Geography

Senior High

Grade 11

Teacher Guide

Standards-Based

Department of Education

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Issued free to schools by the Department of Education

Published in 2020 by the Department of Education, Papua New Guinea

Graphic Design & Layout by Vitus Witnes Kanua

ISBN: 978-9980-905-95-6

Contents

Acknowledgements

Grade 11 Social Science Teacher Guide was developed by the Curriculum Development Division of the Department of Education. It was coordinated by Lily Pup Mali with assistance from the Subject Curriculum Group (SCG) members.

Secondary School teachers in NCD and Central Province and the UPNG lecturers are acknowledged for their contributions to this teacher guide.

Curriculum Panel (CP), Subject Advisory Committee (SAC) and Board of Studies (BOS) members are acknowledged for consideration and endorsement of the teacher guide.

Acronyms

AAL	Assessment As Learning
AFL	Assessment For Learning
AOL	Assessment Of Learning
BOS	Board Of Studies
CDD	Curriculum Development Division
CP	Curriculum Panel
DA	Diagnostic Assessment
IHD	Integral Human Development
GoPNG	Government of Papua New Guinea
KSVA	Knowledge Skills Values and Attitudes
MTDG	Medium Term Development Goals
NDoE	National Department of Education
OBC	Outcomes-Based Curriculum
OBE	Outcomes-Based Education
PNG	Papua New Guinea
SAC	Subject Advisory Committee
SBC	Standards-Based Curriculum
SBE	Standards-Based Education
SCG	Subject Curriculum Group
STEAM	Science, Technology, Engineering, Arts and Mathematics

Secretary's Message

The ultimate aim of Standards-Based Education (SBE) in Papua New Guinea is to prepare students for careers, higher education, and citizenship. SBE will therefore focus on providing students with careers, higher education, and citizenship preparedness knowledge, skills, values and attitudes that they can use to work, study and live in the 21st century.

Standards-Based Curriculum (SBC) in PNG is closely aligned to and is key to achieving this aim and its related operational goals. The curriculum is underpinned by four key pillars:

- morals, values and attitudes;
- cognitive, reasoning, decision-making, problem-solving, high level and 21st century skills;
- Science, Technology, Engineering, Arts and Mathematics (STEAM),
- core curriculum.

Social Science is a significant curriculum framework for teaching children and enabling them to progressively develop proficiency on fundamental ideas of Geography, History, Political Science Economics and Environment. This curriculum addresses Social Science skills and processes of geography, civic and cultural literacy, historical and economical literacy and global awareness.

Thus, students will be able to make informed decisions and will be equipped with problem–solving and management knowledge, skills, values and attitudes in Social Science. This enables them to function effectively in the work and higher education environments as productive and useful citizens of a culturally diverse and democratic society in an interdependent world.

Social Science teachers are expected to effectively plan, teach, and assess these knowledge, skills, values, and attitudes. This teacher guide describes what teachers are expected to know and do to enable all their students to effectively learn and demonstrate the expected levels of proficiency in all the grade level Social Science knowledge, skills, values and attitudes, and attain the national content standards.

I commend and approve this Social Science Teacher Guide for Grade 11 to be used in all High Schools throughout Papua New Guinea.

……..

UKE W. KOMBRA, PhD.
Secretary for Education

Introduction

Social Science aims to develop and instill in students the ability to gauge views from all spectrums of life and be able to analyse and make proper judgments and statements to resonate and promote peace and harmony for all people. As individuals, they must be aware of issues of paramount importance affecting their daily lives such as their social groupings and institutions, governance and the natural world surrounding them. Thus, they are able to create and foster great cohesion within their locality which should have an impact on the world and over to sustain and maintain life.

The study of Social Science enhances students' understanding of inter-disciplinary concepts and issues in relation to geography, history, politics, economics and environment within PNG and globally.

Social Science aims to provide a meaningful pedagogical framework for teaching and learning essential and in demand knowledge, skills, values, and attitudes that are required for the preparation of students for careers, higher education and citizenship in the 21st century.

Students should be prepared to gather and understand information, analyse issues critically, learn independently or collaboratively, organize and communicate information, draw and justify conclusions, create new knowledge, and act ethically.

Students' employability will be enhanced through the study and application of STEAM principles. STEAM is an integral component of the core curriculum. All students are expected to study STEAM and use STEAM related skills to solve problems relating to both the natural and the physical environments. The aim of STEAM education is to create a STEAM literate society. It is envisioned that the study of STEAM will motivate students to pursue and take up academic programs and careers in STEAM related fields. STEAM has been embedded in the Social Science curriculum. Equal opportunities should be provided for all students to learn, apply and master STEAM principles and skills.

Social Science is to be timetabled for 240 minutes per week in grade 11.

Structure of the Teacher Guide

This teacher guide comprises of three main sections that provide essential information that all teachers should know and do to effectively implement the Social Science - Geography curriculum.

1. **General Information**
    - Purpose of the teacher guide
    - How to use the teacher guide
    - Syllabus and teacher guide alignment
    - Learning and performance standards
    - Core Curriculum
    - STEAM
    - Curriculum Integration
    - Essential KSVAs

2. **Teaching and Learning**
    - Teaching and Learning Strategies
    - Units and Topics
    - Standards-Based Lesson Planning

3. **Assessment**
    - Performance Assessment
    - Performance Standards

The above components are linked and closely aligned. They should be connected to ensure that the intended learning outcomes and the expected quality of education standards are achieved. The close alignment of planning, instruction and assessment is critical to the attainment of learning standards.

Purpose of the Teacher Guide

This teacher guide describes what all teachers should know and do. The overarching purpose is to help teachers to effectively plan, teach, assess, evaluate, report and monitor students' learning and mastery of national and grade-level expectations. That is, the essential knowledge, skills, values and attitudes (KSVAs) described in the content standards and grade-level benchmarks, and their achievement of the national and grade-level proficiency standards.

Thus, the teacher is expected to:

- understand the significance of aligning all the elements of Standards-Based Curriculum (SBC) as the basis for achieving the expected level of education quality;
- effectively align all the components of SBC when planning, teaching, and assessing students' learning and levels of proficiency;
- effectively translate and align the Social Science syllabi and teacher guide to plan, teach and assess different Social Science units and topics, and the KSVAs described in the grade-level benchmarks;
- understand the Social Science national content standards, grade-level benchmarks, and evidence outcomes;
- effectively make sense of the content (KSVAs) described in the Social Science national content standards and the essential components of the content described in the grade-level benchmarks;
- effectively guide students to progressively learn and demonstrate proficiency on a range of Social Science knowledge, skills, processes, concepts, ideas, principles, practices, values and attitudes;
- confidently interpret, translate and use Social Science content standards and benchmarks to determine the learning objectives and performance standards, and plan appropriately to enable all students to achieve these standards;
- embed the core curriculum in their Social Science lesson planning, instruction, and assessment to permit all students to learn and master the core KSVAs required of all students;
- provide opportunities for all students to understand how STEAM has and continues to shape the social, political, economic, cultural, and the environment contexts and the consequences, and use STEAM principles, skills, processes, ideas and concepts to inquire into and solve problems relating to both the natural and physical (man-made) worlds as well as problems created by STEAM;
- integrate cognitive skills (critical, creative, reasoning, decision-making, and problem-solving skills), high level thinking skills (analysis, synthesis

and evaluation skills), values (personal, social, work, health, peace, relationship, sustaining values), and attitudes in lesson planning, instruction and assessment;

- meaningfully connect what students learn in Social Science with what is learnt in other subjects to add value and enhance students' learning so that they can integrate what they learn and develop in-depth vertical and horizontal understanding of subject content;

- formulate effective SBC lesson plans using learning objectives identified for each of the topics;

- employ SBC assessment approaches to develop performance assessments to assess students' proficiency on a content standard or a component of the content standard described in the grade-level benchmark;

- effectively score and evaluate students' performance in relation to a core set of learning standards or criteria, and make sense of the data to ascertain students' status of progress towards meeting grade-level and nationally expected proficiency standards, and use evidence from the assessment of students' performance to develop effective evidence-based intervention strategies to help students' who are making inadequate or slow progress towards meeting the grade-level and national expectations to improve their learning and performance.

How to use the Teacher Guide

Teacher Guide provides essential information about what the teacher needs to know and do to effectively plan, teach and assess students learning and proficiency on learning and performance standards. The different components of the teacher guide are closely aligned with SBC principles and practice, and all the other components of PNG SBC. It should be read in conjunction with the syllabus in order to understand what is expected of teachers and students to achieve the envisaged quality of education outcomes.

The first thing teachers should do is to read and understand each of the sections of the teacher guide to help them understand the key SBC concepts and ideas, alignment of PNG SBC components, alignment of the syllabus and teacher guide, setting of content standards and grade-level benchmarks, core curriculum, STEAM, curriculum integration, essential knowledge, skills, values and attitudes, strands, units and topics, learning objectives, SBC lesson planning, and SBC assessment. A thorough understanding of these components will help teachers meet the teacher expectations for implementing the SBC curriculum, and therefore the effective implementation of Grade 11 Social Science Curriculum. Based on this understanding, teachers should be able to effectively use the teacher guide to do the following:

Determine Learning Objectives and Lesson Topics

Topics and learning objectives have been identified and described in the Teacher Guide. Lesson objectives are derived from topics that are extracted from the grade-level benchmarks. Lesson topics are deduced from the learning objectives. Teachers should familiarise themselves with this process as it is essential for lesson planning, instruction and assessment. However, depending on the context and students' learning abilities, teachers would be required to determine additional learning objectives and lesson topics. Teachers should use the examples provided in this teacher guide to formulate additional learning objectives and lesson topics to meet the educational or learning needs of their students.

Identify and Teach Grade Appropriate Content

Grade appropriate content has been identified and scoped and sequenced using appropriate content organisation principles. The content is sequenced using the spiraling sequence principles. This sequencing of content will enable students to progressively learn the essential knowledge, skills, values and attitudes as they progress further into their schooling. What students learn in previous grades is reinforced and deepens in scope with an increase in the level of complexity and difficulty in the content and learning activities. It is important to understand how the content is organised so that grade appropriate content and learning activities can be selected, if not already embedded in the benchmarks and learning objectives, to not only help students learn and master the content, but ensure that what is taught is rigorous, challenging, and comparable.

Integrate the Core Curriculum in Lesson Planning, Instruction and Assessment

Teachers should use this teacher guide to help them integrate the core curriculum – values, cognitive and high-level skills, 21st century skills, STEAM principles and skills, and reading, writing, and communication skills in their lesson planning, instruction and assessment. All students in all subjects are required to learn and master these skills progressively through the education system.

Integrate Cognitive, High Level, and 21st Century Skills in Lesson Planning, Instruction and Assessment

Teachers should integrate the cognitive, high level and 21st century skills in their annual teaching programs, and give prominence to these skills in their lesson preparation, teaching and learning activities, performance assessment, and performance standards for measuring students' proficiency on these skills. Social Science addresses the skills and processes of geography, civic and cultural literacy, historical and economical literacy and global awareness. Thus, students will be able to make informed decisions, problem–solving and management knowledge, skills, values and attitudes in Social Science. This enables them to function effectively in the work and higher education environments as productive and useful citizens of a culturally diverse and democratic society in an interdependent world.

In addition, it envisages all students attaining expected proficiency levels in these skills and will be ready to pursue careers and higher education academic programs that demand these skills, and use them in their everyday life after they leave school at the end of Grade 12. Teachers should use the teacher guide to help them to effectively embed these skills, particularly in their lesson planning and in the teaching and learning activities as well as in the assessment of students' application of the skills.

Integrate Social Science Values and Attitudes in Lesson Planning, Instruction and Assessment

In Social Science, students are expected to learn, promote and use work, relationship, peace, health, social, personal, family, community, national and global values in the work and study environments as well as in their conduct as community, national and global citizens. Teachers should draw from the information and suggestions provided in the syllabus and teacher guide to integrate values and attitudes in their lesson planning, instruction, and assessment. They should report on students' progression towards internalizing different values and attitudes and provide additional support to students who are yet to reach the internalization stage to make positive progress towards this level.

Integrate Science, Technology, Engineering, Arts and Mathematics (STEAM) Principles and Skills in Lesson Planning, Instruction and Assessment

Teachers should draw from both the syllabus and teacher guide in order to help them integrate STEAM principles and skills, and methodologies in their lesson planning, instruction and assessment. STEAM teaching and learning happens both inside and outside of the classroom. Effective STEAM teaching and

learning requires both the teacher and the student to participate as core investigators and learners, and to work in partnership and collaboration with relevant stakeholders to achieve maximum results. Teachers should use the syllabus, teacher guides and other resources to guide them to plan and implement this and other innovative and creative approaches to STEAM teaching and learning to make STEAM principles and skills learning fun and enjoyable and, at the same time, attain the intended quality of learning outcomes.

Identify and Use Grade and Context Appropriate, Innovative, Differentiated and Creative Teaching and Learning Methodologies

SBC is an eclectic curriculum model. It is an amalgamation of strengths of different curriculum types, including behavioural objectives, outcomes, and competency. Its emphasis is on students attaining clearly defined, measurable, observable and attainable learning standards, i.e., the expected level of education quality. Proficiency (competency) standards are expressed as performance standards/criteria and evidence outcomes, that is, what all students are expected to know (content) and do (application of content in real life or related situations) to indicate that they are meeting, have met or exceeded the learning standards. The selection of grade and contextually appropriate teaching and learning methodologies is critical to enabling all students to achieve the expected standard or quality of education. Teaching and learning methodologies must be aligned to the content, learning objective, and performance standard in order for the teacher to effectively teach and guide students towards meeting the performance standard for the lesson. They should be equitable and socially inclusive, differential, student-centred, and lifelong. They should enable STEAM principles and skills to be effectively taught and learned by students. Teachers should use the teacher guide to help them make informed decisions when selecting the types of teaching and learning methodologies to use in their teaching of the subject content, including STEAM principles and skills.

Plan Standards-Based Lessons

SBC lesson planning is quite difficult to do. However, this will be easier with more practice and experience over time. Effective SBC lesson plans must meet the required standards or criteria so that the learning objectives and performance standards are closely aligned to attain the expected learning outcomes. Teachers should use the guidelines and standards for SBC lesson planning and examples of SBC lesson plans provided in the teacher guide to plan their lessons. When planning lessons, it is important for teachers to ensure that all SBC lesson planning standards or criteria are met. If standards are not met, instruction will not lead to the attainment of intended performance and proficiency standards. Therefore, students will not attain the national content standards and grade-level benchmarks.

Use Standards-Based Assessment

Standards-Based Assessment has a number of components. These components are intertwined and serve to measure evaluate, report, and monitor students' achievement of the national and grade-level expectations, i.e., the essential knowledge, skills, values and attitudes they are expected to master and demonstrate proficiency on. Teachers should use the information

and examples on standards-based assessment to plan, assess, record, evaluate, report and monitor students' performance in relation to the learning standards.

Make informed Judgments About Students' Learning and Progress Towards Meeting Learning Standards

Teachers should use the teacher guide to effectively evaluate students' performance and use the evidence to help students to continuously improve their learning as well as their classroom practice.

It is important that teachers evaluate the performance of students in relation to the performance standards and progressively the grade-level benchmarks and content standards to make informed judgments and decisions about the quality of their work and their progress towards meeting the content standards or components of the standards. Evaluation should not focus on only one aspect of students' performance. It should aim to provide a complete picture of each student's performance. The context, inputs, processes, including teaching and learning processes, and the outcomes should be evaluated to make an informed judgment about each student's performance, Teachers should identify the causal factors for poor performance, gaps in students learning, gaps in teaching, teaching and learning resource constraints, and general attitude towards learning. Evidence-based decisions can then be made regarding the interventions for closing the gaps to allow students to make the required progress towards meeting grade-level and national expectations.

Prepare Students' Performance Reports

Reporting of students' performance and progress towards the attainment of learning standards is an essential part of SBC assessment. Results of students' performance should be communicated to particularly the students and their parents to keep them informed of students' academic achievements and learning challenges as well as what needs to be done to ensure the students' make positive progress towards meeting the proficiency standards and achieving the desired level of education quality. Teachers should use the information on the reporting of students' assessment results and the templates provided to report the results of students' learning.

Monitor Students' Progress Towards Meeting the National Content Standards and Grade-Level Benchmarks

Monitoring of students' progress towards the attainment of learning standards is an essential component of standards-based assessment. It is an evidence-based process that involves the use of data from students' performance assessments to make informed judgments about students' learning and proficiency on the learning standards or their components, identify gaps in students' learning and the causal factors, set clear learning improvement targets, and develop effective evidence-based strategies (including preplanning and re-teaching of topics), set clear timeframes, and identify measures for measuring students' progress towards achieving the learning targets.

Teachers should use the teacher guide to help them use data from students' performance assessments to identify individual students' learning weaknesses and develop interventions, in collaboration with each student and his/her parents or guardians, to address the weaknesses and monitor their progress towards meeting the agreed learning goals.

Develop Additional Benchmarks

Teachers can develop additional benchmarks using the examples in the teacher guide to meet the learning needs of their students and local communities. However, these benchmarks will not be nationally assessed as these are not comparable. They are not allowed to set their own content standards or manipulate the existing ones. The setting of national content standards is done at the national level to ensure that required learning standards are standardised, maintained and monitored to sustain the required level of education quality.

Avoid Standardisation

The teaching and learning strategies by means of lesson plans, lesson objectives and assessment should not be standardised when implementing the Social Science curriculum. SBC does not mean that the content, lesson objectives, teaching and learning strategies, and assessment are standardised. This is a misconception and any attempt to standardise the components of curriculum without due consideration of the teaching and learning contexts, children's backgrounds and experiences, and different abilities and learning styles of children will be counterproductive. It will hinder students from achieving the expected proficiency standards and hence, high academic standards and the desired level of education quality. That is, they should not be applied across all contexts and with all students, without considering the educational needs and the characteristics of each context. Teachers must use innovative, creative, culturally relevant, and differentiated teaching and learning approaches to teach the curriculum and enable their students to achieve the national content standards and grade-level benchmarks. And enable all students to experience success in learning the curriculum and achieve high academic standards.

The teaching and learning and assessment strategies provided in this teacher guide are not fixed and can be changed. Teachers should use the information and examples provided in the teacher guide to guide them to develop, select, and use grade, context, and learner appropriate content, learning objectives, teaching and learning strategies, and performance assessment and standards. SBC is evidence-based hence decisions about the content, learning outcomes, teaching and learning strategies, students' performance, and learning interventions should be based on evidence. Teaching and learning should be continuously improved and effectively targeted using evidence from students' assessment and other sources.

Syllabus and Teacher Guide Alignment

A teacher guide is a framework that describes how to translate the content standards and benchmarks (learning standards) outlined in the syllabus into units and topics, learning objectives, lesson plans, teaching and learning strategies, performance assessment, and measures for measuring students' performance (performance standards). It expands the content overview and describes how this content identified in the content standards and their components (essential KSVAs) can be translated into meaningful and evidence-based teaching topics and learning objectives for lesson planning, instruction and assessment. It also describes and provides examples of how to evaluate and report on students' attainment of the learning standards, and use evidence from the assessment of students' performance to develop evidence-based interventions to assist students who are making slow progress towards meeting the expected proficiency levels to improve their performance.

Grade 11 Social Science comprises of the Syllabus and Teacher Guide. These two documents are closely aligned, complimentary and mutually beneficial. They are the essential focal points for teaching and learning the essential Social Science knowledge, skills, values and attitudes.

Syllabus and teacher guide alignment	
Syllabus Outlines the ultimate aim and goals, and what to teach and why teach it	**Teacher Guide** Describes how to plan, teach, and assess students' performance
- Overarching and SBC principles - Content overview - Core curriculum - Essential knowledge, skills, values and attitudes - Strands and units - Evidence outcomes - Content standards and grade-level benchmarks - Overview of assessment, evaluation, and reporting	- Determine topics for lesson planning, instruction and assessment - Formulate learning objectives - Plan SBC lesson plans - Select teaching and learning strategies - Implement SBC assessment and evaluation - Implement SBC reporting and monitoring

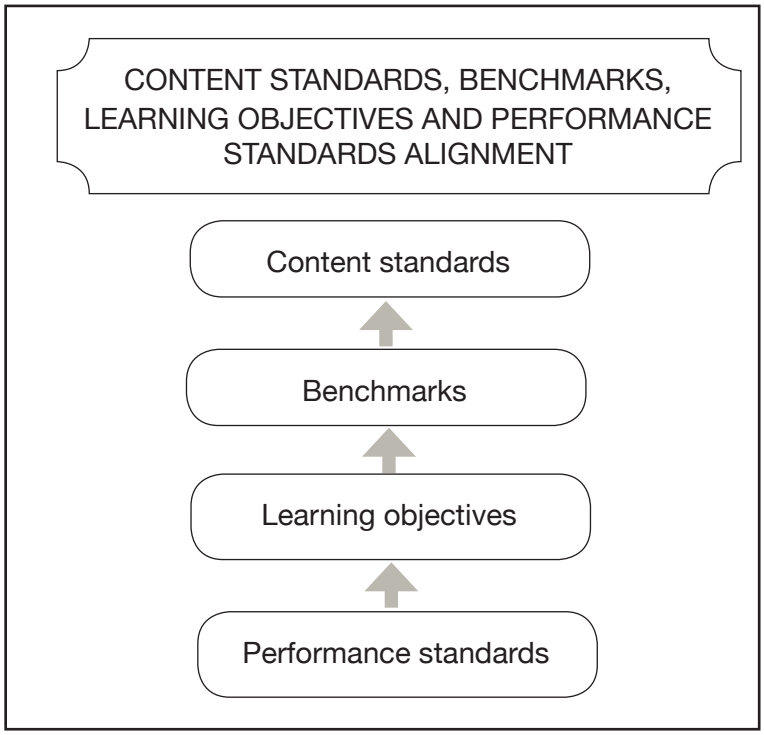
The syllabus outlines the ultimate aim and goals of SBE and SBC, what is to be taught and why it should be learned by students, the underlying principles and articulates the learning and proficiency standards that all students are expected to attain. On the other hand, the teacher guide expands on what is outlined in the syllabus by describing the approaches or the how of planning, teaching, learning, and assessing the content so that the intended learning outcomes are achieved.

This teacher guide should be used in conjunction with the syllabus. Teachers should use these documents when planning, teaching and assessing Grade 11 Social Science content.

Teachers will extract information from the syllabus (e.g., content standards and grade-level benchmarks) for lesson planning, instruction and is for measuring students' attainment of a content standard as well as progress to the next grade of schooling.

Learning and performance standards alignment

Content standards, benchmarks, learning objectives, and performance standards are very closely linked and aligned. There is a close linear relationship between these standards. Students' performance on a significant aspect of a benchmark (KSVA) is measured against a set of performance standards or criteria to determine their level of proficiency using performance assessment. Using the evidence from the performance assessment, individual student's proficiency on the aspect of the benchmark assessed and progression towards meeting the benchmark and hence the content standard are then determined.



Effective alignment of these learning standards and all the other components of PNG SBE and SBC (ultimate aim and goals, overarching, SBC and subject-based principles, core curriculum, STEAM, and cognitive, high level, and 21st century skills) is not only critical but is also key to the achievement of high academic standards by all students and the intended level of education quality. It is essential that teachers know and can do standards alignment when planning, teaching, and assessing students' performance so that they can effectively guide their students towards meeting the grade-level benchmarks (grade expectations) and subsequently the content standards (national expectations).

Learning and Performance Standards

Standards-Based Education (SBE) and Standards-Based Curriculum (SBC) are underpinned by the notion of quality. Standards define the expected level of education quality that all students should achieve at a particular point in their schooling. Students' progression and achievement of education standard(s) are measured using performance standards or criteria to determine their demonstration or performance on significant aspects of the standards and therefore their levels of proficiency or competency. When they are judged to have attained proficiency on a content standard or benchmark or components of these standards, they are then deemed to have met the standard(s). That is, achieved the intend level of education quality.

Content standards, benchmarks, and learning objectives are called learning standards while performance and proficiency standards (evidence outcomes) can be categorised as performance standards. These standards are used to measure students' performance, proficiency, progression and achievement of the desired level of education quality. Teachers are expected to understand and use these standards for lesson planning, instruction and assessment.

Content standards

Content standards are evidence-based, rigorous and comparable regionally and globally. They have been formulated to target critical social, economic, political, cultural, environmental, and employable skills gaps identified from a situational analysis. They were developed using examples and experiences from other countries and best practice, and contextualized to PNG contexts.

Content standards describe what (content - knowledge, skills, values, and attitudes) all students are expected to know and do (how well students must learn and apply what is set out in the content standards) at each grade-level before proceeding to the next grade. These standards are set at the national level and thus cannot be edited or changed by anyone except the National Subject-Based Standards Councils. Content Standards:

- are evidence-based;
- are rigorous and comparable to regional and global standards;
- are set at the national level;
- state or describe the expected levels of quality or achievement;
- are clear, measurable and attainable;
- are linked to and aligned with the ultimate aim and goals of SBE and SBC and overarching and SBC principles;
- delineate what matters, provide clear expectations of what students should progressively learn and achieve in school, and guide lesson planning, instruction, assessment;
- comprise knowledge, skills, values, and attitudes that are the basis for quality education;
- provide teachers a clear basis for planning, teaching, and assessing lessons;

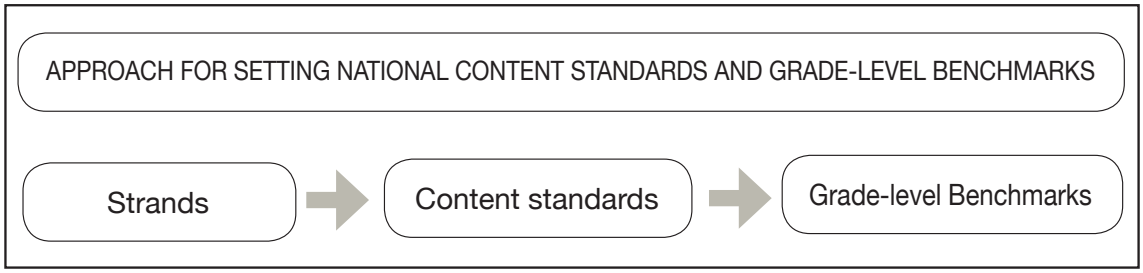
- provide provinces, districts, and schools with a clear focus on how to develop and organise their instruction and assessment programs as well as the content that they will include in their curriculum.

Benchmarks

Benchmarks are derived from the content standards and benchmarked at the grade-level. Benchmarks are specific statements of what students should know (i.e., essential knowledge, skills, values or attitudes) at a specific grade-level or school level. They provide the basis for measuring students' attainment of a content standard as well as progress to the next grade of schooling.

Grade-level benchmarks:

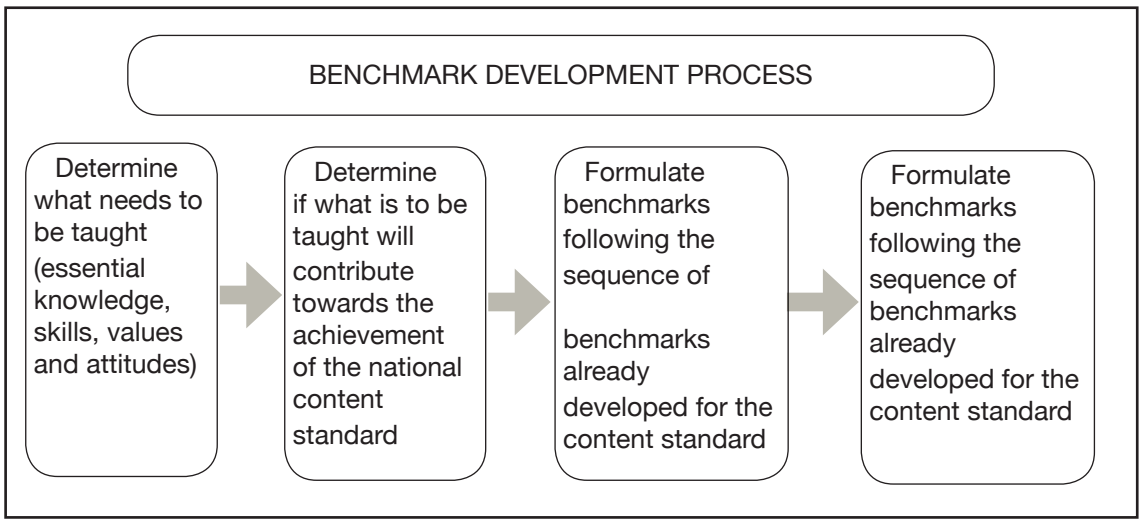
- are evidenced-based;
- are rigorous and comparable to regional and global standards;
- are set at the grade level;
- are linked to the national content standards;
- are clear, measurable, observable and attainable;
- articulate grade level expectations of what students are able to demonstrate to indicate that they are making progress towards attaining the national content standards;
- provide teachers a clear basis for planning, teaching, and assessing lessons;
- state clearly what students should do with what they have learned at the end of each school-level;
- enable students' progress towards the attainment of national content standards to be measured, and
- enable PNG students' performance to be compared with the performance of PNG students with students in other countries.



Development of additional benchmarks

Teachers should develop additional benchmarks to meet the learning needs of their students. They should engage their students to learn about local, provincial, national and global issues that have not been catered for in the grade-level benchmarks but are important and can enhance students' understanding and application of the content. However, it is important to note that these benchmarks will not be nationally examined as they are not comparable. Only the benchmarks developed at the national level will be tested. This does not mean that teachers should not develop additional

benchmarks. An innovative, reflect, creative and reflexive teacher will continuously reflect on his/her classroom practice and use evidence to provide challenging, relevant, and enjoyable learning opportunities for his/her students to build on the national expectations for students. Teachers should follow the following process when developing additional grade-level benchmarks.



