learning outcomes should be monitored through the use of a range of assessment techniques:

- observation
- consultation
- focused analysis
- self-assessment
- peer-assessment

Making Judgements in Science

Teachers can make judgements about students' demonstrations of Science outcomes when they are satisfied with the evidence collected through assessment. Teacher's professional judgement is fundamental to school-based assessment. Consistency of teacher judgement is developed through processes that may involve:

- shared understandings
- criteria sheets
- joint planning and assessment tasks
- examination of students' folios
- progress maps
- formal and informal moderation processes

Reporting

Teachers must keep accurate records of students' achievement of the learning outcomes and report these achievements in fair and accurate ways to parents and guardians, teachers, students and others. Recording methods will include the following:

- journal, diary or anecdotal notes,
- portfolios,
- progressive records,
- checklists,
- work samples with comments written by the teacher.

Student reports should be based on assessment information collected from ongoing assessments and where appropriate, from external examinations (Grade 8). Schools will decide on how reports will be presented to best suit the needs of their communities.

Evaluation

Teachers will use assessment information to evaluate the effectiveness of their teaching, learning and assessment programs and to make improvements to their teaching practice in order to improve student learning.

Schools may use whole school assessment data to evaluate the effectiveness of teaching and learning in a particular subject or at particular grade levels and make decisions on how to improve student learning.