Learning objectives

Learning or instructional objectives are precise statements of educational intent. They are formulated using a significant aspect or a topic derived from the benchmark, and is aligned with the educational goals, content standards, benchmarks, and performance standards. Learning objectives are stated in outcomes language that describes the products or behaviours that will be provided by students. They are stated in terms of measurable and observable student behaviour.

For example, students will be able to identify all the main towns of PNG using a map.

Performance standards

Performance Standards are concrete statements of how well students must learn what is set out in the content standards, often called the **"be able to do"** of **"what students should know and be able to do."** Performance standards are the indicators of quality that specify how competent a student's demonstration or performance must be. They are explicit definitions of what students **must do to demonstrate proficiency or competency at a specific level on the content standards.**

Performance standards:

- measure students' performance and proficiency **(using performance indicators)** in the use of a specific knowledge, skill, value, or attitude in real life or related situations
- provide the basis **(performance indicators)** for evaluating, reporting and monitoring students' level of proficiency in use of a specific knowledge, skills, value, or attitude

- are used to plan for individual instruction to help students not yet meeting expectations **(desired level of mastery and proficiency)** to make adequate progress towards the full attainment of benchmarks and content standards
- are used as the basis for measuring students' progress towards meeting grade-level benchmarks and content standards.

Proficiency standards

Proficiency standards describe what all students in a particular grade or school level can do at the end of a strand, or unit. These standards are sometimes called evidence outcomes because they indicate if students can actually apply or use what they have learnt in real life or similar situations. They are also categorized as benchmarks because that is what all students are expected to do before exiting a grade or are deemed ready for the next grade.

Core Curriculum

A core set of common learnings (knowledge, skills, values, and attitudes) are integrated into the content standards and grade-level benchmarks for all subjects. This is to equip all students with the most essential and in-demand knowledge, skills, and dispositions they will need to be successful in modern/ postmodern work places, higher-education programs and to be productive, responsible, considerate, and harmonious citizens. Common set of learnings are spirally sequenced from Preparatory - Grade 12 to deepen the scope and increase the level of difficulty in the learning activities so that what is learned is reinforced at different grade levels.

The core curriculum includes:

- cognitive (thinking) skills (refer to the syllabus for a list of these skills);
- reasoning, decision-making and problem-solving skills
- high level thinking skills (analysis, synthesis and evaluation skills);
- 21st century skills (refer to illustrative list in *Appendix 2*);
- reading, writing and communication skills (literacy skills);
- STEAM principles and skills;
- essential values and attitudes (Core personal and social values, and sustaining values), and
- spiritual values and virtues.

The essential knowledge, skills, values and attitudes comprising the core curriculum are interwoven and provide an essential and holistic framework for preparing all students for careers, higher education and citizenship.

All teachers are expected to include the core learnings in their lesson planning, teaching, and assessment of students in all their lessons. They are expected to foster, promote and model the essential values and attitudes as well as the spiritual values and virtues in their conduct, practice, appearance, and their relationships and in their professional and personal lives. In addition, teachers are expected to mentor, mould and shape each student to evolve and possess the qualities envisioned by society.

Core values and attitudes must not be taught in the classroom only; they must also be demonstrated by students in real life or related situations inside and outside of the classroom, at home, and in everyday life. Likewise, they must be promoted, fostered and modeled by the school community and its stakeholders, especially parents. A whole school approach to values and attitudes teaching, promoting and modeling is critical to students and the whole school community internalising the core values and attitudes and making them habitual in their work and school place, and in everyday life. Be it work values, relationship values, peace values, health values, personal and social values, or religious values, teachers should give equal prominence to all common learnings in their lesson planning, teaching, assessment, and learning interventions. Common learnings must be at the heart of all teaching and extracurricular programs and activities.

Science, Technology, Engineering, Arts and Mathematics

STEAM education is an integrated, multidisciplinary approach to learning that uses science, technology, engineering, arts and mathematics as the basis for inquiring about how STEAM has and continues to change and impact the social, political, economic, cultural and environmental contexts and identifying and solving authentic (real life) natural and physical environmental problems by integrating STEAM-based principles, cognitive, high level and 21st century skills and processes, and values and attitudes.

Social Science is focused on both goals of STEAM rather than just the goal of problem-solving. This is to ensure that all students are provided opportunities to learn, integrate, and demonstrate proficiency on all essential STEAM principles, processes, skills, values and attitudes to prepare them for careers, higher education and citizenship.

Objectives

Students will be able to:

- examine and use evidence to draw conclusions about how STEAM has and continues to change the social, political, economic, cultural and environmental contexts.
- investigate and draw conclusions on the impact of STEAM solutions to problems on the social, political, economic, cultural and environmental contexts.
- identify and solve problems using STEAM principles, skills, concepts, ideas and process.
- identify, analyse and select the best solution to address a problem.
- build prototypes or models of solutions to problems.
- replicate a problem solution by building models and explaining how the problem was or could be solved.
- test and reflect on the best solution chosen to solve a problem.
- collaborate with others on a problem and provide a report on the process of problem-solving used to solve the problem.
- use skills and processes learnt from lessons to work on and complete STEAM projects.
- demonstrate STEAM principles, skills, processes, concepts and ideas through simulation and modelling.
- explain the significance of values and attitudes in problem-solving.

Content overview

STEAM is a multidisciplinary and integrated approach to understanding how science, technology, engineering, arts and mathematics shape and are shaped by our material, intellectual, cultural, economic, social, political and environmental contexts. And for teaching students the essential and in-demand cognitive, high level and 21st century skills, values and attitudes, and empower them to effectively use these skills and predispositions to identify and solve problems relating to the natural and physical environments as well as the impact of STEAM-based solutions on human existence and livelihoods, and on the social, political, economic, cultural, and environmental systems.

STEAM disciplines have and continue to shape the way we perceive knowledge and reality, think and act, our values, attitudes, and behaviours, and the way we relate to each other and the environment. Most of the things we enjoy and consume are developed using STEAM principles, skills, process, concepts and ideas. Things humans used and enjoyed in the past and at present are developed by scientists, technologists, engineers, artists and mathematicians to address particular human needs and wants. Overtime, more needs were identified and more products were developed to meet the ever changing and evolving human needs. What is produced and used is continuously reflected upon, evaluated, redesigned, and improved to make it more advanced, multipurpose, fit for purpose, and targeted towards not only improving the prevailing social, political, economic, cultural and environmental conditions but also to effectively respond to the evolving and changing dynamics of human needs and wants. And, at the same time, solutions to human problems and needs are being investigated and designed to address problems that are yet to be addressed and concurred. This is an evolving and ongoing problem-solving process that integrates cognitive, high level, and 21st century skills, and appropriate values and attitudes.

STEAM is a significant framework and focal point for teaching and guiding students to learn, master and use a broad range of skills and processes required to meet the skills demands of PNG and the 21st century. The skills that students will learn will reflect the demands that will be placed upon them in a complex, competitive, knowledge-based, information-age, technology-driven economy and society. These skills include cognitive (critical, synthetic, creative, reasoning, decision-making, and problem-solving) skills, high level (analysis, synthesis and evaluation) skills and 21st century skills. Knowledge-based information and technology driven economies require knowledgeable workers and not technicians. Knowledge workers are lifelong learners, are problem solvers, innovators, creators, critical and creative thinkers, reflective practitioners, researchers (knowledge producers rather than knowledge consumers), solutions seekers, outcomes oriented, evidence-based decision makers, and enablers of improved and better outcomes for all.

STEAM focuses on the skills and processes of problem-solving. These skills and processes are at the heart of the STEAM movement and approach to not only problem-solving and providing evidence-based solutions but also the development and use of other essential cognitive, high level and 21st century skills. These skills are intertwined and used simultaneously to gain a broader understanding of the problems to enable creative, innovative, contextually

relevant, and best solutions to be developed and implemented to solve the problems and attain the desired outcomes. It is assumed that by teaching students STEAM-based problem-solving skills and providing learning opportunities inside and outside the classroom, more students will be motivated to pursue careers and academic programs in STEAM related fields thus, closing the skills gaps and providing a pool of cadre of workers required by technology, engineering, science, and mathematics-oriented industries.

Although, STEAM focuses on the development and application of skills in authentic (real life) contexts, for example the use of problem-solving skills to identify and solve problems relating to the natural and physical worlds, it does not take into account the significant influence values and attitudes have on the entire process of problem-solving. Values and attitudes are intertwined with knowledge and skills. Knowledge, skills, values and attitudes are inseparable. Decisions about skills and processes of skills development and application are influenced by values and attitudes (mindset) that people hold. In the same light, the use of STEAM principles, processes and skills to solve problems in order to achieve the outcomes envisaged by society are influenced by values and the mindset of those who have identified and investigated the problem as well as those who are affected by the problem and will benefit from the outcome.

STEAM problem-solving methods and approaches

Problem-solving involves the use of problem-solving methods and processes to identify and define a problem, gather information to understand its causes, draw conclusions, and use the evidence to design and implement solutions to address it.

Even though there are many different problem-solving methods and approaches, they share some of the steps of problem-solving, for example:

1. identifying the problem;
2. understanding the problem by collecting data;
3. analysing and interpret the data;
4. drawing conclusions;
5. using data to consider possible solutions;
6. selecting the best solution;
7. testing the effectiveness of the solution by trialling and evaluating it, and
8. reviewing and improve the solution.

STEAM problem-solving processes go from simple and technical to advance and knowledge-based processes. However, regardless of the type of process used, students should be provided opportunities to learn the essential principles and processes of problem-solving and, more significantly, to design and create a product that addresses a real problem and meets a human need.

The following are some of the STEAM problem-solving processes.

Engineering and technology problem-solving methods and approaches

Engineering and technology problem-solving methods are used to identify and solve problems relating to the physical world using the design process. The following are some of the methods and approaches used to solve engineering and technology related problems.

Parts substitution

It is the most basic of the problem-solving methods. It simply requires the parts to be substituted until the problem is solved.

Diagnostics

After identifying a problem, the technician would run tests to pinpoint the fault. The test results would be used either as a guide for further testing or for replacement of a part, which also need to be tested. This process continues until the solution is found and the device is operating properly.

Troubleshooting

Troubleshooting is a form of problem-solving, often applied to repair failed products or processes.

Reverse engineering

Reverse engineering is the process of discovering the technological principles underlying the design of a device by taking the device apart, or carefully tracing its workings or its circuitry. It is useful when students are attempting to build something for which they have no formal drawings or schematics.

Divide and conquer

Divide and conquer is the technique of breaking down a problem into sub-problems, then breaking the sub-problems down even further until each of them is simple enough to be solved. Divide and conquer may be applied to all groups of students to tackle sub-problems of a larger problem, or when a problem is so large that its solution cannot be visualised without breaking it down into smaller components.

Extreme cases

Considering “extreme cases” – envisioning the problem in a greatly exaggerated or greatly simplified form, or testing using extreme condition – can often help to pinpoint a problem. An example of the extreme-case method is purposely inputting an extremely high number to test a computer program.

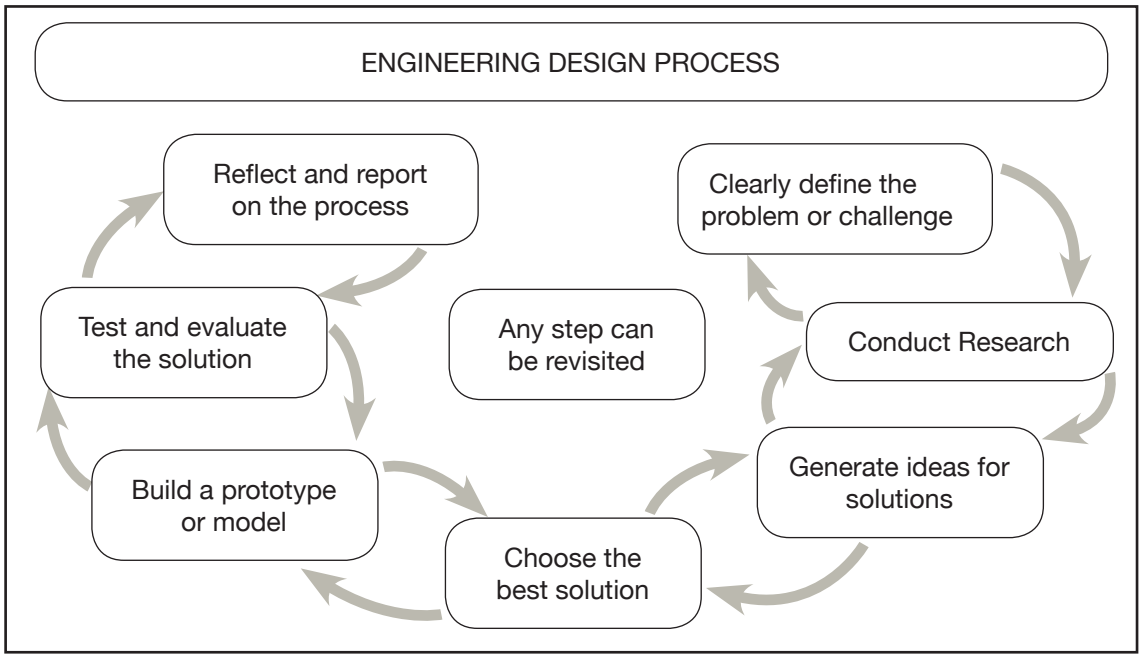
Trial and error

The trial and error method involves trying different approaches until a solution is found. It is often used as a last resort when other methods have been exhausted.

Engineering design process

Technological fields use the engineering design process to identify and define the problem or challenge, investigate the problem, collect and analyse data, and use the data to formulate potential solutions to the problem, analyse each of the solutions in terms of its strengths and weaknesses, and choose the best solution to solve the problem. It is an open-ended problem-solving process that involves the full planning and development of products or services to meet identified needs. It involves a sequence of steps such as the following:

1. Analysing the context and background, and clearly defining the problem.
2. Conducting research to determine design criteria, financial or other constraints, and availability of materials.
3. Generating ideas for potential solutions, using processes such as brainstorming and sketching.
4. Choosing the best solution.
5. Building a prototype or model.
6. Testing and evaluate the solution.
7. Repeating steps as necessary to modify the design or correct faults.
8. Reflecting and report on the process.



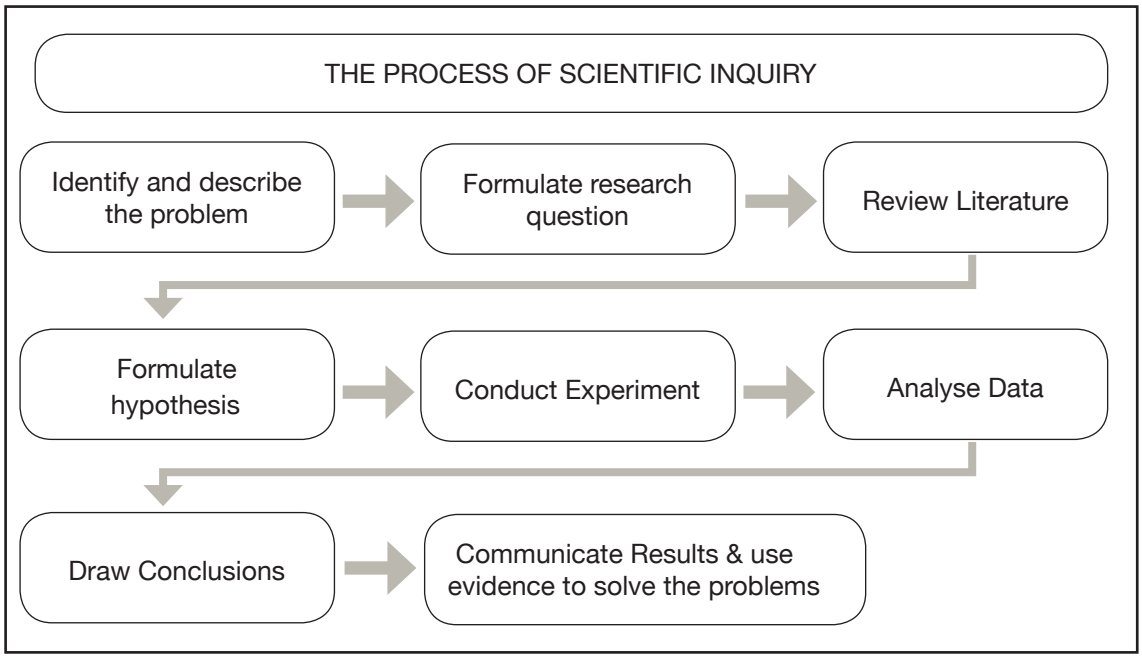
The scientific method and approach to problem-solving

Science uses predominantly the quantitative-scientific inquiry process to investigate, understand, and make informed decisions about problems relating to the natural world. The steps in the process vary, depending on the purpose of the inquiry and the types of questions asked.

There are six basic science process skills:

1. Observation
2. Communication
3. Classification
4. Measurement
5. Inference
6. Prediction

These processes are at the heart of the scientific inquiry and problem-solving process.



The steps above should be taught and demonstrated by students separately and jointly before they implement the inquiry process. Students should be guided through every step of the process so that they can explain it and its importance, and use the steps and the whole process proficiently to identify, investigate and solve problems. A brief explanation and examples of each step are provided below to help teachers plan and teach each step. Students should be provided with opportunities to practice and reflect on each step until they demonstrate the expected level of proficiency before moving on to the next one.

Step 1: Identify and describe the problem

Problems are identified mainly from observations and the use of the five senses – smell, sight, sound, touch and taste. Students should be guided and provided opportunities to identify natural and physical environment problems using their five senses and describe what the problem is and its likely causes.

Example - Observation

i. When I turn on a flashlight using the on/off switch, light comes out of one end.

Step 2: Formulate research question

After the problem is identified and described, the question to be answered is then formulated. This question will guide the scientist in conducting research and experiments.

Example - Question

i. What makes light comes out of a flash light when I turn it on?

Step 3: Review literature

It is more likely that the research problem and question have already been investigated and reported by someone. Therefore, after asking the question, the scientist spends some time reading and reviewing papers and books on past research and discussions to learn more about the problem and the question asked to prepare him/her for his own research. Conducting literature review helps the scientist to better understand his/her research problem, refine the research question and decide on the experiment/research approach before the experiment is conducted,

Example - Literature review

i. The scientist may look at the flashlight's instruction manual for tips or conduct online search on how flashlights work using the manufacturer's or relevant websites. The scientist may even analyse information and past experiments or discoveries regarding the relationship between energy and light.

Step 4: Formulate hypothesis

With a question in mind, the researcher decides on what he/she wants to test (The question may have changed as a result of the literature review). The research will clearly state what he/she wants to find out by carrying out the experiment. He/She will make an educated guess that could answer the question or explain the problem. This statement is called a hypothesis. A hypothesis guides the experiment and must be testable.

Example – Hypothesis

i. The batteries inside a flashlight give it energy to produce light when the flashlight is turned on.

Step 5: Conduct experiment

This step involves the design and conduct of experiment to test the hypothesis. Remember, a hypothesis is only an educated guess (a possible explanation), so it cannot be considered valid until an experiment verifies that it is valid.

Example - Experimental procedure

i. Remove the batteries from the flashlight, and try to turn it on using the on/off switch.
   Result: The flashlight does not produce light
ii. Re-insert the batteries into the flashlight, and try to turn it on using the on/off switch.
   Result: The flashlight does produce light.
iii. Write down these results

In general, it is important to design an experiment to measure only one thing at a time. This way, the researcher knows that his/her results are directly related to the one thing he/she changed. If the experiment is not designed carefully, results may be confusing and will not tell the researcher anything about his/her hypothesis.

Researchers collect data while carrying out their experiments. Data are pieces of information collected before, during, or after an experiment. To collect data, researchers read the measuring instruments carefully. Researchers record their data in notebooks, journals, or on a computer.

Step 6: Analyse data

Once the experiment is completed, the data is then analysed to determine the results. In addition, performing the experiment multiple times can be helpful in determining the credibility of the data.

Example - Analysis

i. Record the results of the experiment in a table.

ii. Review the results that have been written down.

Step 7: Draw conclusions

If the hypothesis was testable and the experiment provided clear data, the scientist can make a statement telling whether or not the hypothesis was correct. This statement is known as a conclusion. Conclusions must always be backed up by data. Therefore, scientists rely heavily on data so they can make an accurate conclusion.

If the data support the hypothesis, then the hypothesis is considered correct or valid. However, if the data do not support the hypothesis, the hypothesis is considered incorrect or invalid.

Example - Valid hypothesis

i. The flashlight did not produce light without batteries. The flashlight did produce light when batteries were inserted. Therefore, the hypothesis that batteries give the flashlight energy to produce light is valid, given that no changes are made to the flashlight during the experiment.

Example - Invalid hypothesis

ii. The flashlight did not produce light when the batteries were inserted. Therefore, the hypothesis that batteries give the flashlight energy to produce light is invalid. In this case, the hypothesis would have to be modified to say something like, “The batteries inside a flashlight give it energy to produce light when the batteries are in the correct order and when the flashlight is turned on.” Then, another experiment would be conducted to test the new hypothesis.

An invalid hypothesis is not a bad thing! Scientists learn something from both valid and invalid hypotheses. If a hypothesis is invalid, it must be rejected or modified. This gives scientists an opportunity to look at the initial observation in a new way. They may start over with a new hypothesis and conduct a new experiment. Doing so is simply the process of scientific inquiry and learning.

Step 8: Communicate findings

Scientists generally tell others what they have learned. Communication is a very important component of scientific progress and problem-solving. It gives other people a chance to learn more and improve their own thinking and experiments. Many scientists' greatest breakthroughs would not have been possible without published communication or results from previous experimentation.

Every experiment yields new findings and conclusions. By documenting both the successes and failures of scientific inquiry in journals, speeches, or other documents, scientists are contributing information that will serve as a basis for future research and for solving problems relating to both the natural and physical worlds. Therefore, communication of investigative findings is an important step in future scientific discovery and in solving social, political, economic, cultural, and environmental problems.

Example - Communication of findings

i. Write your findings in a report or an article and share it with others, or present your findings to a group of people. Your work may guide someone else's research on creating alternative energy sources to generate light, additional uses for battery power, etc.

Artistic design

Science uses predominantly the quantitative-scientific inquiry process to investigate, understand, and make informed decisions about problems. The steps in the process vary, depending on the purpose of the inquiry and the types of questions asked. There are six basic science process skills:

The equipping and enabling of students to become proficient in a broad range of STEAM skills, processes and predispositions can also lead to the attainment of many other societal goals, including national and global development goals and aspirations. These goals include:

- sustainability goals;
- peace related goals;
- work related goals;
- academic goals;
- relationship goals;
- health goals;
- adoption and internalisation of values and attitudes accepted by society, and
- improved social, political, economic outcomes.

Even though the original purpose and the drive of STEAM was to develop a pathway to engage students in learning about, experiencing, and applying STEAM skills in real life situations to motivate and hopefully get them to pursue careers in STEAM related fields and undertake STEAM related higher education programs to meet the demand for STEAM workers, STEAM education can also be used to teach and engage students to study more broadly the impact of STEAM on the social, economic, political, intellectual, cultural and environmental contexts. This line of inquiry is more enriching, exciting, empowering and transformative.

STEAM-based lesson planning

Effective STEAM lesson planning is key to the achievement of expected STEAM outcomes. STEAM skills can be planned and taught using separate STEAM-based lesson plans or integrated into the standards-based lesson plans. To effectively do this, teachers should know how to write effective standards and STEAM-based lesson plans.

Developing STEAM-based lesson plans

Teachers should integrate STEAM content and teaching, learning and assessment strategies into their standards-based lesson plans.

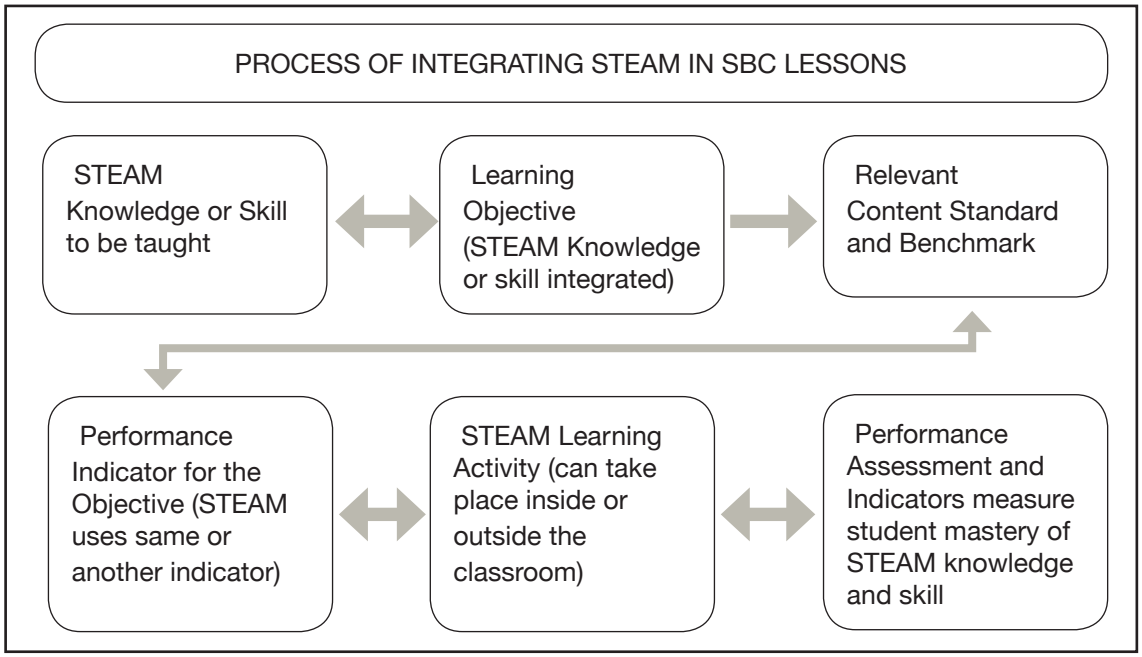
Integration of STEAM problem-solving skills into standards-based lesson plans

Knowing how to integrate STEAM problem-solving skills, principles, values and attitudes as well as STEAM teaching, learning, and assessment strategies into the standards-based lesson plans is essential for achieving the desired STEAM learning outcomes. When integrating STEAM problem-solving skills into the standards-based lesson plans, teachers should ensure that these skills are not only effectively aligned to the learning objective and performance standards, they must also be effectively taught and assessed.

STEAM principles and problem-solving skills are integrated into the content standards and grade-level benchmarks. A list of these skills, including 21st century skills, is provided in the Social Science Grades 11 & 12 Syllabus. Teachers should ensure that these skills are integrated in their standards-based lesson plans, taught and assessed to determine students' level of proficiency on each skill or specific components of the skill. Teachers should use the following process as guide to integrate STEAM principles and problem-solving skills into the standards-based lesson plans.

Teachers are expected to integrate the essential STEAM principles, processes, skills, values and attitudes described in the grade 11 benchmarks when formulating their standards-based lesson plans. Opportunities should be provided inside and outside of the classroom for students to learn, explore, model and apply what they learn in real life or related situations. These learning experiences will enable students to develop a deeper understanding of STEAM principles, processes, skills, values and attitudes and appreciate their application in real life to solve problems.

Process for integrating STEAM principles and problem-solving skills into standards-based lessons



Teachers should follow the steps given below when integrating STEAM problem-solving principles and skills into their standards-based lesson plans.

Step 1: Identify the STEAM knowledge or skill to be taught (From the table of KSVAs for each content standard and benchmark). This could already be captured in the learning objective stated in the standards-based lesson plan.

Step 2: Develop and include a performance standard or indicator for measuring student mastery of the STEAM knowledge or skill (e.g. level of acceptable competency or proficiency) if this is different from the one already stated in the lesson plan.

Step 3: Develop student learning activity (An activity that will provide students the opportunity to apply the STEAM knowledge or skill specified by the learning objective and appropriate statement of the standards). Activity can take place inside or outside of the classroom, and during or after school hours.

Step 4: Develop and use performance descriptors (standards or indicators) to analyse students' STEAM related behaviours and products (results or outcomes), which provide evidence that the student has acquired and mastered the knowledge or skill of the learning objective specified by the indicator(s) of the standard(s).

STEAM teaching strategies

STEAM education takes place in both formal and informal classroom settings. It takes place during and after school hours. It is a continuous process of inquiry, data collection, data analysis, making decisions about interventions, and implementing and monitoring interventions for improvements.

There are a variety of STEAM teaching strategies. However, teaching strategies selected must enable teachers to guide students to use the engineering and artistic design processes to identify and solve natural and physical environmental problems by designing prototypes and testing and refining them to effectively mitigate the problems identified. The following are some of the strategies that could be used to utilise the STEAM approach to solve problems and coming up with technological solutions.

1. Inquiry-Based Learning
2. Problem-Based Learning
3. Project-Based Learning
4. Collaborative Learning

Collaborative learning involves individuals from different STEAM disciplines and expertise in a variety of STEAM problem-solving approaches working together and sharing their expertise and experiences to inquire into and solve a problem.

Teachers should plan to provide students opportunities to work in collaboration and partnership with experts and practitioners engaged in STEAM related careers or disciplines to learn first-hand about how STEAM related skills, processes, concepts, and ideas are applied in real life to solve problems created by the natural and physical environments. Collaborative learning experiences can be provided after school or during school holidays to enable students to work with STEAM experts and practitioners to conduct inquiry and solve problems by developing creative, innovative and sustainable solutions. Providing real life experiences and lessons, e.g., by involving students to actually solve a scientific, technological, engineering, or mathematical, or Arts problem, would probably spark their interest in a STEAM career path.

Developing STEAM partnerships with external stakeholders e.g., higher education institutions, private sector, research and development institutions, and volunteer and community development organizations can enhance students' learning and application of STEAM problem-solving principles and skills.

1. Participatory Learning
2. Group-Based Learning
3. Task Oriented Learning
4. Action Learning
5. Experiential Learning
6. Modeling
7. Simulation

STEAM learning strategies

Teachers should include in their lesson plans STEAM learning activities. These activities should be aligned to principle or a skill planned for students to learn and demonstrate proficiency at the end of the lesson to expose students to STEAM and giving them opportunities to explore STEAM-related concepts, they will develop a passion for it and, hopefully, pursue a job in a STEAM field. Providing real life experiences and lessons, e.g., by involving students to actually solve a scientific, technological, engineering, or mathematical, or arts problem, would probably spark their interest in a STEAM career path. This is the theory behind STEAM education.

STEAM-based assessment

STEAM-based assessment is closely linked to standards-based assessment where assessment is used to assess students' level of competency or proficiency of a specific knowledge, skill, value, or attitude taught using a set of performance standards (indicators or descriptors). The link also includes the main components such as the purpose, the assessment principles and assessment strategies and tools.

In STEAM-based assessment, assessments are designed for what students should know and be able to do. In STEAM learning students are assessed in a variety of ways including portfolios, project/problem-based assessments, backwards design, authentic assessments, or other student-centered approaches.

When planning and designing the assessment, teachers should consider the authenticity of the assessment by designing an assessment that relates to a real world task or discipline specific attributes (such as simulation, role play, placement assessment, live projects, debates) which should make the activity meaningful to the students, and therefore be motivating as well as developing employability skills and discipline specific attributes.

Effective STEAM-based assessment strategies

The following sections describe six assessment tools and strategies shown to impact teaching and learning as well as help teachers foster a 21st century learning environment in their classrooms:

1. Rubrics
2. Performance-Based Assessments (PBAs)
3. Portfolios
4. Student self-assessment
5. Peer-assessment
6. Student Response Systems (SRS).

Although the list does not include all innovative assessment strategies, it includes what we think are the most common strategies, and ones that may be particularly relevant to the educational context of developing countries in this 21st century. Many of the assessment strategies currently in use fit under one or more of the categories discussed. Furthermore, it is important to note that these strategies also connect in a variety of ways.

1. Rubrics

Rubrics are both a tool to measure students' knowledge and ability as well as an assessment strategy. A rubric allows teachers to measure certain skills and abilities not measurable by standardized testing systems that assess discrete knowledge at a fixed moment in time. Rubrics are also frequently used as part of other assessment strategies (portfolios, performances, projects, peer-review and self-assessment). They will be discussed in those sections as well.

2. Performance-Based Assessments

Performance-Based Assessments (PBA), also known as project-based or authentic assessments, are generally used as a summative evaluation strategy to capture not only what students know about a topic, but if they have the skills to apply that knowledge in a "real-world" situation. By asking them to create an end product, PBA pushes students to synthesize their knowledge and apply their skills to a potentially unfamiliar set of circumstances that is likely to occur beyond the confines of a controlled classroom setting.

The implementation of performance-based assessment strategies can also impact other instructional strategies in the classroom.

3. Portfolio Assessment

Portfolios are a collection of student work gathered over time that is primarily used as a summative evaluation method. The most salient characteristic of the portfolio assessment is that rather than being a snapshot of a student's knowledge at one point in time (like a single standardized test), it highlights student effort, development, and achievement over a period of time; portfolios measure a student's ability to apply knowledge rather than simply regurgitate. They are considered both student-centered and authentic assessments of learning.

4. Self-assessment

While the previous assessment tools and strategies listed in this report generally function as summative approaches, self-assessment is generally viewed as a formative strategy, rather than one used to determine a student's final grade. Its main purpose is for students to identify their own strengths and weaknesses and to work to make improvements to meet specific criteria. Self-assessment occurs when students judge their own work to improve performance as they identify discrepancies between current and desired performance. In this way, self-assessment aligns well with standards-based education because it provides clear targets and specific criteria against which students or teachers can measure learning.

Self-assessment is used to promote self-regulation, to help students reflect on their progress and to inform revisions and improvements on a project or paper. In order for self-assessment to be truly effective four conditions must be in place: the self-assessment criteria is negotiated between teachers and students, students are taught how to apply the criteria, students receive feedback on their self-assessments and teachers help students use assessment data to develop an action plan.

5. Peer assessment

Peer assessment, much like self-assessment, is a formative assessment strategy that gives students a key role in evaluating learning. Peer assessment approaches can vary greatly but, essentially, it is a process for learners to consider and give feedback to other learners about the quality or value of their work. Peer assessments can be used for a variety of products like papers, presentations, projects, or other skilled behaviours. Peer assessment is understood as more than only a grading procedure and is also envisioned as teaching strategy since engaging in the process develops both the assessor and assessee's skills and knowledge.

The primary goal for using peer assessment is to provide feedback to learners. This strategy may be particularly relevant in classrooms with many students per teacher since student time will be more plentiful than teacher time. Although any single student's feedback may not be rich or in-depth as teacher's feedback, the research suggests that peer assessment can improve learning.

6. Student Response System

Student response system(SRS), also known as classroom response system (CRS) or audience response system (ARS) is a general term that refers to a variety of technology-based formative assessment tools that can be used to gather student-level data instantly in the classroom through the combination of hardware, (voice recorders, PC, internet connection, projector and screen) and software.

Teachers can ask students a wide range of questions (both closed and open ended), where students can respond quickly and anonymously, and the teacher can display the data immediately on graphs. The use of technology also includes a use of video which examines how a range of strategies can be used to assess students' understanding.

The value of SRS comes from teachers analyzing information quickly and then devising real-time instructional solutions to maximize student learning. This includes a suggested approach to help teachers and trainers assess learning.

Curriculum Integration

What is Curriculum Integration?

Curriculum integration is making connections in learning across the curriculum. The ultimate aim of curriculum integration is to act as a bridge to increase students' achievement and engage in relevant curriculum *(Susan M. Drake and Rebecca C. Burns 2008).*

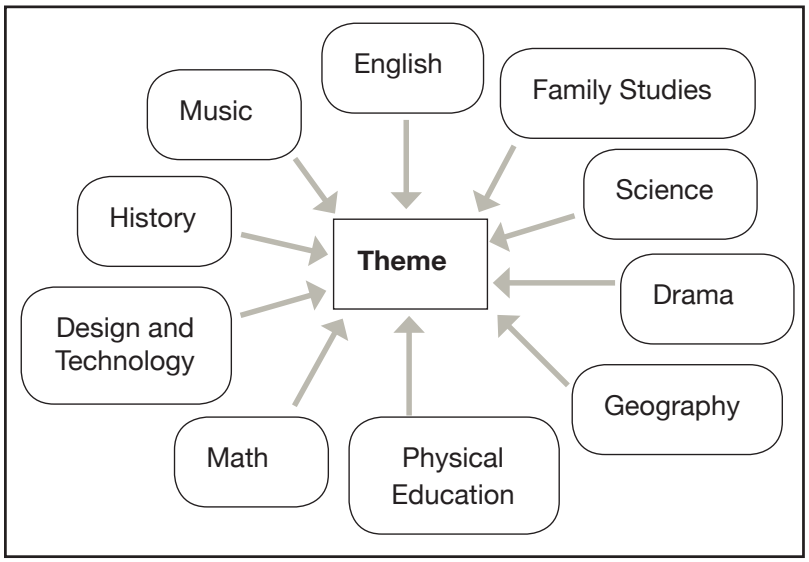
Teachers must develop intriguing curriculum by going beyond the traditional teaching of content based or fragmented teaching to one who is knowledge based and who should be perceived as a 21st century innovative educator. Curriculum integration is a holistic approach to learning thus curriculum integration in PNG SBC will have to equip students with the essential knowledge, skills, values and attitudes that are deemed 21st century.

There are three approaches that PNG SBC will engage to foster conducive learning for all its children whereby they all can demonstrate proficiency at any point of exit. Adapting these approaches will have an immense impact on the lives of these children thus they can be able to see themselves as catalyst of change for a competitive PNG. Not only that but they will be comparable to the world standards and as global citizens.

Engaging these three approaches in our curriculum will surely sharpen the knowledge and ability of each child who will foresee themselves as assets through their achievements and thus contribute meaningfully to their country. They themselves are the agents of change. Integrated learning will bear forth a generation of knowledge based populace who can solve problems and make proper decisions based on evidence. Thus, PNG can achieve its goals like the Medium Term Development Goals (MTDG) and aims such as the Vision 2050 for a happy, healthy and wealthy society whereby, all its citizens should have access to and fair distribution to income, shelter, health, education and general goods and services thus improving the general standard of living for PNG in the long run.

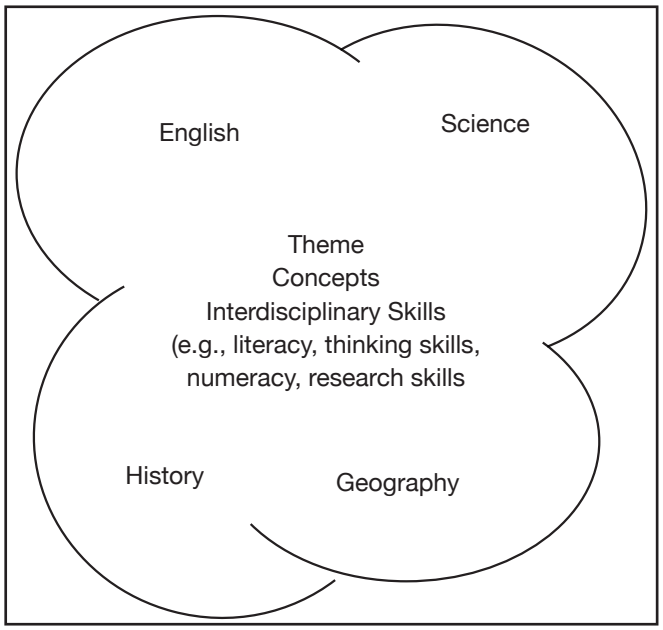
1. Multidisciplinary approach

In this approach, learning involves a theme or concept that will be taught right across all subject areas of study by students. That is, content of a particular theme will be taught right across all subjects as shown in the diagram below. For instance, if the theme is global warming, subject areas create lessons or assessment as per their subjects around this theme. Social Science will address this issue and Science and all other subject will do likewise.



2. Interdisciplinary approach

This approach addresses learning similarly to the multidisciplinary approach of integrated learning whereby learning takes place within the subject area. However, it is termed interdisciplinary in that the core curriculum of learning is interwoven into each subject under study by the students. For instance; in Social Science geography strand, students write essay on internal migration however, apart from addressing the issues of this topic, they are to apply the skill of writing text types in their essay, such as; argumentative, informative, explanatory, descriptive, expository and narrative essay. They must be able to capture the mechanics of English skills such as grammar, punctuation and so forth.



Though these skills are studied under English, they are considered as core skills that cut across all subjects. For example; if Science students were to write about human development in biology, then the application of writing skills has to be captured by the students in their writing. It is not seen as an English skill but a standard essential skill all students must know and do regardless.

Therefore, essential knowledge, skills, values and attitudes comprising the core curriculum are interwoven and provide an essential and holistic framework for preparing all students for careers, higher education and citizenship in this learning.

3. Intra-disciplinary approach

This approach involves teachers integrating sub disciplines within a subject area. For instance, within the subject Social Science, the strands (disciplines) of geography, environment, history and political science will all be captured studying a particular content for Social Science. For example, under global warming, students will study the geographical aspects of global warming, environmental aspect of global warming and likewise for history, political science and economics. Thus, children are well aware of the issues surrounding global warming and can address it confidently at each level of learning.

4. Trans-disciplinary approach

In this approach, learning goes beyond the subject area of study. Learning is organized around students'questions and concerns. That is, where there is a need for change to improve lives, students develop their own curriculum to effect this need.

The trans-disciplinary approach addresses real-life situations thus giving the opportunity to students to attain real life skills. This learning approach is more to do with Project–Based Learning which is also referred to as problem-based learning or place-based learning.

The three steps to planning project based curriculum *(Chard 1998).*

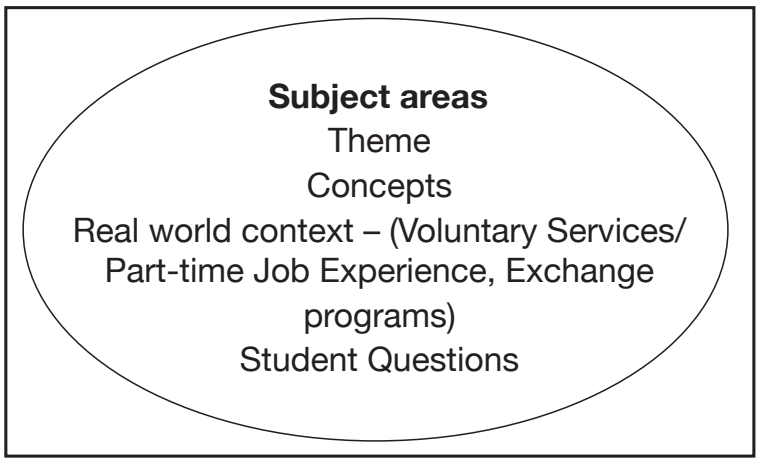
1. Teachers and students select a topic of study based on student interests, curriculum standards, and local resources
2. The teacher finds out what the students already know and helps them generate questions to explore. The teacher also provides resources for students and opportunities to work in the field
3. Students share their work with others in a culminating activity. Students display the results of their exploration and review and evaluate the project.

For instance; students may come up with slogans for school programs such as 'Our culture – clean city for a healthier PNG'. The main aim could be to curb betel nut chewing in public areas especially around bus stops and local markets. Here, students draw up their own instructions and criteria for assessment which is; they have to clean the nearest bus stop or local market once a week throughout the year. They also design and create posters to educate the general public as their program continues. They can also involve the town council and media to assist them especially to carry out awareness.

Studies *(Susan M. Drake and Rebecca C. Burns 2008).* have proven that Project based-programs have led to the following:

- Students go far beyond the minimum effort
- Make connections among different subject areas to answer open-ended questions
- Retain what they have learnt
- Apply learning to real-life problems
- Have fewer discipline problems
- Lower absenteeism *(Curtis, 2002)*

These integrated learning approaches will demand for teaches to be proactive in order to improve students learning and achievements. In order for PNG Standards-Based Curriculum to serve its purpose fully, these three approaches must be engaged for better learning for the children of Papua New Guinea now and in the future.



Essential Knowledge, Skills, Values, and Attitudes

Students' level of proficiency and progression towards the attainment of content standards will depend on their mastery and application of essential knowledge, skills, values, and attitudes in real life or related situations.

Social Science has 5 broad areas (strands) which contain essential knowledge captured in the national content standards and benchmarks. Knowledge is 'what students must know and understand' in Social Science. The fundamental concepts in Social Science are outlined below.

Geography
- The examination, description, and explanation of the earth - its variability from place to place, how places and features change over time, and the processes responsible for these variations and changes.
- Human geography (population, migration,)

History
- Historical roots and how past events have shaped Papua New Guinea and the world.
- Reconstructing and interpreting historical events

Political Science
- Political ideologies and systems (power, authority, governance and functions of different political systems)

Economics
- The concept of scarcity (limited resources & unlimited needs & wants)
- Satisfying needs and wants
- Decision making

Environment
- Physical systems and processes of the environment
- Relationship between people and the environment
- Impact of the exploitation of the natural environment
- Good stewards of the environment

Social Science requires 'inquiry–based learning'. The inquiry–based learning 'is an approach that emphasises the role of the student in the learning process, rather than the teacher telling the students what they need to know. It encourages the students to explore a topic, ask questions and share ideas. Therefore, the skills outlined here are essential for 'inquiry–based learning'.

Research Skills
- Access information
- Organise information
- Evaluate sources
- Use information
- Align solution with task
- Cite all sources accurately

Collaborating Skills Working effectively with peers, listen and share ideas and compromise to create good products - Show independent initiative - Assume shared responsibility - Assist others in their roles - Contribute ideas - Keep an open mind - Apply strategies - Take a variety of roles - Tolerate different view points
Critical Thinking Create products that demonstrate abilities to justify augments, asking questions, analyse complex systems, evaluate evidence, draw conclusions, reflect on learning and explain how to solve problems
Creative and Innovative Skills - Think creatively - Generate ideas - Work creatively with others - Implement innovations
Communicating Skills - Ability to listen, read, write, present, comprehend, share and express ideas and thoughts between different audiences and use multiple forms of media

Thinking is problem-solving. Critical thinking is motivated by a problem. Teachers are advised to raise the level of higher thinking skills for the students.

The 'inquiry-based learning' is a process where students are engaged in;

1. Identify the problem
2. Develop an action plan
3. Research/gather/collect data
4. Analyse/organise data and form conclusions
5. Report the results/presentation

Moreover, Social Science is driven by values. These values and attitudes must be emphasised and reinforced in the teaching and learning process.

Values & Attitudes
• Curiosity • Initiative • Adaptability • Leadership • Collaboration & teamwork • Participation • Passion for exploring & learning • Appreciation of the awesomeness of nature, events, people etc • Being patriotic and responsible • Show consideration • Respect the environment and people • Embrace diversity • Maintain positive values

Teaching and Learning Strategies

Social Science emphasises and embraces the use of cognitive, reasoning, decision-making, problem-solving and higher-level thinking skills to teach to enhance students' understanding of inter-disciplinary concepts and issues in relation to environment, geography, history, politics and economic within PNG and globally. It aims to provide a meaningful pedagogical framework for teaching and learning essential and in-demand knowledge, skills, values, and attitudes that are required for the preparation of students for careers, higher education and citizenship in the 21st century.

Students must be prepared to gather and understand information, analyse issues critically, learn independently or collaboratively, organize and communicate information, draw and justify conclusions, create new knowledge, and act ethically.

These teaching and learning strategies will help teachers to;

- familiarize themselves with different methods of teaching in the classroom
- develop an understanding of the role of a teacher for application of various methods in the classroom

Successful teachers always keep in view that teaching must "be dynamic, challenging and in accordance with the learner's comprehension. He/she does not depend on any single method for making his/her teaching interesting, inspirational and effective".

Please find a list of the different teaching and learning strategies in Appendix 3.

These strategies;

- make learning more engaging
- make learning more effective
- make learning fun
- encourage higher motivational level
- improve attention spans
- develop higher order thinking and reflective skills
- improve communication skills
- develop the spirit of teamwork/collaboration
- develop leadership skills and qualities
- encourage discovery learning

Therefore, teachers are encouraged to utilise the suggested strategies as well as others.

Units and Topics

This section of the teacher guide contains the Social Science - Geography content to be taught in grade 11. It consists of;

- units
- topic

Geography in grade 11 has four (4) units and they are;

1. Geography Skills
2. People and Places
3. People and Resources
4. People and Environment

The table below outlines the units and topics of Geography in grade 11 to be taught in an academic year. This will guide teachers to plan and teach the Geography strand in grade 11.

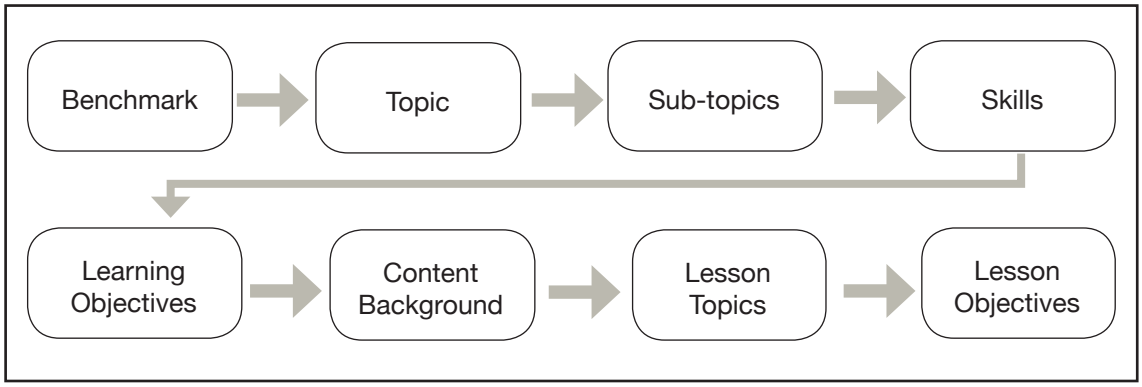
Units	Topics
Geography Skills	Topic 1: Compiling information using geographical tools Topic 2: Grid referencing Topic 3: Distance, direction and bearing Topic 4: Cross-sections Topic 5: Climate and vegetation profiles Topic 6: Locating places and vegetation using climate graphs Topic 7: Distinct maps Topic 8: Demographic information
People and Places	Topic 1: Climate regions Topic 2: Biomass Topic 3: Earth's tilt, rotation and revolution Topic 4: Oceanography
People and Resources	Topic 1: Population distribution Topic 2: Natural resources and industries Topic 3: Distribution of natural resources Topic 4: Distribution of industries
People and Environment	Topic 1: The structure and composition of the earth Topic 2: Natural processes in and outside the earth's crust

How were the topics developed?

The topics given in the table were derived from the benchmarks. That is, National content standards are benchmarked at each grade level, which allows for essential KSAVs to be reinforced and expanded throughout the grades. Benchmarks show grade level expectations of what students are able to do to demonstrate that they are making progress towards attaining the content standard. These grade-level benchmarks were then unpacked to identify the topics. From the topics, teachers should be able to develop sub-topics and learning objectives and of course the lesson topics and lessons objectives to be achieved per lesson.

When we unpack a benchmark, we are identifying what students will know and be able to do when they have mastered the benchmark.

1. Write out the benchmark.
2. Write the verbs (skills/actions) – Higher order thinking skills.
3. Underline or highlight the big idea (content) in the benchmark. The big idea (content) is the topic derived from the benchmark.
4. Develop sub-topics from the big idea (topic).
5. Write learning objectives according to the sub-topics.
6. Derive lesson topics from the learning objectives.



Unit of work

The unit of work outlines the topics, sub-topics and the learning objectives for each of the four (4) units in Geography, derived from the content standard and the benchmarks. It basically presents what the teacher is expected to teach. Teachers are advised to use the learning objectives to create lesson topics and lesson objectives in preparing lessons. Brief content background of each topic is provided to support teacher's lesson preparation.

Unit 1: Geography Skills

Content Standard 1.1: Students will be able to use geographical tools to collect, analyse and interpret information about people, places and environment.

Benchmark 11.1.1.1: Compile and interpret geographical information using geographical tools such as maps, texts, graphs, tables, charts and other schematic representation of geographic information.

Topic 1: Compiling information using geographic tools

Sub-topics:
- Geographic tools
- Geographic information

Skills: Creative thinking (synthesis/compile) and critical thinking (evaluation/ interpret).

Learning Objectives: By the end of the topic, students will be able to:

- Compile geographical information using geographic tools and other schematic representation of geographic information.
- Analyze geographic information using available information compiled from geographic tools.

Content Background

Geographers find out why places are the way they are, why people live there, the way they do the things and why geographical features and events occur all over the earth's surface.

They are always asking questions about the places and the things they see. What geographers find out is called **geographic information** and it is stored and analysed to help geographers work things out, make decisions and plan for action.

- What is it?
- Where is it?
- What is it like?
- Why is it there?
- How did it get to be like this?
- Should it be like this?
- What's the impact of it being there?
- How is it changing over time?
- Why is it changing?
- What might happen in the future?

Geographers need to develop their skills to find answers to such questions mentioned above. Their success in finding answers to these type of questions depend on their skills in using a number of different **tools.**

Geographers use all sorts of tools to help them investigate their questions. They commonly use direct observation, all types of **maps, sketches, globes, atlases, aerial photographs, satellite photographs, information graphics, internet, reference materials and a computer program called GIS.**

Refer to the given table to understand the uses of these tools.

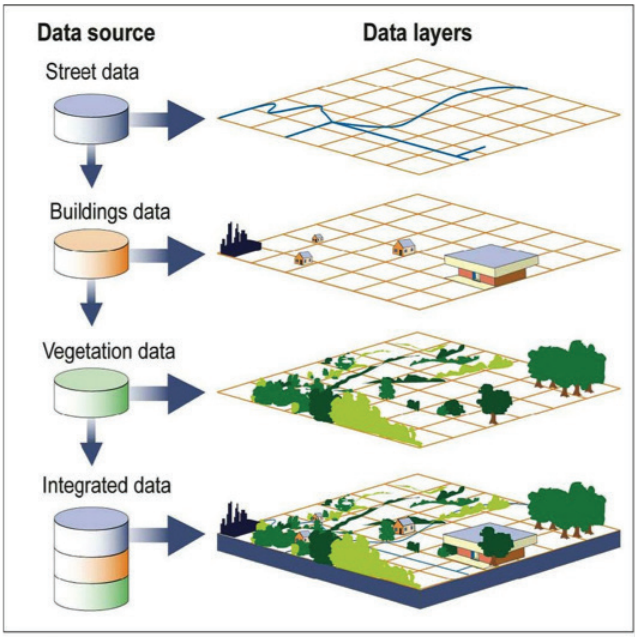
Tools	Uses
1. Maps	A map is a flat representation of a part of Earth. Geographers use many different types of maps. Maps can show lots of different information including the location of places on the world. Maps use projection to try and display a round object (Earth) on a flat surface (a map). Cartographers (map-makers) have long struggled with trying to find the most accurate projection to make maps with.
2. Atlas	An atlas is a book of maps. An atlas contains maps of the world or a region of the world. Some atlases also include more information about the places they include in the maps. Atlases can be very helpful for traveling. Instead of brining many maps, you can bring one atlas.
3. Globe	A globe is a model of the Earth, used to avoid distortions in spatial relations on the world. Maps of the world are distorted from trying to make a round object fit on a flat surface. The globe is round, so it remains accurate. The globe provides an accurate scale of how far apart locations are. You can also use a globe to get a comparison of the size of different locations.
4. Aerial Photographs	Aerial photographs are photographs taken from the sky and used to take measurements or create maps. Aerial photographs can be taken from airplanes, balloons, or even kites.
5. Satellite Photographs	Satellite photographs are like aerial photographs, but they are taken from space. Satellite photographs can capture large areas of the Earth, but they can also zoom in pretty close.
6. Information Graphics	Information Graphics or Infographics are visual symbols of data. They are images that show information using pictures or symbols. Information graphics can be as simple as a bar graph or as complex as the image to the left.
7. GIS (Geographic Information System)	GIS is a computer based program used to store, manage, and analyse data. A GIS map is more than a map because it can pull up a lot of information. Geographers use GIS to help make decisions. Imagine that you wanted to make sure schools were not near any factories that might pollute the air. With a GIS map, geographers can use the database (place that stores information) to show where all the schools are. They can then use the database to also show where all the factories are. GIS helps geographers see all kinds of information and how it relates to locations.

GIS Data Layers

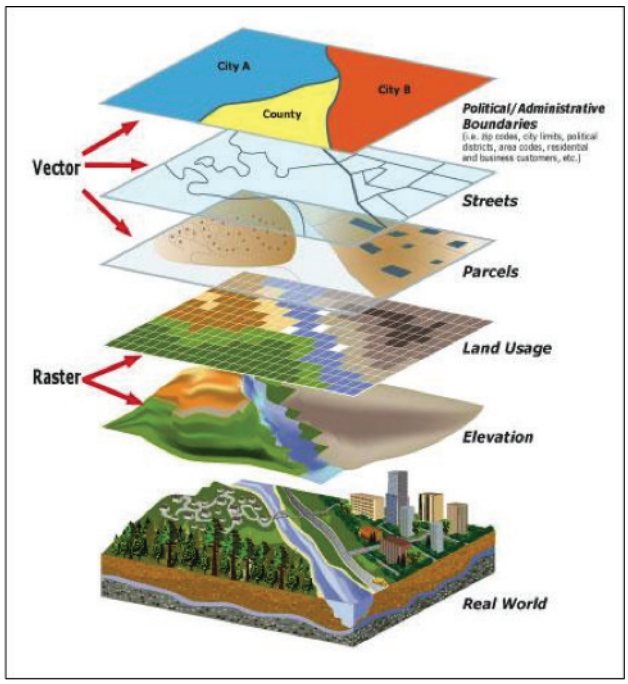
Many different types of data can be integrated into a GIS and represented as a map layer. Examples include; streets, locations, buildings, parks, etc.

When these layers are drawn on top of one another, undetected spatial trends and relationships often emerge. This allows us to gain insight about relevant characteristics of a location.

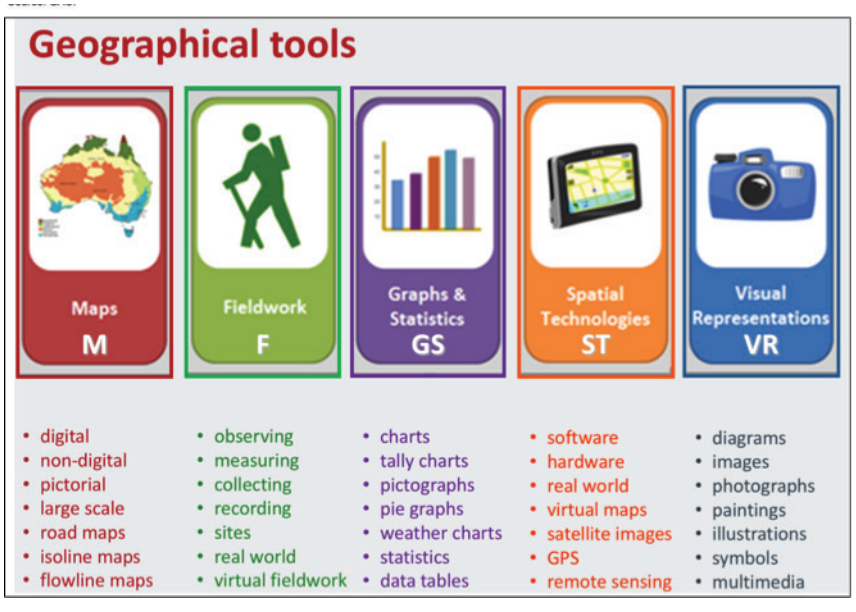
These diagrams illustrate the Geographical Information System (GIS) data layers



Source: Geographic Information System (GIS):Retrieved from: https://www.nationalgeographic.org/encyclopedia/geographic-information-system-gis/



Source: Newberg Oregon: Retrieved from https://www.newbergoregon.gov/engineering/page/about-newberg-gis



Source: Geographical toolkit for primary teachers: Retrieved from https://www.hsiensw.com/uploads/4/7/7/1/47718841/geographical-toolkit-for-primary-teachers-v4sm-pdf

If students know how to use these tools, they can obtain a lot of very valuable information and be able to answer many geographical questions.

Suggested Resources

1. Malcolm Stacey, Chris Bonnor & Brian Ralph, (2008). *Skills in Geography,* Australia, Pearson Education.
2. Elizabeth. D.Taylor & Liz Taylor, *Geographical Techniques,* (1997). Pearson Publishing.

Benchmark 11.1.1.2: Locate places on a topographic map using a four and six figure grid referencing.

Topic 2: Grid referencing

Sub-topic:

- Locating topographic features using a four and six figure grid referencing

Creative thinking skills: synthesis (locate).

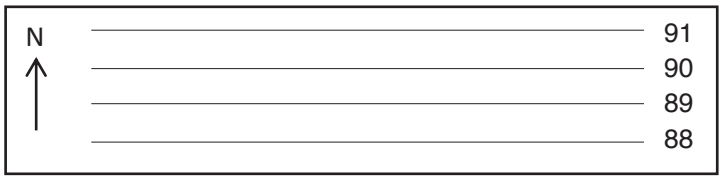
Learning Objectives: By the end of the topic, students will be able to:

- Identify the components of four and six figure grid reference.
- Read four and six figure grid reference correctly.
- Locate places using four and six figure grid reference.

Content Background

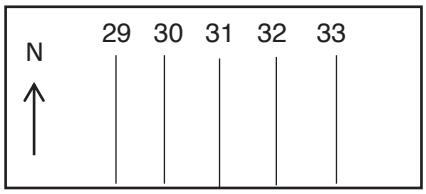
Grid lines are intersecting parallel lines that can help us find features on a map. Grid lines and the locational readings called **grid references** are used extensively when referring to topographic maps.The grid is a combination of vertical and horizontal lines.

1. When a grid is drawn on a map, the horizontal lines are called ***northings.*** Northings are numbered from South to north (bottom to top). Northings are the lines that run from the left to the right of the map. They show you how far North you must go.



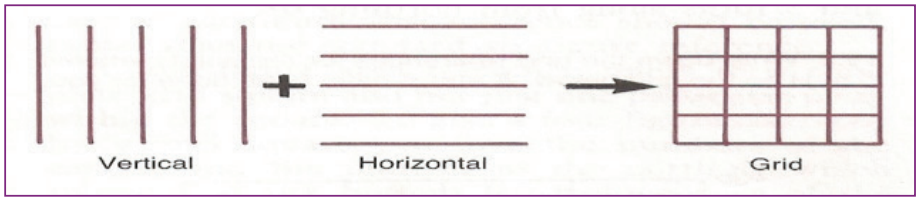
Horizontal Lines NORTHINGS

2. The vertical lines are called ***eastings*** and eastings are numbered from West to East (Left to right). Easting are lines that run from the top of the map to the bottom. They show you how far east you must go.



Vertical Lines EASTINGS

3. Together Eastings and Northings form a grid as shown below.

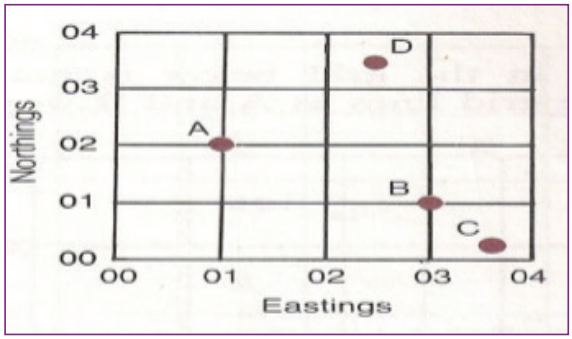


Important

- The reference for the easting is given before the reference for the northing
- Grid references must always be given in this order to avoid confusion, *E* comes before *N* in the alphabet so eastings come before northings.
- Places can be located by using a four figure grid reference or six figure (area reference). To be more precise a six figure reference is used so you need to estimate how many tenths lies between Easting and northing.
- Four and Six figures reference is written with **no gaps, dashes or commas just as a complete word is written without gaps, dashes or commas between the letters that form a word**.

Reading four and six figure grid reference

1. Four figure grid reference.

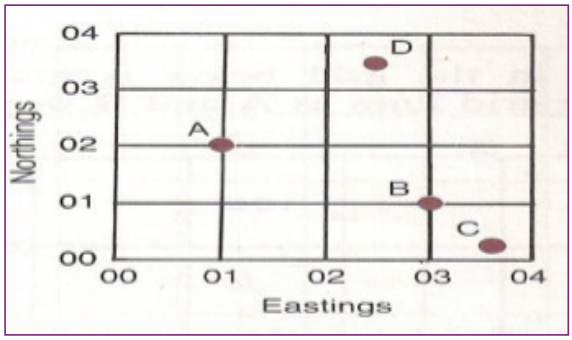


For example;

Area: Point A - **01** **02**

Eastings Northings

2. Six figure reference



For example;

Area: Point A - **010** **020**

Eastings Northings

Also, if the feature in a single grid is being large then the 3rd and 6th figures in the six-figure grid reference are usually taken or read from the centre of the feature.

Suggested Resources

1. Malcolm Stacey, Chris Bonnor & Brian Ralph, (2008). *Skills in Geography,* Australia, Pearson Education.
2. Elizabeth. D.Taylor & Liz Taylor, *Geographical Techniques,* (1997). Pearson Publishing.

Benchmark 11.1.1.3: Calculate distance, bearing and gradient.

Topic 3: Distance, bearing and gradient

Sub-topic:
- Calculating distance, bearings and gradients

Skill: Synthesis (calculate distance, bearing), evaluation (justify, make judgments).

Learning Objectives: By the end of the topic, students will be able to:
- Interpret scale.
- Calculate distance, bearings and gradients.

Content Background

Calculating distances

The distance between two points on a map can be found by measuring the distance on the map and then converting it from centimeters to kilometers and/or meters. Most students do this by using the map's linear scale. There are several ways to measure the distance between two points on a map. Some students use a length of string, while others use a pair of dividers or the straight edge of a paper.

The following methods are more likely to be accurate because they make it easier to work around curves and sharp corners.

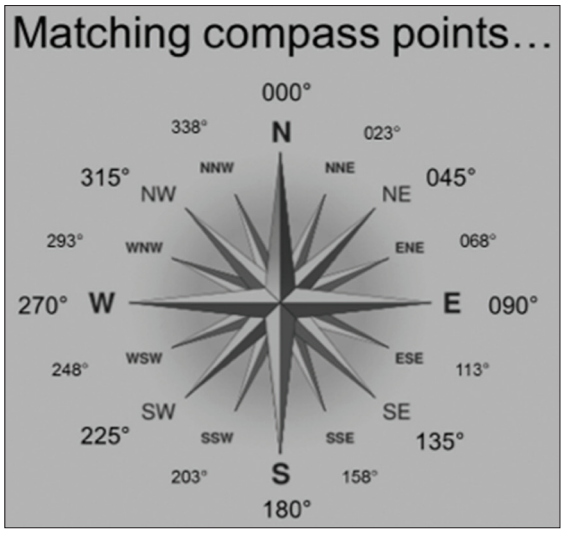
i. **Measuring a straight-line distance**
To estimate a straight-line distance, place the edge of a sheet of paper between the two points and mark on the paper the distance between the points. Place the paper along the map's linear scale. Read off the distance on the scale.

ii. **Measuring a distance along a curved line**
To estimate a distance along a curved line, place a sheet of paper on the map and mark off the starting point. Carefully move the paper so that its edge follows the curve, marking each section with a pencil as you go. Mark the end point and then place your sheet of paper on the linear scale. Read off the distance on the scale.

Bearings

Bearing is an accurate way of giving the direction of one place in relation to another. It is more accurate than direction because it has 360 degree points compared to the 16 points of a compass. Instead of saying, for example, that location 'A' is north east of location 'B', we use degrees. So we would say that location 'B' is situated at 45° from location 'A'.

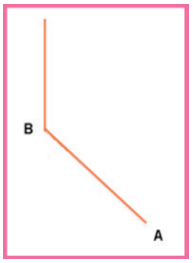
Important points about bearings
- Tells us which direction something is
- Are more accurate than using compass points
- Are always written in three figures
- It is always measured clockwise angle from the North



Source: Bearings lesson: Retrieved from https://www.slideshare.net/adamharbott/bearings-lesson

How to Measure bearings

Find the bearing of *A* from *B*



- Mark the North Line at *B* (if there isn't a North Line draw one in)
- Measure the angle clockwise from the North Line to *A*
- Give the answer as a three figure bearing.
- The North Line is always drawn at the latter location. For example, *A* from *B* means you draw the north line at *B* and read the degrees clock wise until you arrive at *A*.

Now find the bearing of *B* from *A* using the steps.

Note: All bearings are measured clockwise, from north, and are written as 3 digits, eg 013 °.

To find the bearing of *B* from *A*, draw a line from *A* to *B*, draw a North-Line at *A* and measure the angle clockwise from the North Line to line *B*.

Gradient

Gradient is a measure of slope or is the steepness of the slope. Gradient measures the slope between two points. Engineers involved in the construction of roads, railways, and storm sewers need to know the gradient of the slope.

The gradient of the land determines a number of features and uses of the land, geographers need an accurate method of calculating gradient. Some of the geographical features and uses which gradient affects are:

- Vegetation cover
- Chances of erosion
- Land use
- Building of roads and railways
- The choice of clearing land

Using the contour lines and scale on a map, it is possible to calculate the average gradient, or steepness, of a slope, road or river. Gradient is usually expressed as a fraction or ratio.

It is calculated by dividing the difference in height (or vertical interval) between the two points by the horizontal distance between them. Figure 1.5 on the following page gives us an idea of how steep a slope is for selected gradients.

Calculating the gradient between two points involves the two following steps:

Step 1: **Determine the two pieces of information required to complete the calculation.**

1.1: The first piece of information required is the difference in height between the two points. This is called the vertical interval, or **rise**. Find this by subtracting the lowest point from the highest point. Heights are shown by contours on topographic maps and come at intervals of 20 or 40 according to the scale of the map.

1.2: The second piece of information required is the horizontal distance between the two points. This is sometimes referred to as **the run.** Find this by measuring the distance between the two points on the map and then using the scale to determine the actual distance.

Step 2: **To calculate the gradient of a slope use the following formula.**

Note: Because the gradient of a slope is expressed as a ratio, the measurements for the rise (numerator) and run (denominator) must be in the same unit of measurement.

Gradient = Vertical interval (rise) ← Numerator
Horizontal distance (run) ← Denominator

Example: Calculate the gradient of the slope between point 'X' and 'Y' using figure 1.5 on the next page.

$$Gr = \frac{VI}{HD} = \frac{70m}{4500m} = \frac{1}{64} \quad \text{or} \quad 1:64$$

This means that for every 64 m travelled in a horizontal direction, you go up 1m. If you refer to *Figure 1.5* you will see that this is quite a gentle slope. The average person should be able to cycle up such a slope. In other words, the land rises by 1m for every 64cm of horizontal distance travelled.

The following are the important steps in calculating gradient

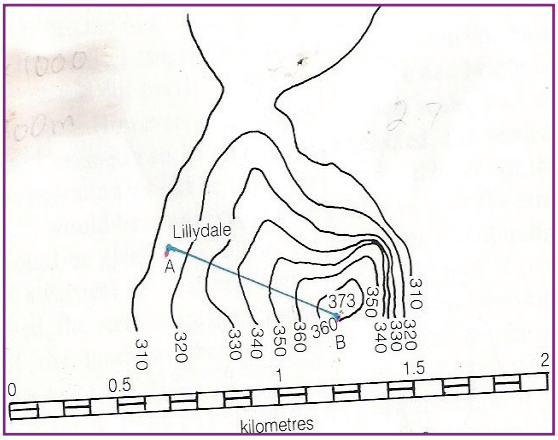
1. Calculate the difference in height between the two points.
2. Calculate the horizontal distance between the two points.
3. Divide the difference in height by the horizontal distance, i.e.

$$\text{Gradient} = \frac{\text{difference in height (VI)}}{\text{horizontal distance}} \qquad \text{Gradient A to B} = \frac{58}{700}$$

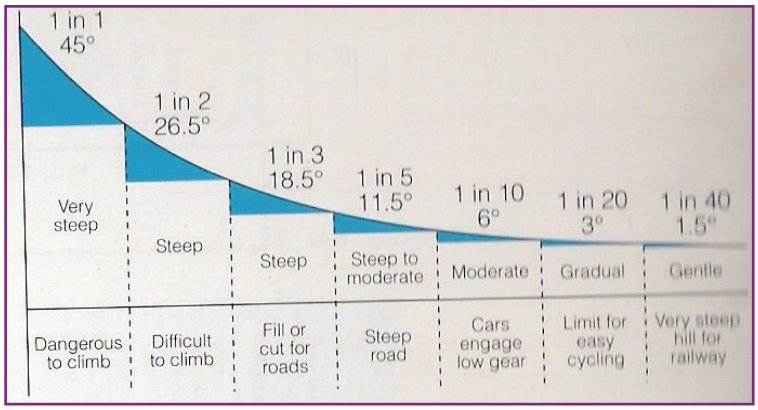
4. The gradient is then expressed as a fraction.
   Therefore; Gradient A to B = 58/700 =1/12.069 =1/12

5. Because, the vertical distance is always presented as metres while the horizontal distance is always presented as kilometers, the horizontal distance must always ne converted to meters before calculating the gradient. This is done by multiplying the kilometer distance by 1000 because there are 1000m in 1 kilometre.

Example 1:



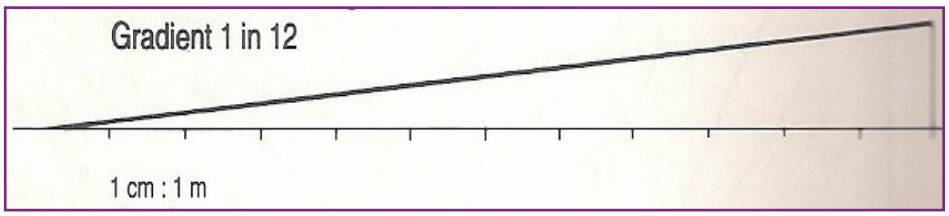
Source: Map Skills-Measuring Height and Gradient: Retrieved from: http://www.google.com/search?q=gradient+in+geography+images



Source: Bunnet, R. B. (1965) Physical Geography in Diagrams

Figure 1.5: Gradient is expressed as a ratio, e.g: 1 in 12, 1 in 5, so the measurements must be in the same units.

A gradient ratio of 1 in 12 means that for every 12m of horizontal distance, there is a 1m rise in height.



Source: Bunnet, R. B. (1965) Physical Geography in Diagrams

Gradients are sometimes expressed as percentages. In this system a 1 in 12 slope is an 8 % gra-dient, a 1 in 5 slope is a 20% gradient, a 1 in 4 slope is a 25 % gradient and a 1 in 10 slope is a 10 % gradient.

The steepness of the slope or the gradient of a slope can also be calculated from a map. The two pieces of information we need are;

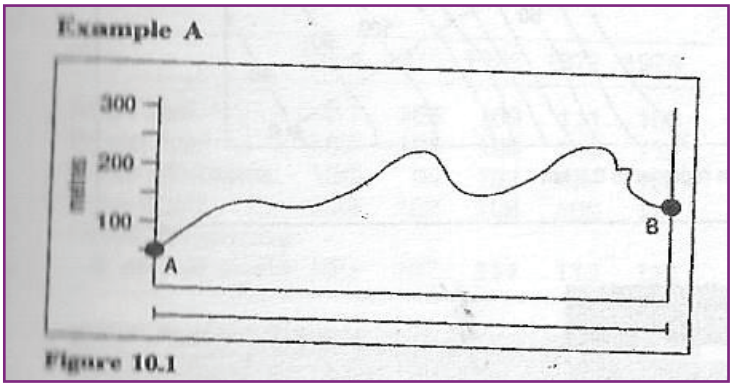
1. The **vertical distance** or difference in height, between the highest and the lowest points on the slope. The vertical distance between two points can be obtained by finding the heights of these points and then deducting one from the other.

2. The **horizontal distance** between these same two points on the map.The horizontal distance between two points can be obtained by measuring the distance between them on the map and then converting this kilometer distance to distance in meters.

Remember:
Gradient is calculated as using this formula;

Gradient	=	Vertical interval (V.I) Horizontal distance (H.D)	(in the same units)

Example 2:



Source: Bunnet, R. B. (1965) Physical Geography in Diagrams

State the gradient between A and B.

Gradient =	V.I	(150m – 50m)	= 100	= 1	(or 1 in 200)
	H.D	(20 km)	20 000	200	(in same units-metres)

- Which means that for every 200 metres travelled, we go up 1 metre. The gradient is expressed as 1/200 or 1 in 200 or 1: 200
  - The slope of the land is described as gentle when there is a smaller rise in the height of the land over a longer horizontal distance travelled.
  - The slope of the land is said to steep when there is a very big rise in the height of the land over a much shorter horizontal distance travelled.
  - For example, the Gradient 1:2.3 represents a steep slope while the Gradient 1:23 represents a rather gentle slope or a flat land rather than a mountain as in the first gradient.

Suggested Resources

1. Malcolm Stacey, Chris Bonnor & Brian Ralph, (2008). *Skills in Geography,* Australia, Pearson Education.
2. Elizabeth. D.Taylor & Liz Taylor, *Geographical Techniques,* (1997). Pearson Publishing.

Benchmark 11.1.1.4: Draw cross-sections and calculate the gradient using a topographic map.

Topic 4: Cross-section

Sub-topic:
- Drawing a cross-section

Skills: Analysis (identify, explain), synthesis (draw).

Learning Objectives: By the end of the topic, students will be able to:

- Define cross-section.
- Identify the use of cross-section.
- Construct cross section using the given steps.

Content Background

Cross-sections
A cross-section is a side view (or profile) of an area of land. Drawing a cross-section from a topo-graphic map is a useful way of interpreting contour lines and gaining a visual impression of the shape of the land.

The following method can be used when drawing a cross-sectional profile between two points; in this case points A and B.

We draw cross-sections so we can study slopes for various reasons such as;
1. Climate
2. Construction
3. Agriculture
4. Drainage
5. Environmental conservation

How to draw a cross section using a topographical map

- A cross section shows the actual shape of the land between two points on a map.
- A cross section is plotted on a graph with the horizontal distance between two points shown on the x-axis and the height of the contour lines shown on the y-axis.
- The length of the horizontal x-axis will be the distance between the two points of the cross-section. The scale of this axis will always be 1:50 000 on topographic maps or 1:100 000
- The vertical scale of the cross-section is either given to you in the question (?) or you will have to choose a suitable scale, e.g. 1cm: 20m or 1cm:40m
- The vertical scale is the number of metres we go up as we move along the slope “From” is always on the left
- Place a strip of paper along the joined line

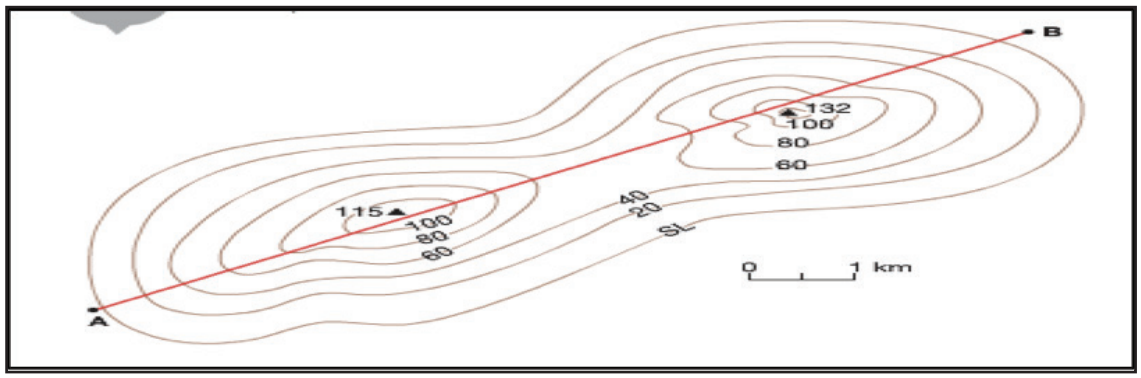
Steps in drawing a cross-section

Drawing a cross-section involves the following steps;

1. Place the straight edge of a sheet of paper along a line joining points A and B. Mark points A and B on your sheet of paper.
2. Starting from point A, mark the position where the edge of the sheet of paper cuts each contour line. Write the value of each contour on the sheet of paper.
3. Draw the horizontal and vertical axes for the cross-section. The length of the horizontal axis should equal the length of the line A–B. For the vertical axis, which shows the height of the land above sea level, you should use a scale appropriate to your needs.
4. Place the sheet of paper along the horizontal axis and then plot the contour points and heights as if you were drawing a line graph.
5. Join the dots with a single smooth, curved line and then shade in the area under the line to highlight the relief or slope.

In geography, we need to learn how to draw cross-sections from topographical maps. Let's look at this step-by-step:

1. Locate two points on a map between which the cross-section is to be made. Label these points A and B



Source: GeoSkills: Drawing Cross Sections: Retrieved from: http://scyear8geography.weekly.com/geoskills-drawing-cross-sections.html

2. Place the straight edge of a paper from point A to point B and mark off the intervals. Also you need to mark points A and B on the piece of paper. The above map shows a contour interval of 20 meters.
3. On your paper, mark the position where your paper crosses each contour line. Write the value of each contour line on your piece of paper (you may need to estimate the height of your starting and finishing points)
4. On a graph paper, draw the horizontal and vertical axes from your cross-section. The length of the horizontal axis should be as wide as the distance between points A and B. For the vertical axis you need to use a scale (distance between each increment) that will not exaggerate the height of the cross-section. We don't want a small hill looking like Mt. Everest.
5. Place the piece of paper along the horizontal axis. In pencil, plot (dot) the contour points and heights as if you were drawing a line graph.
6. Join the dots with a single smooth, curved line.

7. Label any features intersected by your cross-section (i.e., river, major roads etc)
8. Finish off your cross-section by:
    - Shading in the area below the line
    - Labelling the scale on the horizontal and vertical axes
    - Giving your cross-section a title.

Suggested Resources

1. Malcolm Stacey, Chris Bonnor & Brian Ralph, (2008). *Skills in Geography,* Australia, Pearson Education.
2. Elizabeth. D.Taylor & Liz Taylor, *Geographical Techniques,* (1997). Pearson Publishing.

Benchmark 11.1.1.5: Construct a climate and vegetation profile of a region using temperature and rainfall (climate) graphs.

Topic 5: Climate and vegetation profile

Sub-topic:
- Constructing climate and vegetation profile using climate graphs

Skills: Analysis (identify, explain), synthesis (draw).

Learning Objectives: By the end of the topic, students will be able to:
- Interpret information on climate graphs.
- Construct climate and vegetation profile using climate graphs.

Content Background

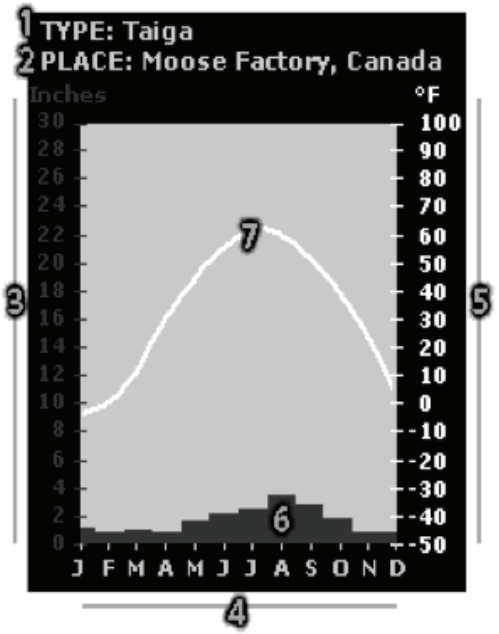
Every place on Earth has weather. Weather is the day to day condition of the atmosphere. However, different places on Earth have different types of "typical" weather. Some places are dry, some are wet, some are hot, some are cold, and some are a little of everything.

You can find out what the weather is like where you live by looking out the window or by stepping outside. Weather refers to temperature, precipitation (rain and snow), and the wind's direction and speed. Scientists who study the weather collect information from different places on Earth and come up with averages, or typical types of weather, for a particular place. This average, or typical type of weather that occurs during a year, is called the "climate."

A quick way to get an idea of the climate of a particular place is to look at a "climate-graph," or "climograph." A climograph is what scientists create to show a particular location's average tem-perature and precipitation during the year.

How to read a climograph
Below is a climograph for Moose Factory, Canada. To help you learn to read a climograph, the different parts of the climograph have been identified by a number. A description of each of the numbered parts is given below.

1. The type of biome associated with the place.
2. The place where the temperature and precipitation were measured.
3. A scale used to indicate inches of precipitation.
4. The months of the year. The letters J, F, M, etc., stand for January, February, March, etc.
5. The temperature scale in degrees Fahrenheit.
6. A bar graph showing the average precipitation for each month. In this example, the average total precipitation is about 1 inch in January and nearly 4 inches in August. (Note: Values for this graph are found on the left-hand scale.)
7. A line graph showing monthly temperature during the year. In this example, the lowest temperature is about -5°F in January and the highest is about 45°F in July. (Note: Values for this graph are found on the right-hand scale.)



Source: How to read climograph: Retrieved from: coff.edu/ele/modules/msese/earthsysflr/climograph.html

Climatic statistics can be more easily read and compared when presented in a climate graph. Rainfall is drawn at the bottom of the graph using bars to represent precipitation for each month. Temperatures are represented by a line graph. Rainfall and temperature can be shown on separate graphs or they can be combined in one climograph.

A climograph usually lists the temperature on the left vertical axis and the rainfall measurements on the right vertical axis.

Graphs can provide valuable information, but sometimes only a certain amount of information is required. This is where a table becomes a useful method for presenting data.

Suggested Resources

1. Malcolm Stacey, Chris Bonnor & Brian Ralph, (2008). *Skills in Geography,* Australia, Pearson Education.
2. Elizabeth. D.Taylor & Liz Taylor, *Geographical Techniques,* (1997). Pearson Publishing.

Benchmark 11.1.1.6: Locate a place and the likely vegetation of this place using its temperature and rainfall characteristics presented on its climate graph.

Topic 6: Locating places and vegetation using climate graphs

Sub-topics:
- Locate places using climate graphs
- Identifying vegetation using climate graphs

Skills: Analysis (identify, explain), synthesis (locate).

Learning Objectives: By the end of the topic, students will be able to:

- Locate a place using its climate graph.
- Describe the vegetation of a place using its climate graph.

Content Background

Climate graphs are used to illustrate the average temperature and rainfall experienced at a particular place over the course of a year. The graphs consist of a line graph showing an average monthly temperature and a simple column graph showing average monthly rainfall figures.

Climate graphs comprised of two key components;
1. Bar graph
2. Line graph

Some useful hints and tips in the integration of Climate and Topographical Maps.

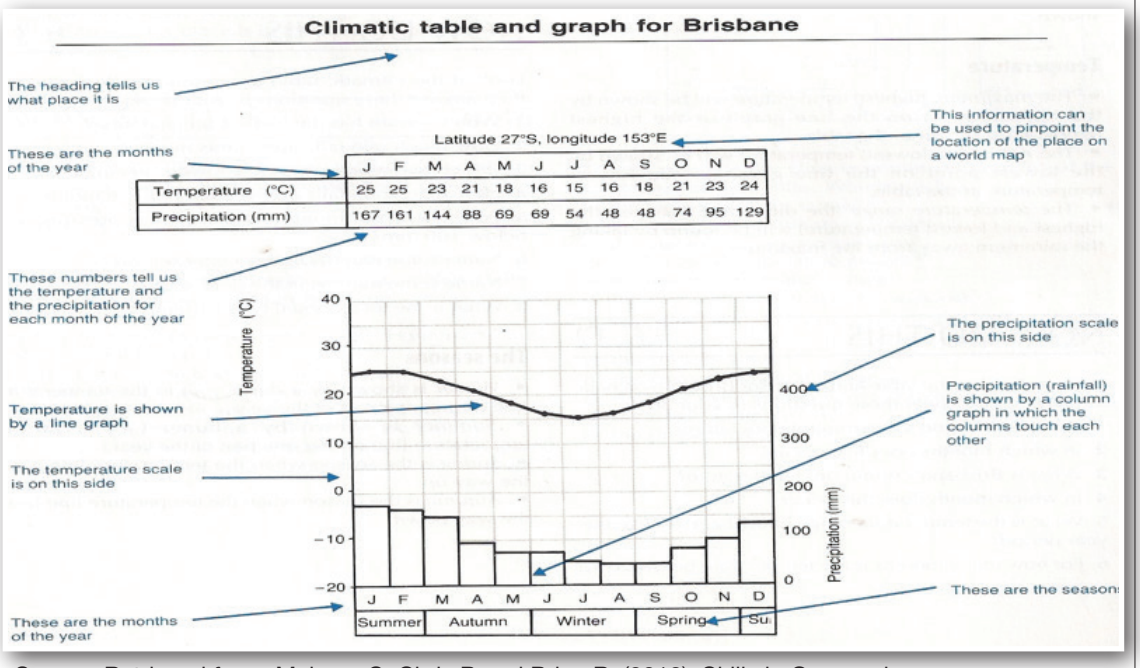
- Rainfall in an area can be determined by the amount of natural vegetation. If there is less natural vegetation with non-perennial rivers and little evidence of farming the map would fall into a low rainfall region. If there is more natural vegetation with perennial rivers and more evidence of farming the map would fall into a higher rainfall region.
- Places further north are closer to the equator and usually have higher temperatures than places further south. (Determine the location by the grid reference).
- Use contour lines to determine altitude and then determine the relationship between temperature and altitude.
- Remember that coastal locations especially on the eastern half of the country experience Maritime climates and inland areas experience Continental climates.
- In South Africa, the north-facing slopes receive more sunlight. This can be determined by the contour lines.
- The prevailing wind in a valley during the day or night (katabatic air flows down the valley at night and anabatic air flows up the slopes during the day)

Temperature

- The maximum (highest) temperature will be shown by the highest point on the line graph or highest temperature shown on the table.
- The minimum (lowest) temperature will be shown by the lowest point on the line graph or lowest temperature in the table.

The temperature range (the difference between the highest and the lowest temperature) is found by subtracting the minimum from the maximum.

Given below is a sample of a climatic graph (climograph)



Source: Retrieved from: Malcom S, Chris B and Brian R, (2018): Skills in Geography

Precipitation

The highest precipitation will be shown by the highest column in the graph or the largest precipitation figure in the table.

- The lowest precipitation will be shown by the lowest column in the graph or the smallest precipitation figure in the table.
- A grouping together of a number of higher columns will show a distinct wet season.
- A grouping together of a number of the low columns will show a distinct dry season.
- If all columns are quite low it is probably very dry all year round.
- To find out the total precipitation for the year, add up all twelve precipitation bit figures from the table.

The Seasons

- Winter is shown by a dip  in the temperature line during one part of the year.
- Summer is shown by a bump  in the temperature line during one part of the year.

- Spring is the season when the temperature line is on the way up.
- Autumn is the season when the temperature line is on the way down

Location

- A temperature lines which is almost flat or level shows that this place is close to the equator.
- Places closer to the equator have a small temperature range or variation.
- A temperature line which has a large dip in it shows a place that is either quite a long way from the equator or a long way inland. These places have large temperature ranges. If the temperature line dips during June, July and August (showing winter is in the middle of the year), this place is in the Southern hemisphere.
- If the temperature lines dips during December, January and February, this place is in northern hemisphere.

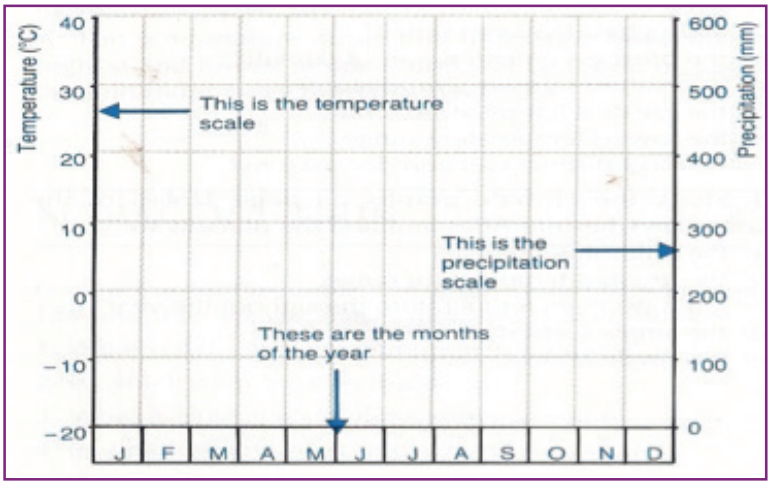
Constructing climographs

Here are steps you must follow to draw a climatic graph.

A. (i) Line graphs - Temperature

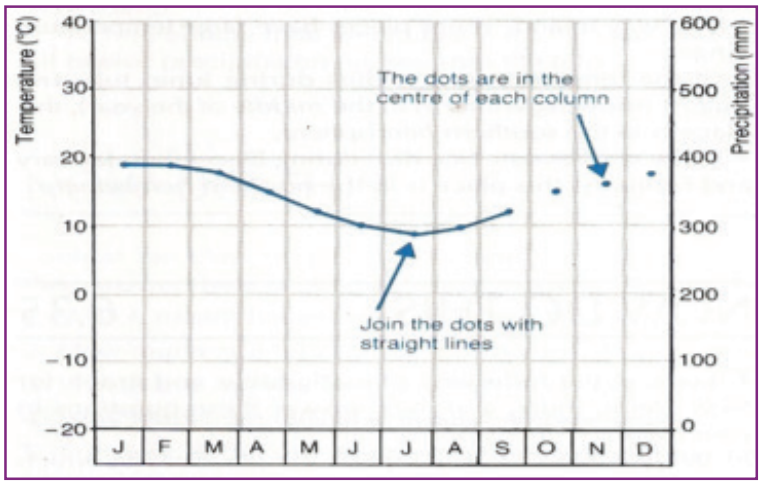
Step 1: Rule up the horizontal axis so there are twelve spaces across it. Write in the letter for each month.

- Rule up the Temperature scale and the Precipitation scale.
- Write in the temperature and Precipitation figures.



Source: Retrieved from: Malcom S, Chris B and Brian R, (2018): Skills in Geography

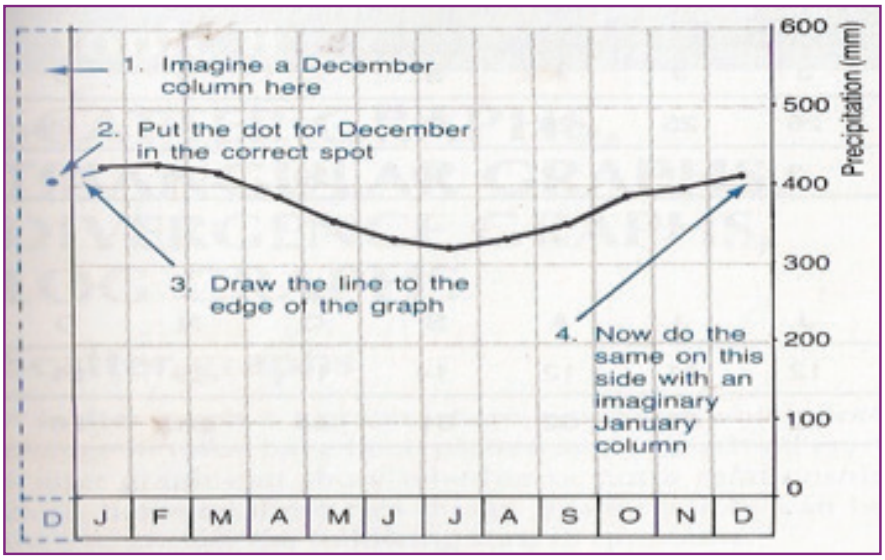
Step 2: Begin plotting the temperature information from the table and join up the dots with a straight line.



Source: Retrieved from: Malcom S, Chris B and Brian R, (2018): Skills in Geography

Step 3: Complete the temperature line so that it reaches the edge of the graph on both sides.

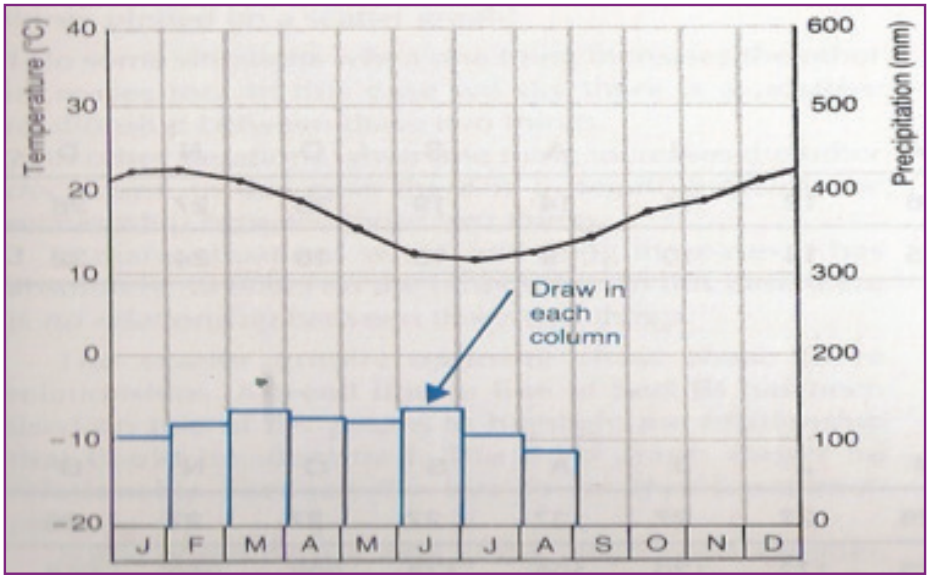
a. Imagine December column to the left of January column. Plot the temperature for December in this imaginary column and rule a line from January dot towards this December dot. Stop at the edge of this graph.
b. Do the same for January.



Source: Retrieved from: Malcom S, Chris B and Brian R, (2018): Skills in Geography

(ii) Bar Graph-Pricipitation

Step 4: Begin drawing in the columns to show precipitation. Always use a ruler and shade in columns if necessary.



Source: Retrieved from: Malcom S, Chris B and Brian R, (2018): Skills in Geography

Step 5: Complete the graph by putting a title at the top

Suggested Resources

1. Malcolm Stacey, Chris Bonnor & Brian Ralph, (2008). *Skills in Geography,* Australia, Pearson Education.
2. Elizabeth. D.Taylor & Liz Taylor, *Geographical Techniques,* (1997). Pearson Publishing.

Benchmark 11.1.1.7: Interpret distinct maps on distinct natural and human geographical features.

Topic 7: Distinct maps

Sub-topic:
- Maps of natural and human geographical features

Skills: Analysis (identify, explain).

Learning Objectives: By the end of the topic, students will be able to:

- Identify features of distinct map.
- Interpret distinct maps on distinct natural and human geographical features.

Content Background

Geographers study features on the earth's surface, what's there, where it is the way it is arranged or distributed and the spartial patterns created by the spread of these features. All these is either called spartial information or geographical information.

Maps for everything

Just about everything can be mapped. Many maps can be thematic maps, that is they focus on one theme, feature or topic, and use colours, shading symbols, lists or dots to show information Sometimes different ways of showing information on the map can lead to different conclusions and quite different predictions of likely outcomes. Some of these maps used are:

1. **Topological Maps:** One of the world's best known maps and one that will even become better known due to the London 2012 Olympics. Topological maps don't have a scale, and the distance, directions, sizes and shapes they show are not correct. What is correct on the Topological map however is the relative position of points or places.
2. **Dot Maps:** One of the main type of thematic map is the Dot Map or the Dot Distributed Map, which uses a small dot repeated across the map to show the numbers of a particular object or feature. A dot map shows the absolute number of objects and their:
    - Distribution, or relative spread
    - Density, or relative closeness

   Geographers find dot maps very useful because they provide an overall impression of broad spatial patterns that is the arrangement of objects or features across the earth's surface.
3. **Choropleth Maps:** These maps show the density or features in a given area by shades, using colours or patterns. They are thematic maps that map one theme or topic per map such as the distribution of children aged from 0 to 5 or the percentage of children with access to doctors. Choropleth maps are based on statistics obtained from counting objects or features in a given area.

4. **Isoline Maps:** An isoline is a line that joins places with the same or equal value. An isoline map use isolines to show gradual change continuous data, that is data that is found everywhere about one feature of the earth's surface.
5. **Flowline maps:** Flowline maps are used to show the flows and movements between places, countries and groups of countries. Flowline maps illustrate flows and movements with arrows and lines. They simplify patterns so we can see networks and flows and the relative differences of the size of the flow.
6. **Proportional symbol maps:** These are thematic maps that use a highly visual method of showing data. They give an impression of the number or quality of an object or feature at a point or in an area compared with the same object or feature at another point or in another area.

Suggested Resources

1. Malcolm Stacey, Chris Bonnor & Brian Ralph, (2008). *Skills in Geography,* Australia, Pearson Education.
2. Sue. Baker, (1995), *Pathways in senior geography.* Australia, Thomas Nelson.

Benchmark 11.1.1.8: Compile demographic information of different countries using a population pyramid.

Topic 8: Demographic information

Sub-topic:
- Compiling demographic Information using population pyramids

Skills: Analysis (identify, explain).

Learning Objectives: By the end of the topic, students will be able to:

- Identify features of a population pyramids.
- Differentiate between the population pyramid of a developed country from a developing country.
- Compile demographic information using population pyramids.

Content Background

Demography is the statistical study of populations, especially human beings. Demography encompasses the study of the size, structure, and distribution of these populations, and spatial or temporal changes in them in response to birth, migration, aging, and death. As a very general science, it can analyse any kind of dynamic living population, i.e., one that changes over time or space (see population dynamics). Demographics are quantifiable characteristics of a given population.

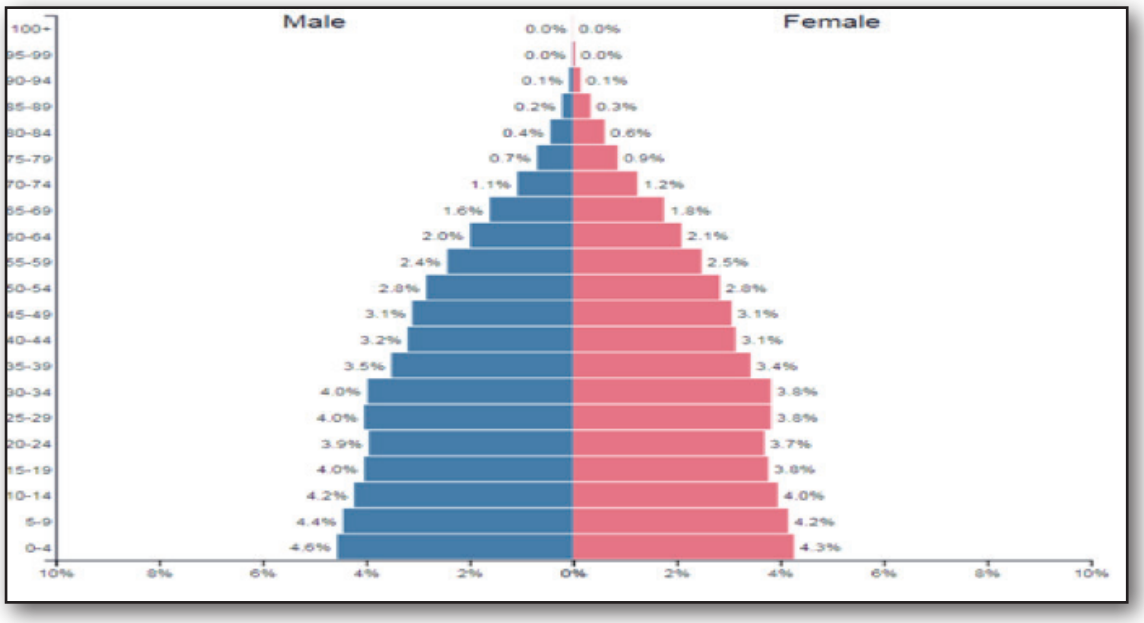
Demographic analysis can cover whole societies or groups, defined by criteria such as education, nationality, religion, and ethnicity. Educational institutions usually treat demography as a field of sociology, though there are a number of independent demography departments. Based on the demographic research of the earth, earth's population up to the year 2050 and 2100 can be estimated by demographers. Formal demography limits its object of study to the measurement of population processes, while the broader field of social demography or population studies also analyses the relationships between economic, social, cultural, and biological processes influencing a population.

Population Structure and Population Pyramids: Population structure means the 'make up' or composition of a population. Looking at the population structure of a place shows how the population is divided up between males and females of different age groups. Population structure is usually shown using a population pyramid. A **population pyramid** can be drawn up for any area, from a whole continent or country to an individual town, city or village.

Below are two examples of a developed and developing countries pyramids for the United Kingdom and Mozambique.

- Notice how in the UK (2000) pyramid there is a bulge in the area of the **30-34** and **35-39 age groups,** with the numbers thereafter reducing fairly steadily as the ages increase.
- A narrow base shows a low birth, so not very many young people
- A broad shape at the top that shows a high proportion of people living longer. Women live longer than men.

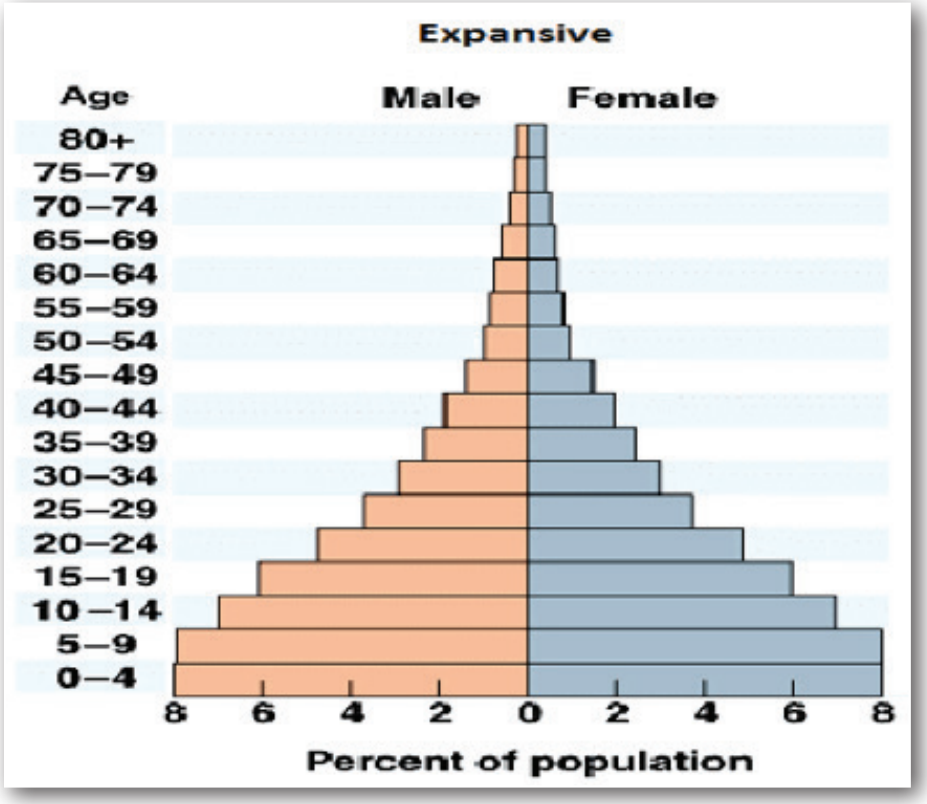
Population pyramid for United Kingdom 2000



Source: Retrieved from: https://www.populationpyramid.net/united-kingdom/2000

- The bulge in the middle of the pyramid showing a baby boom/high rate of births) which, is related to periods of no wars, rapid economic growth, etc., in the 1960´s and 1970´s.

Population pyramid for Mozambique 2000



Source: Retrieved from: https://www.populationeducation.org/what-are-different-types-population-pyramids/

In this graph, notice that in 2000 the 0-4 age group contained the largest number of people, with the numbers thereafter declining steadily as the ages increase.

A narrow shape on the top shows a low proportion of people living in old-age and a high death rate. Women live longer than men. This country has a low life expectancy.

The middle of the pyramid shows that there are many young dependants. In the age group 15-19 there is an indent showing high mortal rate than normal which relates to war, famine, disease, emigration, etc.

A wider shape on the base shows a high birth rate and a large number of children.

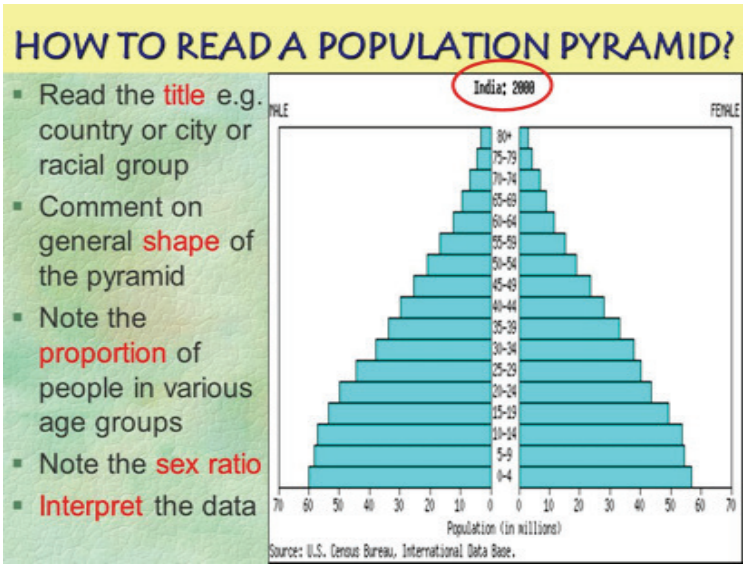
Analyzing population pyramids

Key things to know about population pyramids;

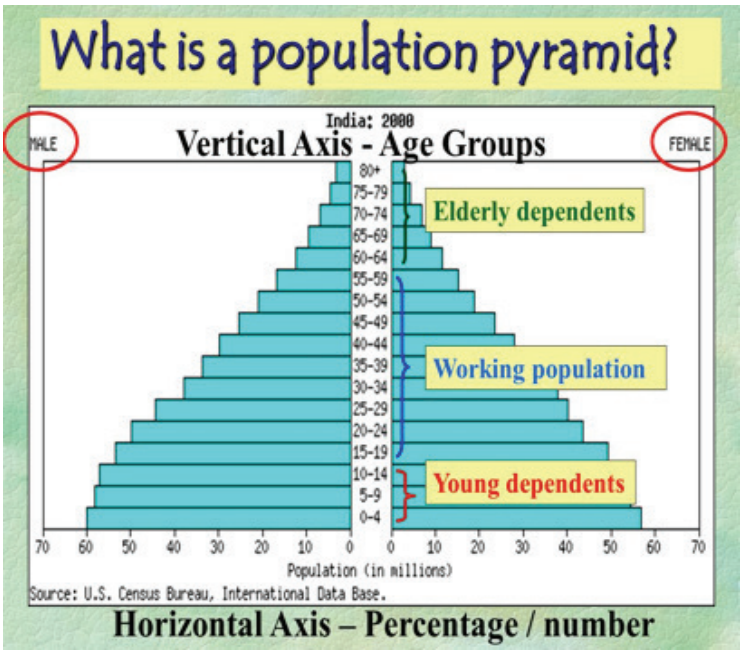
- The shape of a population pyramid can tell us a lot about an area's population.
- It gives us information about birth and death rates as well as the life expectancy.
- A population pyramid tells us how many dependents are there. There are two groups of dependants; young dependants (aged below 15) and elderly dependants (aged over 65).
- Dependants rely upon the economically active population for economic support.
- Many Low Economic Developing Countries (LEDCs) have a high number
- of **young dependants,** whilst many Middle Economic Developing Countries (MEDCs) have a growing number of **elderly dependants.**

How do pyramids change over time?

- A population pyramid that is very triangular (eg Mozambique in 2000) shows a population with a high number of young dependants and a low life expectancy.
- A population pyramid that has fairly straight sides (more like a barrel) shows a population with a falling birth rate and a rising life expectancy.
- Over time, as a country develops, the shape changes from triangular to barrel-like.
- Places with an ageing population and a very low birth rate would have a structure that looks like an upside-down pyramid.
- Population numbers change over time, influenced by births, deaths and migration into or out of the area.
- Global population levels, having grown slowly for most of human history, are now rising.



Source: Retrieved from: https://www.google/search?q=how+to+read+a+population+pyramid+%2B+images+.....



Source: Retrieved from: https://www.google/search?q=how+to+read+a+population+pyramid+%2B+images+.....

Suggested Resources

1. Malcolm Stacey, Chris Bonnor & Brian Ralph, (2008). *Skills in Geography,* Australia, Pearson Education.
2. Sue. Baker, (1995), *Pathways in senior geography.* Australia, Thomas Nelson.

Unit 2: People and Places

Content Standard 1.2: Students will be able to investigate and explain how geographic and human characteristics create culture and define places.

Benchmark 11.1.2.1: Identify and distinguish the world's climatic regions.

Topic 1: Climatic regions

Sub-topics:
- World climatic regions

Skills: Analysis (identify, explain),

Learning Objectives: By the end of the topic, students will be able to:
- Identify the world's climatic regions.
- Describe each of the climatic regions.

Content Background

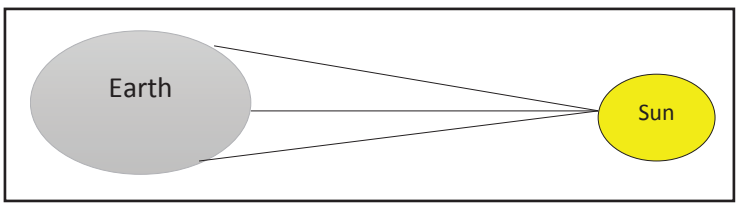
What is Climate? Climate is the long-term average weather, typically averaged over a period of one year.

Weather is defined as the condition of the atmosphere at a particular time or place consisting of the air's temperature, moisture conditions and movements.

Climate is defined as the general weather conditions experienced by a locality during a longer period of time such as a season or year; includes average weather conditions and extremes. There are three main climatic zones on the earth or three (3) main types of climates:

i. Tropical
ii. Temperate
iii. Polar

The differences are caused mainly by the varying distances from the sun and the angle of incidence.



Each of the 3 climatic zones can be broken up into individual climate areas. These are:

1. Tropical:

i. Equatorial wet
ii. Tropical savanna
iii. Tropical maritime
iv. Tropical Monsoon
v. Hot Deserts

2. Temperate

i. Warm temperate (Subtropical) Eastern Maritime
ii. Mediterranean (Warm Temperate Western Maritime)
iii. Cool Temperate Western Maritime
iv. Temperate Continental (Mid-Latitude Steppes)
v. Cool Temperate Eastern Continental (Humid Continental)

3. Polar

i. Cold Temperate or Subarctic
ii. Tundra
iii. Icecap or Polar

World Climatic Zone

Zones		Type of climate	Climate characteristics	Vegetation type
EQUATORIAL	1	Equatorial Wet	Hot and wet, very wet all year round	Equatorial rainforest
	2	Tropical Savanna or Subequatorial	Summer - Hot and Wet Winter - Warm and Dry	Savanna grassland and Woodland
	3	Tropical Maritime or Tropical East Coasts	Summer - Hot and Very Wet Winter - Warm and Wet	Tropical rainforest
	4	Tropical Monsoonal	Summer - Hot and very Wet Winter - Warm and very Dry	Monsoonal (semi-deciduous forest) This climate is found in Indian subcontinent; Myanmar, Thailand, Vietnam, Cambodia, Laos
	5	Hot Desert	Summer - Very Hot and Dry Winter - Cool and Dry	Desert
TEMPERATE	1	Warm Temperate or Sub Tropical Eastern Maritime	Summer - hot and wet Winter - Cool and wet	Evergreen Forest (some mixed forest)
	2	Mediterranean Warm Temperate Western Maritime	Summer - Hot and Dry Winter - Cool and Wet	Evergreen shrub or Woodland (Chappel)
	3	Cool Temperate Western Margin	Summer - Warm and Wet Winter - Cool/Cold and Wet	Mixed deciduous and coniferous forest
	4	Temperate Continental	Summer - Hot and Dry or Semi-arid Winter - Very Cold and Dry	Temperate grassland and Desert
	5	Cool Temperate Eastern Continental	Summer - Hot and Wet Winter - Cold and Dry	Mixed deciduous and coniferous forest
POLAR	1	Cold Temperate (Subarctic)	Summers - Warm Winter - very Cold Low annual precipitation	Coniferous (Boreal) forest or Taiga
	2	Tundra	Summer - Cool Winter - Long and very Cold Low annual precipitation	Tundra
	3	Polar or Icecap	Cold to very cold and dry all year	Nil

Source: Malcolm Stacey, Chris Bonnor & Brian Ralph, (2008). *Skills in Geography,* Australia, Pearson Education.

Suggested Resources

1. Malcolm Stacey, Chris Bonnor & Brian Ralph, (2008). *Skills in Geography,* Australia, Pearson Education.
2. Sue. Baker, (1995), *Pathways in senior geography.* Australia, Thomas Nelson.

Benchmark 11.1.2.2: Identify and distinguish the world's biomass.

Topic 2: Biomass

Sub-topic:
- World's biomass

Skills: Analysis (identify, explain), synthesis, (create awareness, dramatize, replicate).

Learning Objectives: By the end of the topic, students will be able to:

- Define biomass.
- Identify the world's biomass.
- Distinguish the world's biomass.

Content Background

Biomass covers all kinds of organic matter from fuel wood to marine vegetable, there existing a wide range of options for conversion into more convienient and useful form of energy such as heat and electrical energy.

Biomass is a term used to describe all the organic matter produced by photosynthesis, existing on the earth's surface. They include all of the water and land-based vegetation and trees, and all waste biomass such as municipal solid waste (MSW), municipal bio-solids (sewage), and animal wastes (manures), forestry and agricultural residues, and certain types of industrial wastes. The world's energy markets have relied heavily on the fossil fuels. Biomass is the only other naturally occurring energy containing carbon resource that is large enough in quantity to be used as a substitute for fossil fuels.

Sources of biomass: It can be obtained from different sources comprising Organic wastes which accumulate at specific locations such as municipal solid waste (MSW).

Residues left as plant materials in the field or forest during the post harvestation period of agricultural crops or timber.

Methods of extracting biomass energy

Biomass can be converted to thermal energy, liquid, solid or gaseous fuels and other chemical products through a variety of conversion processes. Bio-power technologies are proven electricity-generation options in the United States, with 10GW of installed capacity. All of today's capacity is based on mature, direct-combustion technology. Future efficiency improvements will include co-firing of biomass in existing coal-fired boilers and the introduction of high-efficiency gasification, combined-cycle systems, fuel cell systems, and modular systems. Generally, the prominent bio-power technologies are comprised of direct combustion, co-firing, gasification, pyrolysis, anaerobic digestion, and fermentation.

1. **Direct Combustion:** This is perhaps the simplest method of extracting energy from biomass. Industrial biomass combustion facilities can burn many types of biomass fuel, including wood, agricultural residues, wood pulping liquor, municipal solid waste (MSW) and refuse derived fuel. Bio-mass is burned to produce steam, the steam turns a turbine and the turbine drives a generator, producing electricity. Because of potential ash build-up (which fouls boilers, reduces efficiency and increases costs), only certain types of biomass materials are used for direct combustion.

2. **Gasification:** Gasification is a process that exposes a solid fuel to high temperatures and limited oxygen, to produce a gaseous fuel. The gas produced by the process is a mix of gases such as carbon monoxide, carbon dioxide, nitrogen, hydrogen, and methane. The gas is then used to drive a high efficiency, combined-cycle gas turbine. Gasification has several advantages over burning solid fuel. One is convenience – one of the resultant gases, methane, can be treated in a similar way as natural gas, and used for the same way.

   Another advantage of gasification is that it produces a fuel that has had many impurities removed and could therefore cause fewer pollution problems when burnt. Under suitable circumstances, it can also produce synthesis gas, a mixture of carbon monoxide and hydrogen which can be used to make Hydro-carbon (e.g., methane and methanol) for replacing fossil fuels. Hydrogen itself is a potential fuel.

Suggested Resources

1. Introduction to Biomass Energy a Renewable
2. Biomass - The Growing Energy Source

Benchmark 11.1.2.3: Examine the effects of earth's tilt, rotation and revolution on the global temperature distribution, world and regional winds, ocean currents, climatic region and world biomass.

Topic 3: Earth's tilt, rotation and revolution

Sub-topics:

- Effects of Earth's tilt, rotation and revolution on global temperature distribution
- Effects of Earth's tilt, rotation and revolution on world and regional winds
- Effects of Earth's tilt, rotation and revolution on climatic regions
- Effects of Earth's tilt, rotation and revolution on world biomass.

Skills: Analysis (identify, explain), synthesis (create awareness, dramatize, replicate).

Learning Objectives: By the end of the topic, students will be able to:

- Explain earth's tilt, rotation and revolution.
- Describe the earth's tilt, rotation and revolution on:
  - Global temperature distribution
  - World and regional winds
  - Ocean currents
  - Climatic regions and
  - World biomass.

Content Background

How does the tilt of the earth affect the weather?

earth's axis is tilted by approximately 23.5 degrees. In other words, Earth's daily rotation is shifted by 23.5 degrees with regard to its yearly revolution around the sun. This axial tilt is the reason why Earth experiences different seasons throughout the year, and also why summer and winter occur opposite each other on either side of the equator and with greater intensity farther away from the equator.

Sunlight Angle: The sun burns with the same intensity all year. Earth's elliptical orbit brings it closer or farther at different times of the year, but this change in distance has a negligible effect on weather. The important factor is the incident angle of sunlight. As an example, imagine that you have a flashlight and a piece of paper. Hold the paper so that it is perpendicular to the beam of the flashlight, and shine the light on the paper. The light hits the paper at 90 degrees. Now, tilt the paper. The same light is spread over a larger area, and is therefore much less intense. The same phenomenon occurs with Earth and the sun.

Equator versus the Poles: The reason the equator is the hottest part of the planet is because its surface is perpendicular to the sun's rays. At higher latitudes, however, the same amount of solar radiation is spread over a larger area, due to Earth's spherical shape. Even without any tilt, this would result in the equator being warm and the poles being cold because the earth is a sphere.

Axial Tilt: Because Earth is tilted, different latitudes receive different sun angles throughout the year. During summertime in the Northern Hemisphere, Earth is tilted so that the Northern Hemisphere is angled more directly at the sun. It receives more direct sunlight and is warmer. At the same time, the Southern Hemisphere is angled away from the sun, so it receives less direct sunlight and experiences winter. The axial tilt doesn't change throughout the year, but as Earth travels to the other side of the sun, the opposite hemisphere is angled toward the sun and the seasons change

Length of Days: At the fall and spring equinoxes, in mid-September and mid-March, the axis is pointed neither toward nor away from the sun, and the Northern Hemisphere and Southern Hemisphere receive the same amount of sunlight. Day and night are of equal length at these times. After the equinox, the days begin to get shorter in one hemisphere and longer in the other. At the summer and winter solstices on the 21st or 22nd of June and December, the days are at their longest or shortest, respectively. The summer solstice in the Northern Hemisphere, June 21st or 22nd, is also the winter solstice in the Southern Hemisphere, and vice versa.

"The Reasons for the Seasons"

The Earth takes 365 and 1/4 days to complete one revolution around the sun and this amount of time is called a "year." Every four years, 1/4 of a day or 6 hours will add up to 24-hour day, and we add an extra day (February 29th) to the calendar. This is why we have a "leap year" with one extra day every four years. The Earth's orbit is nearly circular (or slightly elliptical) and Earth is actually closer to the sun during the northern hemisphere's winter months.

Rotation and revolution

On Earth, each day begins at sunrise and ends at sunset. You see the Sun "come up" or rise in the morning and "go down" or set at night. When we use these phrases, what do you think they imply about the way our solar system works? Does the Sun really rise and set in the sky throughout the day?

Rotation is a term that describes the motion of a spinning object. Each of the planets and moons in our solar system rotates about an axis. An axis is an imaginary line about which each planet or moon spins. This imaginary line marks the center of a planet or moon's rotation.

In space, there is no such thing as up or down. An object's position can be measured only relative to other objects. The Sun is the center of our solar system. Therefore, the motion of the planets and other objects in our solar system can be measured relative to the Sun. Like the other planets, Earth rotates about an axis. Earth's axis is not a perfectly vertical or perpendicular line. Instead, our planet tilts at an angle of 23.5° relative to its path around the Sun. The northern end of Earth's axis, known as the geographic North Pole, always points at the North Star.

Suggested Resources

1. Introduction to Biomass Energy a Renewable
2. Biomass - The Growing Energy Source

Unit 3: People and Resources

Content Standard 1.3: Students will be able to analyse and discuss the different ways human factors and the distribution of resources affect the development of places and the movement of populations.

Benchmark 11.1.3.1: Examine the physical and human factors that affect the distribution of people.

Topic 1: Population distribution

Sub-topics:
- Physical factors that affect the distribution of people
- Human factors that affect the distribution of people

Skills: Analysis (examine)

Learning Objectives: By the end of the topic, students will be able to:

- Identify physical factors and explain how they affect the distribution of people.
- Analyse how human factors affect the distribution of people and human factors affect the distribution of people.

Content Background

Distribution of population in the world

- Population distribution is the distribution pattern of people across the countries and locations in the world. The distribution of people across the world in uneven.
- Population density refers to the total number of people occupying one square kilometre of land. For example; 50 people/km2.
- Sparsely populated places contain fewer people in an area of land.
- Densely (crowded) populated areas contain many people in an area of land.

Causes of population distribution – *(Adapted: Freire, S.2010)*

- The uneven distribution of population around the world are mainly caused by; geographical/physical factors: topography, climate, soil, water and mineral and human causes that are both social and cultural.
- There are three main types of population dispersion: clumped (cluster), uniform (evenly distributed) and random (random spacing). Clumped population distribution is the most common type where people cluster around areas to access resources and services, form of protection, and can identify enemy from afar. The closer the distance is to the resources, there is an increase access to it. This on the other hand, means that more people are found.

Physical factors affecting population distribution – *(Adapted Source: Freire, S.2010)*

The main physical factors that determine distribution of people across the world are;

- Climate, landforms, topography, soil, energy and mineral resources.
- Accessibility like distance from the sea coast, natural harbours, navigable rivers or canals.
- Areas covered permanently covered in snow are also sparsely populated.
- Rainfall distribution – For example, places where rainfalls of more than 1000ml of rainfall attracts more people then places having less than 70 ml of water.
- Fertile land – Fertile volcanic valleys are good for growing food crops which means abundant food to feed the large population.
- River mouths and estuaries – Such areas are good for easy access to marine food and on fertile alluvial soils deposition by floods resources.
- Deserts and arid areas have low population density compared to wet areas.
- Thickly forested areas infested with dangerous insects and reptiles are also sparsely populated

Human factors affecting population distribution

Human factors can be divided into both social and cultural factors.

Social Factors

- Political boundaries.
- Controls on migration and trade.
- Government policies: good government policies that take care of the citizen's welfare and meet the societies' needs attracts more people. On the other hand, bad policies gives rise to bad practices, high corruption and weak rule of law is unattractive to investment thus affecting population.
- Types of entertainments.
- Safety and respect: People are social beings, when safety measures and community respects each other people live more freely, and where there are safety issues, population cluster for protection.

Cultural factors: *(Adapted: Small, C. 2001, October)*

- Open and multicultural society that encourages people to live together. For example, Melbourne in Australia is densely populated and is often referred to as the most multicultural city.
- People love to live in places where there is diversity of cultures as this encourages people to learn each other's culture, food, and their countries. Countries with small population often have people from only one country, for example PNG. Although PNG is ethnically diverse with more than 800 plus languages, that does not mean more people live in PNG compared to Melbourne which contains people from all over the world.

What is the relationship of these factors and the distribution of population?

- Population distribution is the corresponding size of the population over a given land area giving a reflection of the burden of land resources versus the available services.
- Availability of a common resource in a particular location attracts more people to that location, for example: river mouths, newly built road, or mining sites or development of a town or a project site.
- In sparsely populated locations, the distance and accessibility influence population patterns.

Suggested Resources

1. Berry, B. J., Simmons, J. W., & Tennant, R. J. (1963). *Urban population densities: structure and change.* Geographical Review, 389-405.
2. Castells, M., & Sheridan, A. (1977). *The urban question: a Marxish approach. Social Structure and Social Change,* (1).
3. Fox, J., Rindfuss, R. R., Walsh, S. J., & Mishra, V. (2008). *People and Environment.*
4. Freire, S. (2010). Modeling of spatiotemporal distribution of urban population at high resolution–value for risk assessment and emergency management. In *Geographic information and cartography for risk and crisis management* (pp. 53-67). Springer, Berlin, Heidelberg.
5. Richardson, H. W. (1981). *Defining urban population distribution goals in development planning.*
6. Small, C. (2001, October). Global analysis of urban population distributions and the physical environment. In *Proceedings of the Open Meeting of the Human Dimension of Global Environmental Change Research Community, Brazil Academy of Science, Rio de Janeiro, Brazil* (pp. 6-8).
7. Small, C., & Naumann, T. (2001). The global distribution of human population and recent volcanism. *Global Environmental Change Part B: Environmental Hazards, 3*(3), 93-109.
8. Tian, Y., Yue, T., Zhu, L., & Clinton, N. (2005). Modeling population density using land cover data. *Ecological Modelling, 189*(1-2), 72-88.
9. Yaukey, D. (1985). *Demography: The study of human population*

Benchmark 11.1.3.2: Assess and describe the global distribution of natural resources and industries.

Topic 2: Natural resources and industries

Sub-topic:
- Global distribution of natural resources and industries

Skills: Analysis (evaluate).

Learning Objectives: By the end of the topic, students will be able to:

- Assess and describe the global distribution of natural resources and industries.
- Using available information, maps and tables, explain the global distribution of natural resources and industries.
- Analyse and discuss the impact of this relationship on development and people.

Content Background

PNG's economy, natural resource and industries

- The main economic activities come from major industries in these sectors: Agriculture and Livestock, Forestry, Mining and Petroleum, Tourism and Hospitality, Fisheries and Marine resources, Manufacturing, Retailing and Wholesaling, Building and Construction, Transport and Telecommunications, and Finance, Business and Trade.
- Main natural resources in PNG include: timber, precious metals such as gold, silver and copper and bauxite used in producing aluminum and is recently added to PNG's export trade list., food and water (food is becoming an important export resource for PNG).
  (Source: Retrieved from http://www.cultureofthecountryside.ac.uk/resources/minerals-and-natural-materials-papua-new-guinea)
- PNG's economy: underdeveloped, dominated by agriculture, forestry and fishing sector which makes up the labour force.
- Mineral and energy extraction sector makes up most of PNG's GDP and accounts for most of PNG's export earnings. Most proceeds earned from this sector goes to infrastructural development in towns and cities like Port Moresby and Lae.
  (Source: Adapted from PNG Economics, a blog by former Australian and Papua New Guinean Treasury official, Paul Flanagan)

PNG industry, resource and impacts to development

- PNG's economy is dependent on imports of manufactured goods and its industrial sector excluding mining contributes very little to its exports.
- PNG has a small scale industry producing mainly beer, soap, concrete products, clothing, paper products, matches, ice cream, canned meat, fruit juices, furniture, plywood, and paint.
- Main constraints and challenges to large scale industries are: small domestic markets, rela-tively high wages and increased transport costs.
- Weak laws and high corruption and tax evasion in the country has

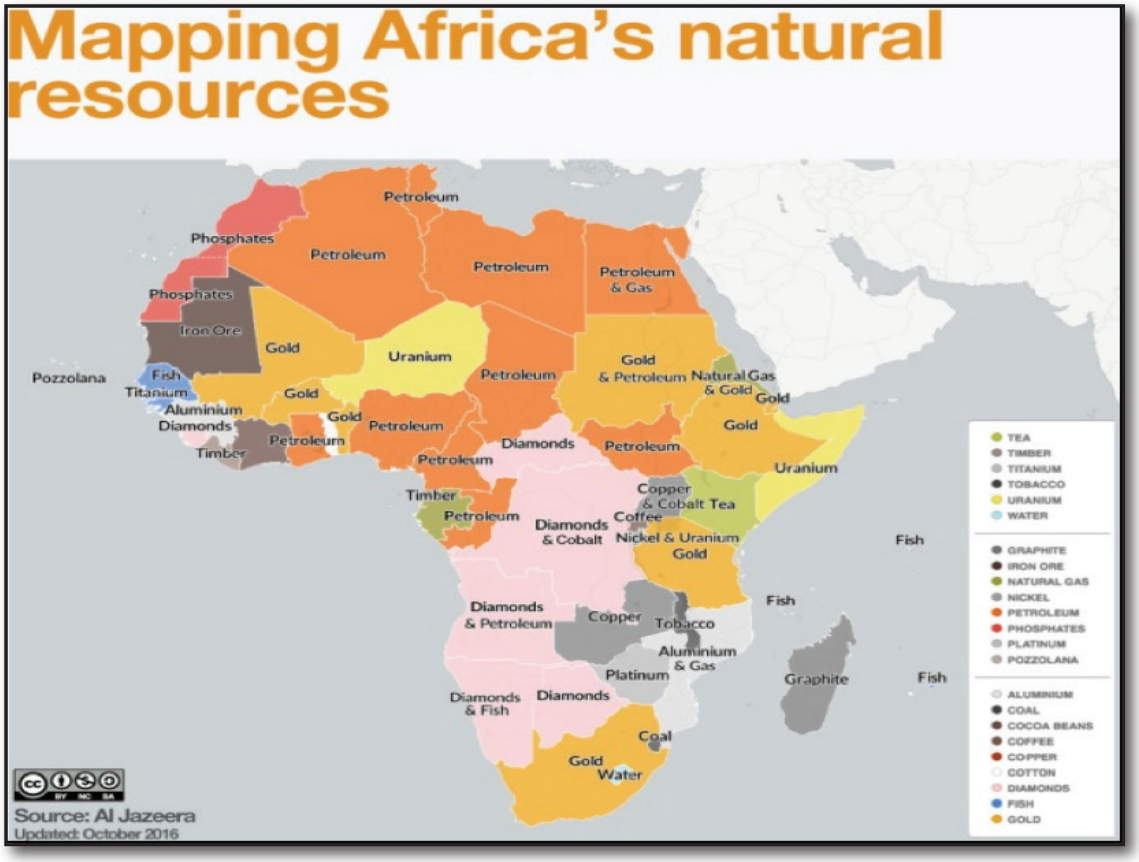
hindered development progress.

- There is a strong relationship between resources and armed conflicts and the historical processes in which they are embedded. A good example is the Bougainville Crisis. (Adapted: Le Billon, P. 2001).
  (Source: https://www.worldenergy.org/assets/images/imported/2016/10/World-Energy-Resources-Full-report-2016.10.03.pdf)

Global distribution of natural resource and industries *(adapted from Castells, M., & Sheridan, A. (1977).*

- **Uneven distribution of resources:** There is an uneven distribution of resources around the world just as population is unevenly distributed.
- **Availability of resources:** This uneven distribution of resources around the world contributes to the problem of limited resources. Areas or places with high population density may not have abundant resources to sustain its population. This led countries to trade and build industries so they can produce and provide for the resources they may not have. For example, Japan lacks resources so it imports raw materials (resources such as minerals) and builds industries and factories to produce goods it does not have and export others to countries that needs it.
- **Problem of resource scarcity:** The problem of limited resources known as 'scarcity' is one of the basic economic problems that countries face across the world today. While resources are limited to meet the increasing global demand for goods and services, countries have to choose to make trade-offs. A decision to produce one good requires a decision to forgo or produce less of other goods (opportunity cost). Another method governments use to solve the problem of scarcity is by increasing prices of certain goods but ensuring that the poorest countries must afford to pay for that good.
- **Globalisation:** is a process where people, ideas and goods have spread across the entire world increasing more interactions and integration between the world's cultures, government and economies. As more countries become globalized, resources travel across different economies of the world in the hope of solving the basic problem of scarcity. However, on the other hand, new problems arise such as poor countries not able to afford certain goods and services due to the cost and distance. Thus problems of resource scarcity remain different for different countries.
- **Technical expertise:** Uneven distribution of resources on the other hand, means that countries can now build industries to manufacture and produce goods and services. In order to do that, they need technical expertise.
- **Type of industry:** The type of industry a country has very much depends on the type of resources it is able to utilise. For example, Japan has few natural resources but has well trained human resources. They have technological industries that produce technological products and sell them at a cheaper rate to countries that do not have it.

Industries depend on the type of resources available in a particular location. For example, Botswana, Angola and the Democratic Republic of Congo have diamond and so have a diamond mining industry that makes up most of these countries' revenue whereas in PNG, most of the population have rural base agricultural livelihoods which results in agriculture industry and gold and copper resources contribute to its mining industry. Maritime provinces and coastal locations will have a fisheries industry.



(Source: http://worldpopulationreview.com/countries/third-world-countries/. 24th Oc-tober, 2019.

Global industries, resources and impacts on development and people

- globalisation is the force driving today's movement of resources and industries across the world even claiming and enhancing the control power on top cities of the world.
- The development of improved transport systems and communication technologies have greatly enhanced multicorporations' economic activities along the value chains across different locations. For example: China's Open Door Policy has encouraged and increased multicorporations' referred to as MNCs to enter Chinese markets and increase their resource commitments and expand their geographical boundaries in China. Many of these MNCs have formed spatial clustering in industries. *(Source: He, C. F., & Xiao, X. J. 2011).*

Note: *Teachers can expand using global and local examples. In PNG, chain shops owned by Asians are clustering and growing in all towns and cities of PNG as mining and agriculture industries boom.*

- Globalisation of industries, resources and development has also posed greater challenges on country's security. For example; In the 1990's, many

armed groups have relied on revenues from natural resources such as oil, timber, or gas to substitute for cold war sponsorship.

- Resources not only financed, but in some cases motivated conflicts, and shaped strategies of power based on the commercialization of armed conflicts and the territorialisation of sovereignty around valuable resource areas and trading networks. *(Source: Le Billon, P. 2001).*
- In PNG, mining laws are amended to safeguard resource exploitation; however, high corruption and abuse of proper processes hinder development, thus affecting other sectors like health and education. This in turn affects population distribution in the country as more people migrate to urban areas and resource locations or cluster in project sites.
- Risks of violence and rise of armed rebel groups often results from the populations' dependency on a natural resource rather than the problem of scarcity or abundance. *(Adapted: Bannon, I., & Collier, P. 2003).*

Suggested Resources

1. Bannon, I., & Collier, P. (2003). Natural resources and conflict: What we can do. *Natural Resources and Violent Conflict, Options and Actions*, 1-16.
2. Castells, M., & Sheridan, A. (1977). The urban question: a Marxish approach. *Social Structure and Social Change,* (1).
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7. Mather, A. S. (1990). *Global forest resources.* Belhaven Press.
8. Parker, B. *Geography for global citizens.* Macmillan Education AU, 2008.

Benchmark 11.1.3.3: Analyse the factors that influence the distribution of natural resources.

Topic 3: Distribution of natural resources

Sub-topic:
- Factors affecting distribution of natural resources

Skills: Critical thinking skills (analysis)

Learning Objectives: By the end of the topic, students will be able to:

- Identify the factors that affect the distribution of natural resources.
- Explain how these factors affect the distribution of natural resources.
- Justify the connection between natural resources and economic growth.

Content Background

What are resources?

A natural resource is anything that is available in nature that people can use. Natural resources are produced without human intervention. Examples are: air, water, wood, oil, wind energy, iron and coal are examples of natural resources.

Human resources mean people and people who are skilled and trained to do the job. It includes the physical muscles to do work as well as the knowledge and skills acquired through education and experience found in humans.

Types of natural resources

1. Renewable resources
   Renewable resources are resources that are available for use over a longer period of time. It is infinite in supply. Examples of renewable resources include: forest, air, water, sunlight, soil, stone, plants, animals. However, some of these renewable resources are now threatened by human activities and now termed as 'potentially renewable resources'. They include fresh air, fresh water, fertile soils and biodiversity.

2. Non-renewable resources.
   Non-renewable resources are resources that are limited in supply and can run out in the future. Examples of non-renewable resources are: fossil fuels, minerals, LNG gas, petroleum, minerals etc. They take hundreds of millions of years to be produced by earth.

Difference between renewable and non-renewable resources	
Renewable resources	Non-renewable resource
It can be renewed as it is available in infinite quantity	Once completely consumed, it cannot be renewed due to limited stock
Sustainable in nature	Exhaustible in nature
Low cost and environmentally friendly	High cost and less environmentally friendly
Replenish quickly	Replenish slowly or do not replenish at all

Four most important natural resources that need to be used sustainably;

1. Fresh air
3. Fertile soil
2. Fresh water
4. Biodiversity (plants and animals)

These resources termed as 'potentially renewable resources' are now under serious threat because of pollution, overharvesting, global warming, coral bleaching and deforestation.

1. **Fresh Air:** Living things need fresh air to survive. Today, pollution through addition of various air pollutants together with changing proportions of greenhouse gases is affecting the optimum range of living organism. Bush fires triggered by high summer temperatures and deforestation for plantation agriculture is also affecting air quality.

2. **Fresh Water:** Fresh, clean water at the right pH value is useful for living things. Today, water pollution of various forms from acid rain, global warming sedimentation, eutrophication, mercury poisoning and pollution by hydrocarbons (oil spills) are threatening living species in the soils, fresh water systems like lakes and rivers and the seas. Fresh water is both a habitat and a resource for all living things.

3. **Fertile Soil:** A good fertile soil is made overtime by a good combination of rock minerals, organic matter (both dead and living), water and gases. Today, population increase has resulted in larger areas of arable land being cultivated to meet the needs of the growing population. Human's careless practices have also resulted in top soil being eroded by wind and water while desertification is encroaching new areas as deserts intensity.

4. **Biodiversity:** The role of biodiversity is immense. Humans eat plants and animals from the land, sea and fresh water systems. Humans also take in air (oxygen) from the environment from plants through the carbon cycle during photosynthesis. Humans also gather their building materials and clothes and fuel for cooking and keeping themselves warm from plants and animals. Humans also enjoy their life given the diversity of plants and animals. Different plants and animals in turn perform different ecological roles to make earth and interesting place to live. Unfortunately, deforestation, pollution, global warming, sedimentation, eutrophication, coral bleaching, acid rain, forest fires, overharvesting and increased human population are affecting biodiversity through species loss and eventual species extinction.

Factors affecting the distribution of natural resources

- Resource distribution is defined as the geographic occurrence or spatial arrangement of resources on earth (location).
- Natural resources are not evenly distributed all over the world. Some places are more endowed than others - for instance, some regions have lots of water (and access to ocean and seas) while others have water shortage.
- The distribution of resources is unequal because these factors differ from country to country and from place to place on this earth.

- The distribution of natural resources depends upon many physical factors like, land, climate and altitude.
- Australia is an oldest continent and is rich in minerals. It is a dry and arid continent and has large cereal and dairy farms found in areas where rainfall does not exceed 15-12 inch. This is an example of how rainfall affects the distribution of resources and influences the type of industry each region or location in Australia has.
- Some also get a lot of income from their resources in the form of tourism and recreation. For example, Fiji generates most of its income from tourism while PNG generates most income from agriculture and marine resources. Japan has fewer natural resources but receives most of its income from utilising its human resource who are technical experts in technology.

The connection between natural resource and economic growth

The following questions are adapted from Gylfason, T. (2002). *Ideas for teachers to expound on*

- What is the connection between natural resources and economic growth?
- What are the advantages and disadvantages?
- Why does PNG has abundance of natural resources but slow economic growth compared to Fiji with limited natural resources but strong economic growth?
- What can be done to improve PNG's economic development with the available resources? Explain how that will affect economic decision making in terms of global trade-offs (opportunity costs).

Impact of land use and development

Urbanisation means land is converted into urban settings, with development projects, new houses and shopping centers built, office spaces and parking sites are developed and road networks established and industrial sites created. The impact on natural habitat and living organisms is that it takes away the habitats and changes the landscape affecting the natural environment. Man-made development does affect location of natural resources. Many of modern land use development practices have contributed to loss and destruction of millions of acres of land and natural environment which are habitats to plants and animals.

Lifestyle of the 21st Century

The lifestyle of people in this era has greatly threatened the sustainability of natural resources. Increase in demand for comfortable lifestyle and modern goods and services like clothing and entertainments, food and shelter, education and health, recreation and sports means that more resources are needed to increase production. This simply means more industries, more energy and more resources is needed to increase production to meet this demand.

Suggested Resources

1. Castells, M., & Sheridan, A. (1977). The urban question: a Marxish approach. *Social Structure and Social Change,* (1).
2. Gylfason, T. (2002). Natural resources and economic growth: what is the connection?. *In Fostering Sustainable Growth in Ukraine* (pp. 48-66). Physica, Heidelberg.
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5. Parker, B. *Geography for global citizens.* Macmillan Education AU, 2008.
6. Wilkinson, P.R. (1970). Factors affecting the distribution and abundance of the cattle tick in Australia: observations and hypothesis. *Acarolgia,* 12(3), 492-508.

Benchmark 11.1.3.4: Investigate the factors that influence the distribution of industries.

Topic 4: Distribution of industries

Sub-topic:
- Factors affecting distribution of industries

Skills: Critical thinking (investigate)

Learning Objectives: By the end of the topic, students will be able to:
- Ascertain the factors that influence the distribution of industries.
- Expound on how these factors influence the distribution of industries.

Content Background

Following the Industrial Revolution, an estimated one third of the economic output comes from manufacturing industries. An industry is a sector that produces goods or services within an economy and is a major indicator of the source of revenue and what industry it is classified under. Industries are important because they help in increasing employment opportunities and economic development.

It also increases rural and urban growth of a country and contributes to the development of a country's economic growth.

The distribution of industries is influenced by the availability of resources and the technical expertise in manufacturing the resources into goods and services to meet the increasing needs and wants. For example, coastal and maritime locations will have fishing industries while locations with gold, copper and other minerals will have mining industries.

Geographical factors

1. Raw materials: Availability of natural resources that can be used as raw materials. Raw materials are one of the important factors in an industrial location. The mere location of the industries itself may be determined by the availability or location of the raw materials.

2. Technology: To turn the resource into an asset with value. Thus industries may be located where the source of power or energy is, example a river.

3. Power: To utilise the technology. Be it convectional (coal, mineral or hydro-electricity) or onconventional in nature is a necessity for any industrial establishment Thus industries may be located where the source of power or energy is.

4. Labour: Human resource in the area who function as labour to run the processes. Availability of labour or skilled workforce is the success mantra for the growth of all industries. Therefore, some industries are located where there is a pool of human resource or labour.

5. Transport: Road/rail/sea connectivity. Availability of easy transportation always influences the location of the industry. So the junction points of waterways, roadways, and railways become humming centres of industrial activity.

6. Storage and warehousing: Some industries need huge space or need to be located away from residential areas for safety.

7. Marketing feasibility: The finished goods should reach the market at the end of the process of manufacturing. Thus nearness to the market is an add-on quality in the process of selecting a location for industry.

8. Characteristics of land and soil: Characteristics of land and soil: The site that is selected for the establishment of an industry must have adequate land area. For instance, a swampy area may not be suitable for setting up an industry.

9. Climate: The climate of the area selected for the industry is important, very harsh climate are not suitable for the successful industrial growth.

10. Precipitation and water resources: Availability of water is another factor that influences location of industries. Many industries are established near rivers, canals, and lakes, because of this reason. Iron and steel industry, textile and chemical industries require large quantity of water, for their proper functioning. Agriculture is also an industry that thrives on water.

11. Vulnerability of natural resources: Some resources are vulnerable and some are fragile and perishable so the industries are located where they are extracted or produced or grown.

Other non-geographical factors include;

1. Capital Investment: Capital or huge investment is needed for the establishment of industries.

2. Availability of loans: Available grants and financial incentives from the governments. Sometimes, the government provides incentives like subsidized power, lower transport cost, and other infrastructure so that industries may be located in rural and remote areas.

3. Investment climate: Industrial inertia is the predisposition of industries or companies to avoid relocating facilities even in the face of changing economic circumstances that would otherwise induce them to leave. Often the costs associated with relocating fixed assets and labor far outweigh the cost of adapting to the changing conditions of an existing location.

4. Government policies/regulations: Government policies are another factor that influences industrial location. The government sets certain restriction in the location of land for industries in order to reduce regional disparities, to control excessive pollution and to avoid the excessive clustering of industries in big cities.

5. Influence of pressure groups: For example Greenpeace, anti-logging groups etc. It can also be population that entirely depends on particular resources. For example: The Sepik River people will mobilise to form pressure groups on the river system, Sepik Crocodile Festival can influence the Tourism Industry and enhance revenue.

6. Efficient and enterprising organisation and management: These are essential for running the modern industry successfully.

7. The location: The location that has better banking facilities and insurance are best suited for the establishment of industries. Urbanization refers to the number of urban dwellers while industrialisation refers to the number of industries.

It is often impossible to find all these factors at one location. For example, manufacturing activity is located at the most appropriate place where accessibility to all the factors of industrial location is available at a lower cost. After an industrial activity starts, urbanisation will follow. Urbanisation refers to the number of urban dwellers while industrialisation refers to the number of industries. This means industrialisation and urbanisation go hand in hand because cities and towns provide markets and banking services for industries.

Industrial productivity depends on;

- Technological Development
- Quality of Human Resource
- Availability of Finance
- Managerial Talent
- Government Policy
- Natural Factors

Suggested Resources

1. Aguilar, F. X., Goerndt, M. E., Song, N., & Shifley, S. (2012). Internal, external and location factors influencing cofiring of biomass with coal in the US northern region. *Energy Economics, 34*(6), 1790-1798.
2. Epperson, T. E. (1960). Geographic factors influencing the manufacturing industries of Upper East Tennessee.
3. Holt, J., Purcell, W. R., Gray, S. J., & Pedersen, T. (2008). Decision factors influencing MNEs' regional headquarters location selection strategies. In *Thought Leadership in Advancing International Business Research* (pp. 104-133). Palgrave Macmillan, London.
4. Kathuria, V., & George, A. S. (2005, November). Spatial location of Industries–Factors influencing locational choice. In *Conference 2nd Annual Conference on Economic Growth and Devel-opment.*
5. Luo, L., Brennan, L., Liu, C., & Luo, Y. (2008). Factors influencing FDI location choice in China's inland areas. *China & World Economy, 16*(2), 93-108.
6. Mauri, A. J., & Phatak, A. V. (2001). Global integration as inter-area product flows: The internalization of ownership and location factors influencing product flows across MNC units. *MIR: Management International Review,* 233-249.
7. Wei, L. (1983). A study on the factors influencing the Location selection for light industry in china [J]. *Acta Geographica Sinica, 3.*

Unit 4: People and Environment

Content Standard 1.4: Students will be able to evaluate how geographic processes and human actions modify the environment and how the modified environment affects humans.

Benchmark 11.1.4.1: Use research skills to investigate and discuss the structure and the composition of the earth.

Topic 1: The structure and composition of the earth

Sub-topics:
- The composition of the earth
- The structure of the earth

Skills: Analysis (investigate).

Learning Objectives: By the end of the topic, students will be able to:

- Identify and explain the composition of the earth.
- Examine the structure of the earth and the important minerals and rocks each contain.
- Illustrate the layers of the earth.
- Investigate the composition of the earth structure and relate its importance in how it is able to sustain the earth (state of equilibrium).

Content Background

The earth is a fragile ball of interacting processes in the solar system and is the only planet with every ingredient to support life that evolved 3.5 billion years ago. The earth itself was formed 4.6 billion years ago.

Four main spheres that make up the earth we live in are;
1. Atmosphere (zone of gases)
2. Biosphere (zone of life that contains all the living things - plants and animals)
3. Hydrosphere (zone of water that consists of the water cycle, oceanography- the study of oceans, waters, lakes and the icebergs)
4. Lithosphere (zone of rocks and soil and contains the earth's structure)

Each of these four spheres have other interacting systems working in them, (water cycle, river systems, river erosion, plate tectonic,) to give the earth a state of equilibrium the earth's ability to sustain itself. Many human activities around the world have put a lot of pressure on most of these systems, and some of the effects of this are the current global warming affecting the world today.

Let us look at;

Lithosphere: Earth's structure and its composition

(This section was adapted from Bunnet. R.B. (1965).)

The earth's structure – the different layers that make up the earth and is divided into four major components. The internal structure of the earth is layered in spherical shells: an outer silicate solid crust, a highly vicious than mantle, and a solid inner core, each layer with its own physical properties.

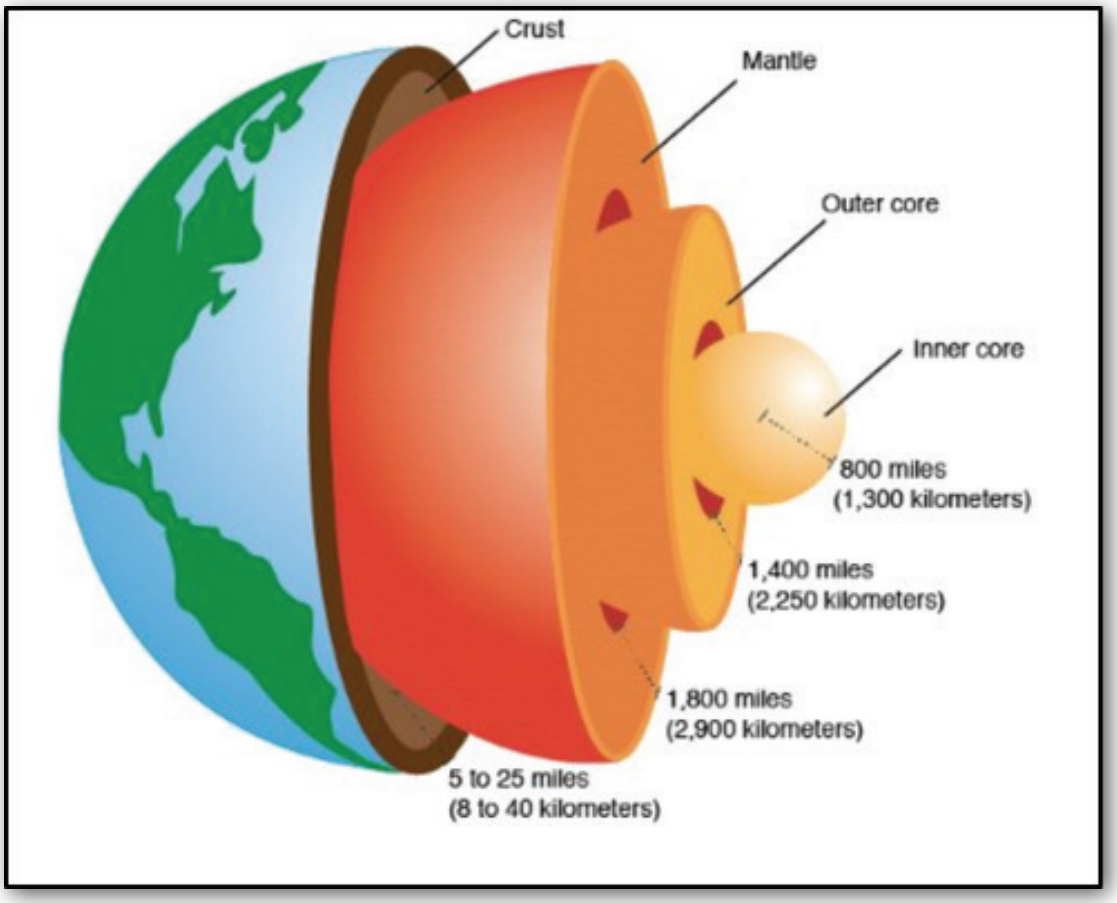
Crust, mantle, outer core and the inner core

The outer core and the inner core are responsible for the movement in the mantle by convection currents (hot air) rising from the hot molten rocks in the inner core and causes earthquakes and volcanic eruptions.

Earths layers	Description and thickness	Mineral composition
The crust	This is the layers on which you stand on. All the mountains, jungles, oceans and rivers you know are carried on this layer. It is the thinnest layer of the four layers.	The crust is mostly composed of silica, alumina, lime, magnesia, and iron iron oxide (rust).
Oceanic crust	Oceanic crust is some 5 to 6km thick and is slightly denser than the continental crust.	Mainly basalt
Continental crust	It is light in density and is 50 to 70 km thick.	Mainly granite and sedimentary rocks.
Mantle	This layer starts below the crust and is denser than the crust. It is 3,000km thick (Africa and Europe). In this layer, the rocks are constantly in motion; They rise and sink due to internal heat from the core, and set up the convective currents that also cause tectonic plates to move and crash into each other causing earthquakes.	Mostly composed of silicate rocks rich in magnesium and iron. At some location, the rock is completely melted, which is called magma. When this magma reaches near the crust, it erupts as lava from volcanoes.
Outer core	This layer of the earth is in a liquid state at a temperature of 5000°C and is 5,100km thick from the crust. The outer core is always in constant circulatory motion, which creates a magnetic field around the earth. This magnetic field protects our earth from the sun's deadly wind. Without this magnetic field, out earth would never have atmosphere, oceans and life.	This layer is mostly made of iron and nickel. Both of these two metals are in a liquid state due to intense heat.
Inner core	This is the hottest layer of the earth. It is 6, 370km from the crust reaching a temperature of 7,000°C; much hotter than the surface of the Sun.	It is also composed of iron and nickel metal but this layer is in the solid state, despite the fact that it is the solid part of the Earth. This is due to the tremendous pressure from the weight of other layers.

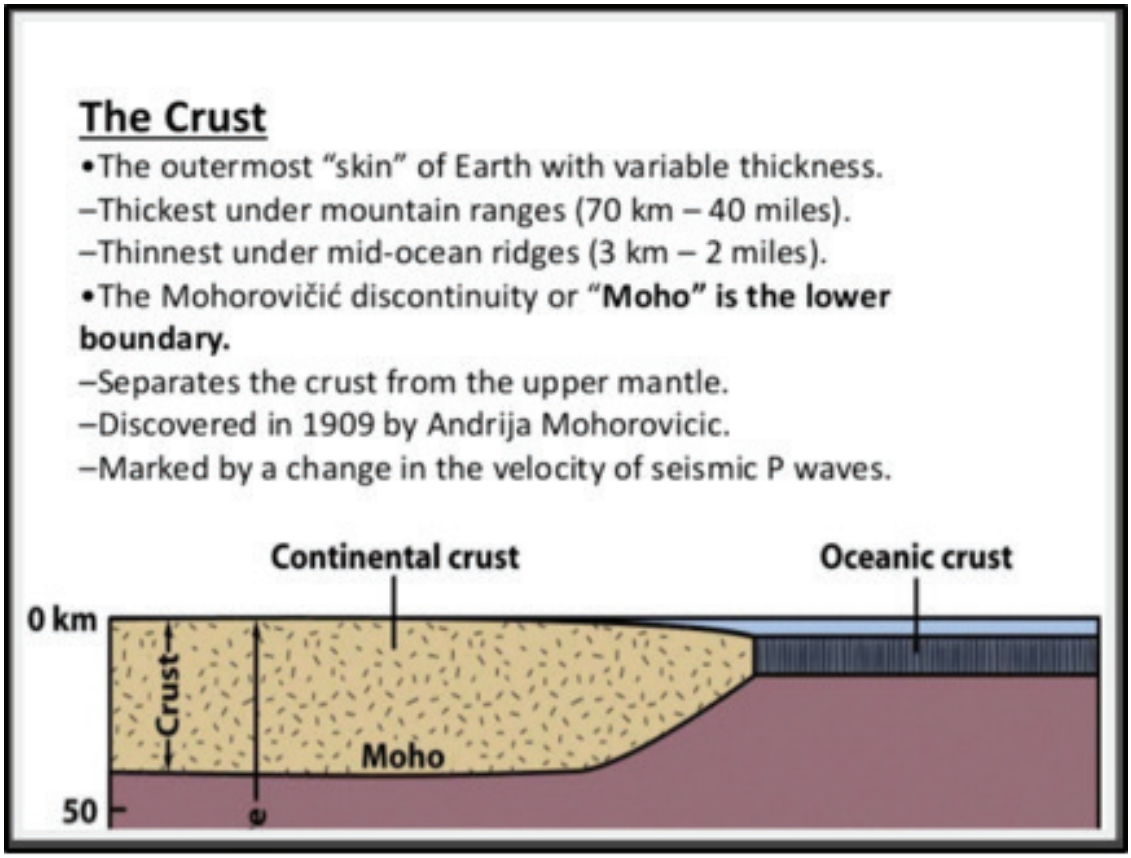
Source: Bunnet R, B. (1965)

Structure in diagram



Source: https://www.shutter.com/search/earth+core

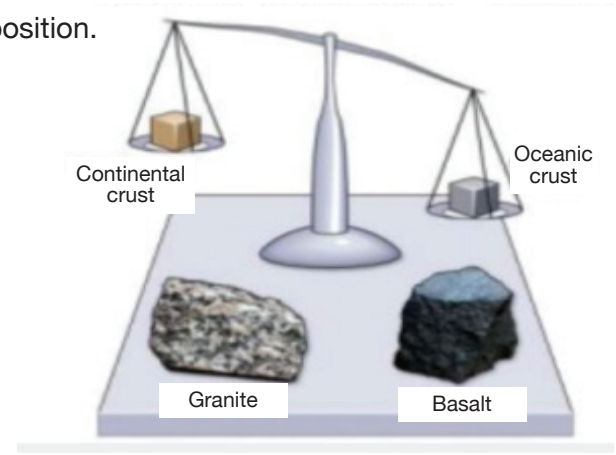
The Crust



Source: Abdul Wahab (2019). Composition of the Earth

Two Types of Crust
•Continental crust – Underlies the continents.
–Avg. rock density about 2.7 g/cm3.
–Avg. thickness 35-40 km.
–Felsic composition. Avg. rock type = Granite
•Oceanic crust – Underlies the ocean basins.
–Density about 3.0 g/cm3
–Avg. thickness 7-10 km.
–Mafic composition
Avg. rock type =
Basalt/Gabbro

- Crustal density controls surface position.
  Continental crust
  - Less dens; "floats higher"
  Oceanic crust
  - More dense: "floats lower"



Source: Abdul Wahab (2019). Composition of the Earth

Earth's mantle

- Solid rock layer between the crust and the core.
- 2,885km thick, the mantle is 82% of Earth's Volume.
- Mantle composition = ultramafia rock called periodotite.
- Below ~ 100-150km, the rock is hot enough to flow.
- It convects: hot mantle rises, cold mantle sinks.
- Three subdivisions: upper, transitional, and lower

The core

- An iron-rich sphere with a radius of 3,471km.
- 2 components with differing seismic wave behaviour.
- Flow in the outer generates the magnetic field.

Outer core	Inner core
Liquid iron-nickel-sulfur	Solid-nickel alloy
2,255km thick	Radius of 1,220km
Density - 10-12g/cm3	Density - 13g/cm3

Some facts about the planet earth

- Earth is the only planet, where life is found.
- It is the third planet from the Sun.
- It has only one moon, called Luna
  (Source: Abdul Wahab (2019)

Suggested Resources

1. Abdul Wahab, *"Composition of the Earth",* in *Science4Fun, October 23, 2019, http://science4fun.info/composition-of-the-earth/.*
2. Bunnet.R.B. (1965). *Physical Geography in Diagrams,* Addision Wesley Longman Singapore Pte Ltd, Singapore.
3. Squire. Stan. (1998). *Interactions in Physical Geography Today,* Kyodo Printing Company, Singapore.

Benchmark 11.1.4.2: Investigate the natural processes occurring inside and outside the earth's crust and the associated outputs, landforms, risks and hazards, and assess the social, economic, political, and environmental consequences.

Topic 2: Natural processes within and outside the earth's crust

Sub-topics:
- Internal processes (inside the earth's crust)
- External processes (outside the earth's crust)

Skills: Analysis (investigate)

Learning Objectives: By the end of the topic, students will be able to:

- Investigate the processes occurring inside of the earth's crust.
- Examine the processes occurring outside of the earth's crust.
- Distinguish between geological agents and processes and classify them into external and internal processes.
- Identify the associated outputs from the internal and external processes.
- Assess the social, economic, political and environmental consequences of natural processes.

Content Background

The earth consists of four important spheres as learnt earlier. These spheres comprises of different systems and processes happening in an interrelated interactions to sustain life. The processes acting on the lithosphere can be internal and external and are responsible for either building the land and or wearing down of the land.

1. The Internal processes refers to the processes that occur within the earth's crust. They are;
   i. Folding and faulting (diastrophism)
   ii. Volcanism (the escape of magma)

2. External processes takes place outside the solid earth. They are;
   i. Weathering
   ii. Erosion
   iii. Deposition

The earth's surface has been subjected to numerous changes and phenomena known as geological processes. Cliff erosion, a volcanic eruption, or sedimentation at a mouth of a river are examples of these geological processes. The geological agents responsible for these processes are:
- waves
- the internal heat of the earth, or
- rivers

Geological agents and processes are classified as internal and external.

Internal processes

1. Internal geological agents and processes are driven by the heat that is stored in the earth's interior and occurs far from the earth 'surface. The main internal geological agent is the movement of the lithospheric plates called tectonics. Tectonic plate movements are respon-sible for some of the world's catastrophic events such as earthquakes and volcanic eruptions.
2. Others are the movement of the continents, opening new and closing old seas and forming of mountain ranges.
3. This dynamic internal process links the core, the mantle and the crust.
4. The main internal geological agent is the movement of the lithospheric plates.

It can be said that internal geological processes build the earth's relief (mountains/landforms).

Table below shows the internal and external forces and the outputs that are produced from the processes from these two forces. Information below *adapted from Bunnet. R.B. (1965) and Squire. Stan. (1998).*

Forces which produces physical features	
A. Internal (operate within the earth's crust)	
1. Earth movement	**Landforms/Outputs**
i. Vertical	Up and down movement of the earth's crust causing faults in the crustal rocks producing features such as: plateaus, block mountains (horsts); basins and some types of escarpments
ii. Lateral	Sideways movements of the crust causing folding of the crustal rocks which produces features like: fold mountains; rift valleys; horsts, block mountains.
2. Volcanic Eruptions	**Landforms/Outputs**
i. External	Lavas reach the earth's surface and produce features such as: lava plains and plateaus, volcanic cones; geysers;
ii. Internal	Lava solidifies within the earth's crust and forms features such as: dykes; sills; batholiths; laccoliths.
B. External (operate on the earth's surface)	
1. Denudation	**Landforms/Outputs**
i. Weathering	The breaking up of rocks into soil particles by heating and cooling, chemical actions and the actions of living things. These produce features such as: soil, earth pillars (by rain action); screes.
ii. Erosion	Is the breaking up of rocks into soil particles by wind, water and ice which produce features such as: valleys, pen plains, cliffs, river and coastal features such as beaches, meanders, ox-bow lakes, gulleys, silt, escarpments, desert features such as sand dunes.
iii. Transportation	The movement of rock particles by wind, water and ice causing movement of plant seeds to other areas.

2. Deposition (agents)	Landforms/Outputs
i. Water	Features produced by water and sea deposition: flood plains; levees; alluvial fans; deltas; beaches; lake plains; marine alluvial plains
ii. Ice	These features are produced by ice sheets and galley deposition: boulder clay plains; outwash plains; moraines; drumlins; eskers.
iii. Wind	The following features are produced by wind deposition: loess plains; sand dunes
iv. Living organisms	Living organisms also produce landform features by excreting their waste; for example coral polyps secretes calcium to form coral. Worms excrete soil particles to form soil found on the humus layer of the crust.
v. Evaporation and precipitation	The deposited features from evaporation and precipitation processes forms feature such as salt.
vi. Organic matter	Organic matter when compressed under immense pressure for thousands of years in layers is deposited as coal deposits.

Source: Bunnet R, B. (1965) and Squire S. (1998)

External processes

- External geological agents and processes affect the earth's surface. They are powered by solar energy.
- The external agents that carry out this process are: water, ice wind, atmosphere living things and human beings. They include all the changes that alter or wear down the rocks and deposit materials resulting from erosion.
- Internal agents and processes tend to lift and build the earth's relief from the interior.
- External agents and processes tend to destroy and shape the earth's relief.

Although, processes such as volcanic eruption and earthquakes affect the earth's surface, they clearly originate in the earth's interior. Therefore, they are internal processes.

Both internal and external geological agents need a source of energy to drive them so that processes can take place. These driving forces are:

1. **Earth's internal heat:** the internal heat stored in the earth is responsible for our planet being geologically active. The origin of this heat comes from two sources:
    i. Energy stored since the beginning of the earth's formation resulting from the collision of a body of moving gas particles, namely hydrogen and helium particles.
    ii. The rest is generated by the disintegration of radioactive elements.

This internal heat generates convection currents in the mantle, which behaves like an extremely thick liquid. When the materials in the interior heats up, they expand, become less dense and rise. As they cool, they descend and continue the cycle.

2. **Geothermal gradient:** refers to the increase in temperature as you go down deeper (depth) into the earth's interior and is an indicator of the earth's internal heat. The average gradient on the continents is 30°C per km, although the values are higher in active volcanic areas and lower in old cratons.

3. **Solar Energy:** it is the energy mostly responsible for driving processes from external agents shaping relief on the earth's surface. This energy creates differences in temperature in air masses, causing winds. It also powers the water cycle as it allows the evaporation of large quantities of water from the oceans that fall on the continents in the form of rain or snow.

4. **Gravity:** Gravity plays an important role in both external and internal geological processes. It contributes to the formation of convection currents in the earth's interior, in which cold, dense materials sink and are replaced by hotter and lighter materials that rise (convection current). On the surface, gravity causes water and ice to accumulate on the continents and move towards the sea, forming rivers and glaciers which erode and shape rocks along their courses. In addition, gravitational pull is responsible for one of the movements of the sea: the tides.
   Above information retrieved from Source: (https://www.blinklearning.com/coursePlayer/classes2.php?idclase+19028789&idcurso=453599)

Thought provoking activity:

1. Distinguish between geological agents and processes and classify them into external or internal.
2. Explain the role of gravity in the process of water erosion.
3. Explain how a glacier is moved by solar energy and gravity?
4. Why is the earth active, with internal dynamics, while the Moon, Mercury or Mars are geologically dead?

Suggested Resources

1. Bunnet.R.B. (1965). *Physical Geography in Diagrams,* Addision Wesley Longman Singapore Pte Ltd, Singapore.
2. Squire. Stan. (1998). *Interactions in Physical Geography Today,* Kyodo Printing Company, Singapore.

Standards-Based Lesson Planning

What are Standards-Based Lessons?

In a Standards-Based Lesson, the most important or key distinction is that, a student is expected to meet a defined standard for proficiency. When planning a lesson, the teacher ensures that the content and the methods of teaching the content enable students to learn both the skills and the concepts defined in the standard for that grade level and to demonstrate evidence of their learning.

Planning lessons that are built on standards and creating aligned assessments that measure student progress towards standards is the first step teacher must take to help their students reach success. A lesson plan is a step-by-step guide that provides a structure for an essential learning.

When planning a standards-based lesson, teacher instructions are very crucial for your lessons. How teachers instruct the students is what really points out an innovative teacher to an ordinary teacher. Teacher must engage and prepare motivating instructional activities that will provide the students with opportunities to demonstrate the benchmarks. For instance, teacher should at least identify 3-5 teaching strategies in a lesson; teacher lectures, ask questions, put students into groups for discussion and role play what was discussed.

Why is Standards-Based Lesson Planning Important?

There are many important benefits of having a clear and organized set of lesson plans. Good planning allows for more effective teaching and learning. The lesson plan is a guide and map for organizing the materials and the teacher for the purpose of helping the students achieve the standards. Lesson plans also provide a record that allows good, reflective teachers to go back, analyze their own teaching (what went well, what didn't), and then improve on it in the future.

Standards-based lesson planning is vital because the content standards and benchmarks must be comparable, rigorous, measurable and of course evidence based and be applicable in real life that we expect students to achieve. Therefore, teachers must plan effective lessons to teach students to meet these standards. As schools implement new standards, there will be much more evidence that teachers will use to support student learning to help them reach the highest levels of cognitive complexity. That is, students will be developing high-level cognitive skills.

Components of a Standards-Based Lesson Plan

An effective lesson plan has three basic components;

- aims and objectives of the course;
- teaching and learning activities;
- assessments to check student understanding of the topic.

Effective teaching demonstrates deep subject knowledge, including key concepts, current and relevant research, methodologies, tools and techniques, and meaningful applications.

Planning for under-achievers

Who are underachieving students?
Under achievers are students who fail or do not perform as expected. Underachievement may be caused by emotions (low self-esteem) and the environment (cultural influences, unsupportive family)

How can we help underachievement?
Underachievement varies between students. Not all students are in the same category of underachievement.

Given below a suggested strategies teachers may adopt to assist underachievers in the classroom.

- Examine the Problem Individually
  It is important that underachieving students are addressed individually by focusing on the student's strengths.
- Create a Teacher-Parent Collaboration
  Teachers and parents need to work together and pool their information and experience regarding the child. Teachers and parents begin by asking questions such as;
  - In what areas has the child shown exceptional ability?
  - What are the child's preferred learning styles?
  - What insights do parents and teachers have about the child's strengths and problem areas?

- Help student to plan every activity in the classroom
- Help students set realistic expectations
- Encourage and promote the student's interests and passions.
- Help children set short and long-term academic goals
- Talk with them about possible goals.
- Ensure that all students are challenged (but not frustrated) by classroom activities
- Always reinforce students.

Sample of Standards-Based Lesson Plan

To help teachers plan effective Standards-Based lesson plans, a sample lesson is provided here. Teachers are encouraged to study the layout of the different components of this lesson and follow this design in their preparation and teaching of each lesson. Planning a good lesson helps the teacher to focus on the essential knowledge, skills, values and attitudes that students are expected to learn and master at the end of the lesson.

NOTE FOR TEACHER

GIVEN BELOW IS A GRADE 10 SBC LESSON PLAN. USE THIS TO HELP YOU DESIGN YOUR LESSON PLANS FOR GRADE 11 GEOGRAPHY

Strand 1: Geography

Unit 1: Geography Skills

Content Standard 1.1: Student will be able to use geographical tools to locate and interpret information about people, places and environment.

Benchmark 10.1.1.1: Identify and explain the different types of population pyramids.

Topic 1: Types of population pyramid

Lesson topic: Expansive population pyramid

Grade: 10

Length of Lesson: 40 minutes

Essential knowledge, skills, values and attitudes:
Knowledge:

- Population pyramid
- Features of expansive population pyramid

Skill(s): Analysis (identify), Synthesis (sketch manually or using the computer), Evaluate (justify and make judgments as to why the structure is expansionary

Values: Be responsible by controlling the number of births per family

Attitudes: Appreciate the fact that there are varying population pyramids because of the size of the population in those countries

Performance indicator: Illustrate an expansive population pyramid with its features clearly labeled.

Materials:

Instructional Objective(s): By the end of the lesson, students will be able to;

- Identify and explain the features of an expansive population pyramid
- Sketch a simple structure of an expansive population pyramid

Essential Questions:

- What is a population pyramid?
- What are the features of an expansive population pyramid?

Lesson Procedure

Teacher Activities	Student Activities
Introduction (5 minutes)	
Ask questions in relation to the lesson topic. • Do you think the government takes care of you? • How does the government know you exist in Papua New Guinea? Build on the answers given by students to ask more relating questions about population pyramid. Tell the students the importance of learning about population pyramid.	Listen carefully and answer questions (possible answers) • Yes, by proving basic services like health and education etc… • Because my name is registered in the census book of PNG
Body (30 minutes)	
Modeling	
Show and explain a sample of an expansive population pyramid	Listen and observe
Guided Practice	
Ask students to name features of expansive population pyramid	Listen and answer questions
Independent Practice	
Give students handout showing expansive population pyramid Ask students to use the handout to do the following; • Identify features of expansive population pyramid • Name countries with such population pyramid Ask students to draw a sketch of the expansive population pyramid and describe its features	Use the handout to identify the expansive population pyramid Make a list by writing down the; • Features of expansive population pyramid • Name countries with such population pyramid Draw a sketch of the expansive population pyramid and describe its features
Conclusion (5 minutes)	
Ask students to name the features of an expansive population pyramid	Listen carefully and answer

Assessments, Reporting and Monitoring

What is Standards-Based Assessment (SBA)?

Standards-Based Assessment is an on-going and a systematic process of **assessing, evaluating, reporting** and **monitoring** students' performance and progression towards meeting grade and national level expectations. It is the measurement of students' proficiency on a learning objective or a specific component of a content standard and progression towards the attainment of a benchmark and content standard.

Purpose of Standards-Based Assessment

Standards-Based Assessment (SBA) serves different purposes. These include instruction and learning purposes. The primary purpose of SBA is to improve student learning so that all students can attain the expected level of proficiency or quality of learning.

Enabling purposes of SBA is to:

- measure students' proficiency on well-defined content standards, benchmarks and learning objectives
- ascertain students' attainment or progress towards the attainment of specific component of a content standard
- ascertain what each student knows and can do and what each student needs to learn to reach the expected level of proficiency
- enable teachers to make informed decisions and plans about how and what they would do to assist weak students to make adequate progress towards meeting the expected level of proficiency
- enable students to know what they can do and help them to develop and implement strategies to improve their learning and proficiency level
- communicate to parents, guardians, and relevant stakeholders the per formance and progress towards the attainment of content standards or its components
- compare students' performances and the performances of other students

Principles of Standards-Based Assessment

The principle of SBA is for assessment to be;

- emphasising on tasks that should encourage deeper learning
- be an integral component of a course, unit or topic and not something to add on afterwards
- a good assessment requires clarity of purpose, goals, standards and criteria
- of practices that should use a range of measures allowing students to demonstrate what they know and can do
- based on an understanding of how students learn
- of practices that promote deeper understanding of learning processes by developing students' capacity for self-assessment
- improving performance that involves feedback and reflection
- on-going rather than episodic

- given the required attention to outcomes and processes
- be closely aligned and linked to learning objectives, benchmarks and content standards.

Standards-Based Assessment Types

In standards-Based Assessment, there are three broad assessments types.

1. Formative Assessment

Formative assessment includes 'assessment *for* and *as*' and is conducted during the teaching and learning of activities of a topic.

Purposes of Assessment For Learning

- On-going assessment that allows teachers to monitor students on a day-to-day basis.
- Provide continuous feedback and evidence to the teachers that should enable them to identify gaps and issues with their teaching, and improve their classroom teaching practice.
- Helps students to continuously evaluate, reflect on, and improve their learning.
- Help teachers to make inferences about student learning to inform their teaching.
- Provide continuous feedback to both students and teachers which enables them to monitor progress, identify and address gaps and errors in learning.

Purposes of Assessment As Learning

- Occurs when students reflect on and monitor their progress to inform their future learning goals.
- Helps students to continuously evaluate, reflect, and improve their own learning.
- Helps students to understand the purpose of their learning and clarify learning goals.

2. Summative Assessment

Summative assessment focuses on 'assessment of learning' and is conducted after or at the conclusion of teaching and learning of activities or a topic.

Purposes of Assessment Of Learning

- Help teachers to determine what each student has achieved and how much progress he/she has made towards meeting national and grade-level expectations.
- Help teachers to determine what each student has achieved at the end of a learning sequence or a unit.
- Enable teachers to ascertain each student's development against the unit or topic objectives and to set future directions for learning.
- Help students to evaluate, reflect on, and prepare for next stage of learning.

3. Authentic Assessment

- Is performed in a real life context that approximates as much as possible, the use of a skill or concept in the real world.
- Is based on the development of a meaningful product, performance or process.
- Students develop and demonstrate the application of their knowledge, skills, values and attitudes in real life situations which promote and support the development of deeper levels of understanding.

Authentic Assessment Criteria

Authentic assessment refers to assessment that:

- Looks at students actively engaged in completing a task that represents the achievement of a learning objective or standard.
- Takes place in real life situations.
- Asks students to apply their knowledge, skills, values and attitudes in real life situations.
- Students are given the criteria against which they are being assessed.

Performance Assessment

Performance assessment is a form of testing that requires students to perform a task rather than select an answer from a ready-made list. For example, a student may be asked to explain historical events, generate scientific hypotheses, solve math problems, converse in a foreign language, or conduct research on an assigned topic. Teachers, then judge the quality of the student's work based on an agreed-upon set of criteria. It is an assessment which requires students to demonstrate that they have mastered specific skills and competencies by performing or producing something.

Types of performance assessment;

i. Products

This refers to concrete tangible items that students create through either the visual, written or auditory media such as;

- Creating a health/physical activity poster
- Video a class game or performance and write a broadcast commentary
- Write a speech to be given at a school council meeting advocating for increased time for health and physical education in the curriculum
- Write the skill cues for a series of skill photo's
- Create a brochure to be handed out to parents during education week
- Develop an interview for a favorite sportsperson
- Write a review of a dance performance
- Essays
- Projects

ii. Process Focused Tasks

It shows the thinking processes and learning strategies students use as they work such as;

- Survival scenarios
- Problem-solving initiative/adventure/activities
- Decision making such as scenario's related to health issues
- Event tasks such as creating a game, choreographing a dance/ gymnastics routine, creating an obstacle course
- Game play analysis

- Peer assessment of skills or performances
- Self-assessment activities
- Goal setting, deciding a strategy and monitoring progress towards achievement

iii. Portfolio
This refers to a collection of student work and additional information gathered over a period of time that demonstrates learning progress.

iv. Performances
It deals with observable affective or psycho-motor behaviours put into action such as;

- Skills check during game play
- Role plays
- Officiating a game
- Debates
- Performing dance/gymnastics routines
- Teaching a skill/game/dance to peers

Performance Standards

Performance Standards are concrete statements of how well students must learn what is set out in the content standards, often called the "be able to do" of "what students should know and be able to do." Performance standards are the indicators of quality that specify how competent a students' demonstration or performance must be. They include explanations of how well students must demonstrate the content, explaining how good is good enough.

Performance standards:

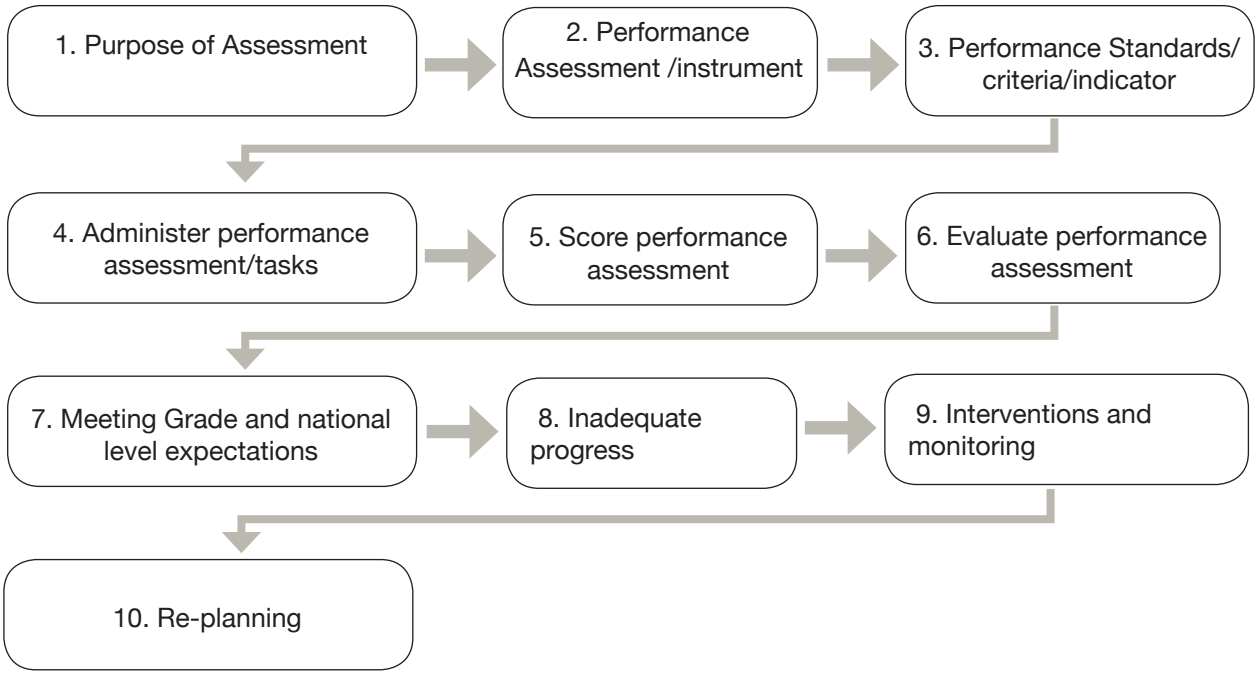
- measure students' performance and proficiency (using performance indicators) in the use of a specific knowledge, skill, value, or attitude in real life or related situations
- provide the basis (performance indicators) for evaluating, reporting and monitoring students' level of proficiency in use of a specific knowledge, skills, value, or attitude
- are used to plan for individual instruction to help students not yet meeting expectations (desired level of mastery and proficiency) to make adequate progress towards the full attainment of benchmarks and content standards
- are used as the basis for measuring students' progress towards meeting grade-level benchmarks and content standards.

Assessment Strategies

It is important for teachers to know that, assessment is administered in different ways. Assessment does not mean a test only. There are many different ways to find out about student's strengths and weaknesses. Relying on only one method of assessing will not reflect student's achievement. Provided in the appendices is a list of suggested strategies you can use to assess student's performances. These strategies are applicable in all the standards-based assessment types.
Please refer to Appendix 5 to see the suggested strategies.

There are different performance assessment methods and assessment strategies for assessing students' learning and performance on significant components of content standards.

Standards-Based Assessment Process



Scoring Students' Assessment

Assessment scoring methods describe how students' assessment tasks will be scored.

The most commonly used methods of scoring students' assessment are:

i. Checklists
ii. Rating Scales
iii. Rubrics

Students' performance is assessed and scored using:

i. a set of well-defined criteria
ii. performance standards or indicators,

Checklists, rating scales and rubrics are tools that state specific criteria and allow teachers and students to gather information and to make judgements about what students know and can do in relation to the standards. They offer systematic ways of collecting data about specific behaviours, knowledge and skills.

The quality of information acquired through the use of checklists, rating scales and rubrics is highly dependent on the quality of the descriptors chosen for assessment.

Checklists usually offer a yes/no format in relation to student demonstration of specific criteria. This is similar to a light switch; the light is either on or off. They may be used to record observations of an individual, a group or a whole class.

Rating Scales allow teachers to indicate the degree or frequency of the behaviours, skills and strategies displayed by the learner. Rating scales state the criteria and provide three or four response selections to describe the quality or frequency of student work.

Teachers can use rating scales to record observations and students can use them as self-assessment tools. Teaching students to use descriptive words, such as **always, usually, sometimes** and **never** helps them pinpoint specific strengths and needs. Rating scales also give students information for setting goals and improving performance. In a rating scale, the descriptive word is more important than the related number. The more precise and descriptive the words for each scale point, the more reliable the tool.

Effective rating scales use descriptors with clearly understood measures, such as frequency. Scales that rely on subjective descriptors of quality, such as fair, good or excellent, are less effective because the single adjective does not contain enough information on what criteria are indicated at each of these points on the scale.

Rubrics use a set of criteria to evaluate a student's performance. They consist of a fixed measurement scale and detailed description of the characteristics for each level of performance. These descriptions focus on the quality of the product or performance and not the quantity; e.g., not number of paragraphs, examples to support an idea, spelling errors. Rubrics are commonly used to evaluate student performance with the intention of including the result in a grade for reporting purposes. Rubrics can increase the consistency and reliability of scoring.

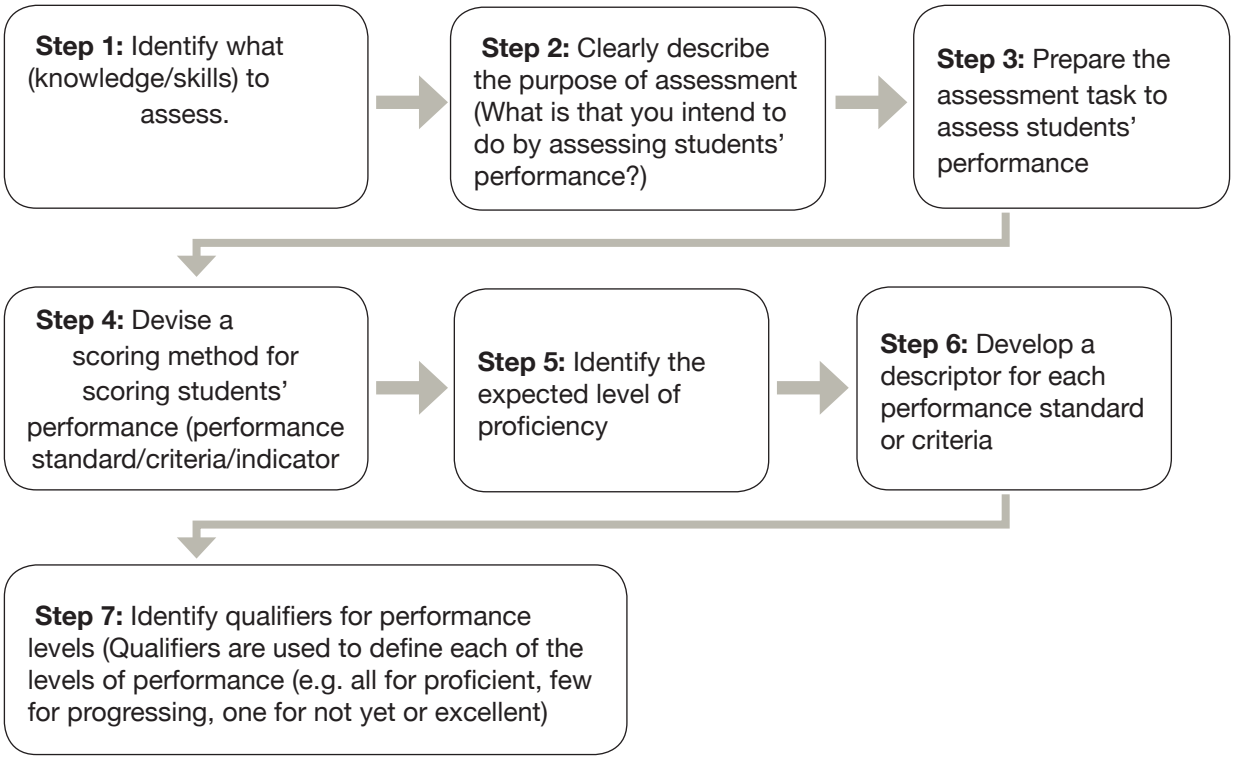
Rubrics use a set of specific criteria to evaluate student performance. They may be used to assess individuals or groups and, as with rating scales, may be compared over time.

Rubrics are recognized as a way to effectively assess student learning and communicate expectations directly, clearly and concisely to students. The inclusion of rubrics in a teaching resource provides opportunities to consider what demonstrations of learning look like, and to describe stages in the development and growth of knowledge, understandings and skills. To be most effective, rubrics should allow students to see the progression of mastery in the development of understandings and skills.

However, regardless of which method is used, students' performance, proficiency, and quality of learning should be meaningfully and effectively measured. This will help ascertain if students are meeting grade-level expectations and progressing towards meeting the content standard.

Assessment Samples

Teachers are required to use the steps outlined below when planning assessment. These steps will guide you to develop effective assessments to improve student's learning as well as evaluating their progress towards meeting national and grade –level expectations.



There are three (3) assessment samples provided here to guide teachers when preparing assessment for students. There is a/an;

i. formative assessment sample
ii. summative assessment sample
iii. authentic assessment sample

All these samples are based on one topic;

Teachers are encouraged to give a variety of assessments using different strategies on one topic to test the understanding and achievement of a content standard and a benchmark by individual students.

NOTE FOR TEACHER

GIVEN BELOW IS A GRADE 10 SBC LESSON PLAN. USE THIS TO HELP YOU DESIGN YOUR LESSON PLANS FOR GRADE 11 GEOGRAPHY

Formative Assessment

Strand 1: Geography

Unit 1: Geography Skills

Content Standard 1.1: Student will be able to use geographical tools to locate and interpret information about people, places and environment.

Benchmark 10.1.1.1: Identify and explain the different types of population pyramids.

Topic 1: Types of population pyramid

Lesson Topic: Expansive population pyramid

What is to be assessed? - (KSAVs)
Expansive population pyramid and label its features.

Performance Task
Draw a sketch of the expansive population pyramid and label its features.

Purpose of the assessment
To measure students' proficiency on the achievement of the benchmark and learning objectives.

Expected level of proficiency
Identify main features of expansive population pyramid.

Assessment Strategy
This assessment can be conducted in one lesson as an assessed lesson exercise.

Assessment Scoring

Rubrics must be developed to articulate the real proficiency of the child. This is an analytical rubrics used to assess the child's learning through the assessment tool a lesson exercise.

Performance Standards/Criteria	A	B	C	D	Score
	Advance 10	Proficient 9-5	Progressing 3-4	Not Yet 2	__/10 Marks
Draw a sketch of the expansive population pyramid and describe its features *10 marks*	Correct sketch drawing of the expansive population pyramid and describes and explain all its features	Good sketch drawing of the expansive population pyramid and describes some of its features	Satisfactory sketch drawing of the expansive population pyramid and describes 2 of its features	Poor sketch drawing of the an expansive population pyramid and describes only 1 feature	

Summative Assessment

Strand 2: History

Unit 1: Making Sense of History

Content Standard 2.1: Student will be able to discover that people construct knowledge of the past from multiple and various types of sources to make sense of historical patterns, periods of time and the relationship among these elements.

Benchmark 10.2.1.1-10.2.1.5: *(refer to the benchmarks in unit1)*

Topics 1-5: *(refer to the topics in unit 1)*

What is to be assessed? - (KSAVs)
Expansive population pyramid and label its features.

Performance Task
Students will do an assignment out of 30marks. You can use other assessment tools (assignment, projects, etc.) assess students proficiency on these benchmarks.

Task: Students will be given two week to complete this assignment. They are to;

1. *Choose one of the following countries; PNG, Fiji, Solomon Islands, Tahiti and New Caledonia*
2. *Research on a major event that occurred in one of these countries which shaped the history of the Pacific Region. Use criteria (performance standard) given in the assessment scoring.*

Purpose of the assessment
To measure students' proficiency on the achievement of the benchmarks and learning objectives in this unit. (This assessment is to be conducted after teaching the unit)

Expected level of proficiency
All students are expected to;

- Identify and interpret major social, political, economic, religious and cultural events that have shaped the history of the Pacific Region
- Define and investigate a social, political, economic, religious and cultural events that occurred in the Pacific Region.
- Use available information to document and compare the social, political, economic, religious and cultural history of the people of the Pacific region
- Examine how knowledge of history is constructed, stored, managed and disseminated in different countries of the Pacific Region
- Analyse the colonial history of the countries of the Pacific Region in terms of the reasons for colonisation, and social, economic, political and cultural impact.

Assessment Strategy
An assignment will be used to measure students proficiency.

Assessment Scoring

Rubrics must be developed to articulate the real proficiency of the child. This is an analytical rubrics used to assess the child's learning through the assessment tool an assignment.

Performance standards/Criteria	A	B	C	D	Score
	Advance 30	**Proficient 29-25**	**Progressing 15-24**	**Not Yet 2-10**	**__/30 Marks**
State and explain the major event, the date it occurred and the Pacific Island country that it happened in. *(2 marks)*	Exceptional title, detailed, clear and succinct explanation of the event	Good title and clear explanation of the event	Fair title and satisfactory explanation of the event	Title has no connection to the assigned tasks and the explanation of the event is poor	
Draw a map of the Pacific Island country it happened in and plot the location the major event occurred at. *(10 marks)*	Correct map drawn and precise location of the place where the event occurred	Good map and place of event marked almost near to the exact location	Satisfactory drawing but the location is far from the exact location	Poor drawing of the map and no attempt to mark the location	
Name the key person or persons who were involved in this major event Attach their profile (pictures, photographs, memoirs). *(10 marks)*	Detailed profile of the person or persons involved in these events	Shows good knowledge of person or persons involved in these events	Shows fair knowledge of the person or persons involved in these major events	Shows poor knowledge of the person or persons involved in these major events	
Name other foreign countries that took part in this event and what was their reason for taking part. *(3 marks)*	Correct names of foreign countries who took part and the correct reasons for them taking part in this major event(s)	Shows good knowledge of why foreign countries got involved in this major event(s)	Shows fair knowledge of why foreign got involved in this major event(s)	Shows no idea of foreign countries involvement in this event (s)	
How has this event shaped the history of the Pacific. *(5 marks)*	Correct explanation of the impact of this event on the Pacific	Good explanation of the impact of this event on the Pacific	Fair explanation of the impact of this event on the Pacific	Unsatisfactory explanation of this event on the Pacific	

Authentic Assessment

Strand 3: Political Science

Unit 1: Government and Citizenship

Content Standard 3.4: Students will be able to evaluate and elaborate on the roles and responsibilities, and the rights of citizens in different government systems.

Benchmark 10.3.4.1-10.3.4.5: *(refer to the benchmarks in unit4)*

Topics 1-5: *(refer to the topics in unit 4)*

What is to be assessed? - (KSAVs)
Human Rights in Papua New Guinea

Performance Task
Students will do a project worth 20 marks. You can use other assessment tools (assignment, simulation, interview etc) to assess students' proficiency on these benchmarks.

Task: Students will be given two weeks to complete this project then carry out an awareness.

1. *They will collect information on Human Rights for example; Children's Rights, Women Rights etc.*
2. *They will make presentation on these rights during assembly, recess and lunch time. (Students will be grouped into 5-6 students per group)*
3. *The best presentation will be given a chance to make presentation in public in their local community.*

The aim of this project is to develop in students the art of oration or public speaking at the same time gear them towards careers in this field and promoting good citizenship for all.

Purpose of this assessment
To measure students proficiency on the achievement of the benchmarks and learning objectives in this unit. This assessment is to be conducted after teaching this unit.

Expected level of proficiency
All students are expected to;

- examine policies and laws on human rights in Papua New Guinea and create context to appropriately implement or apply each law,
- identify and evaluate the types of human rights spelt out in the Papua New Guinea constitution,
- probe the difference between inalienable rights and other rights and how each is promoted and protected using the legal system,
- investigate and report on how the rights of women and girls, people with disability, and other marginalised and vulnerable groups are enforced in Papua New Guinea,
- examine the rights of children and evaluate the policy and legal frame works as well as the processes for enforcing and protecting these rights.

Assessment Strategy
A project will be used to measure students' proficiency.

Assessment Scoring

Rubrics will be developed to find out the real proficiency of the child. This is an analytical rubrics used to assess the child's learning through the assessment tool a project.

Performance standards/Criteria	A	B	C	D	Score
	Advance 25	**Proficient 20-24**	**Progressing 10-19**	**Not Yet 2-9**	**__/ Marks**
Define Human Rights, identify and explain one Human Rights and explain this right *(5marks)*	Exceptional title, keywords clearly defined and very clear, logical explanations of the issues on Human Rights	Very good title, key words defined and good explanations covering issues on Human Rights researched on.	Good title, satisfactory explanation of the key words and fair explanations covering issues on Human Rights researched on	Poor title, key words not defined well as well as poor explanations covering issues on Human Rights researched on	
Findings must be substantiated with facts and figures (Newspapers, photographs and articles must be quoted or cited) *(10 marks)*	Correct information supporting the findings	Some correct information used to substantiate research	Few information used to substantiate findings	No information used to substitute findings	
Presentation of finding as an awareness in the school	Work presented is clear on the chart, oral presentation is loud and clear and confidence is clearly portrayed	Good presentation of the awareness, that is poster was logic but oral presentation and confidence were moderate	Fair presentation of the awareness, that is poster had few inconsistency on the findings and oral presentation and confidence was fair	Poor presentation of the awareness, poster work was oral presentation was inaudible and general lack in confidence during presentation	

STEAM Assessment

Strand 5: Environment

Unit 4: Environmental Change

Content Standard 5.4: Students will be able to evaluate and elaborate on the roles and responsibilities, and the rights of citizens in different government systems.

Benchmark 10.5.4.2: Investigate and explain the notion of "ecological foot print'

Topic: Ecological footprint

Lesson Topic: Notion of 'ecological footprint'

What is to be assessed? - (KSAVs)
The concept of 'ecological foot print'

Purpose of the assessment
To measure students proficiency on the achievement of the benchmarks and learning objectives in this topic. This assessment is to be conducted after teaching this topic.

Expected level of proficiency
All students are expected to;

- investigate and explain the notion of "ecological foot print'

Assessment Strategy
An assignment will be used to measure students proficiency.

Performance Task
Student will carry out a project worth 30 marks that should contribute to the School Learning Improvement Program (SLIP). This project will assess students' proficiency on the mentioned benchmarks. In order for this assessment type to attain its intended purpose the following must be done carefully;

Task: Students will be given a month to complete this project.

1. *all grade 10 Social Science teachers discuss the STEAM project with their HOD*
2. *the Social Science HOD brings this project to the attention of the Head Teacher hence it will involve the learning of all grade 10 classes in the school.*
3. *once approved by the Head Teacher, the Social Science HOD now convenes a meeting with all other subject HOD to integrate this project into their learning. HOD for Social Science will have developed a criteria already and will discuss around that.*
4. *the HOD for other subjects meet with their respective subject teachers to gauge their views and write up criteria with reference to the theme of the project, "Ecological Footprints" bringing out the essence of their subjects in this project.*

5. *the Head Teacher then convenes a meeting with all teachers as they are now aware of the project. HOD for respective subjects give feedback from their meetings. Issues concerning this project must be ironed out and all subjects now carry out this assessment, starting with Social Science.*

The grade 10 Social Science teacher will now do the following;

i. *Group the students into groups of 6 to design (drawing and manual) a tangible technology that will enhance the notion of " Ecological Footprints"*

ii. *The teacher then assess their designs and the best designs now competes with the other best designs from other grade 10 classes.*

iii. *All the best designers now create models of their designs (e.g., greenhouse) with assistance from their class members. At this stage the other subjects now carry forward this assessed projects theme, 'Ecological Footprint' however in the context of their subjects. STEAM is an integrated approach of teaching. All subjects must incorporate the theme put forward by Social Science. They develop criteria that should address this theme. For instance; Business Studies teacher can already think of income earning opportunities for the school by developing a criteria for students to develop business plan from this project. Technology and Industrial Arts (TIA) will develop criteria that will engage the students to construct the models. Science teachers will develop criteria to test students knowledge of the Science process of Engineering Design thinking when they create the models around the theme of 'Ecological Footprint'. The English subject teachers will set criteria and guidelines for students on how to write manuals so they write about this technology. They must also be given guidelines to writing report. Students get to write report of how they designed this technology. The Mathematics teacher will provide a criteria for the students in terms of the measurements, angles and operations used to work out the size and shape of the technology (e.g., Greenhouse)*

Assessment Scoring

Rubrics must be developed to find out the real proficiency of the child. This is an analytical rubrics used to assess the child's learning through the assessment tool a project.

Performance standards/Criteria	A	B	C	D	Score
	Advance 30	**Proficient 29-25**	**Progressing 15-24**	**Not Yet 2-14**	**___/ Marks**
Design (drawing) a simple technology which should portray the theme *(10 marks)*	Exceptional title, drawing is clear, detailed and precise	Very good title, drawing is clear though some details missing	Good title, drawing is clear but a lot of details missing	Poor title, drawing does not capture the essence of the theme	
Write a simple manual that is steps on how to create this technology *(5 marks)*	All steps to create the model clearly explained and in logical order	Steps are in order but not explained clearly	Some steps are missing and explanation of these steps not clear	Steps not in order and explanation is poor	
Construct simple model (prototype) of the technology *(15 marks)*	Construction of the model captures all aspects of the theme	Some aspects of the theme captured in the model	Few aspects of the theme captured in the mode	No aspects of the theme evident in the model	

Glossary

Terms	Definitions
Assessment	Activities teachers use to help students learn and to measure and monitor their progress towards the attainment of expected levels of proficiency.
Assessment As Learning	Assessment is used to help students understand and reflect on what they have learnt or are having difficulties with, identify areas of strengths and weaknesses, and set clear, measurable, and attainable personal goals to improve their own learning.
Assessment For Learning	A common form of assessment. It is an ongoing assessment process that arises out of the interaction between teaching and learning. Also referred to as formative assessment.
Assessment Of Learning	Provides a summary of students learning over a given period of time and is generally carried out at the end of a course of study. Also referred to as summative assessment.
Assessment Strategies	Different ways or approaches of assessing students work.
Authentic Assessment	A type of broad assessment that involves students actively engaged in completing a task that represents the achievement of a learning objective or standard. Authentic assessment takes place in real life situations.
Benchmarks	Benchmarks are more detailed descriptions of a specific level of performance expected of students at particular ages, grades, school levels or levels of development. They are the specific components of the knowledge, process, skill, concept, principle, or idea identified by a content standard.
Content Standards	Content Standards are broadly stated expectations of what (content) students should know. They describe the knowledge, skills, values, and attitudes that students should attain.
Curriculum Integration	Curriculum integration in teaching and learning refers to an approach or methodology that cuts across and draws on multiple subject areas to focus on a topic or theme.
Diagnostic Assessment	An assessment given to identify child's strengths and learning needs for improvement.
Evaluation	Assessment information used to assess the effectiveness of teaching and learning and to make improvements to teaching practices in order to improve students learning.
Formative Assessment	A form of assessment used throughout a unit of study in teaching and learning to measure student's understanding and progress.
Monitoring	General supervision over the teaching and learning of the standards.
Performance Assessment	A form of assessment that is focused on measuring students' mastery of knowledge, skills, values and attitudes taught and learnt in each lesson.
Performance Standards	Performance standards are the indicators of quality that specify how competent a students' demonstration or performance must be.
Proficiency	Mastery of the essential knowledge, skills, values and attitudes in the content standards and benchmarks.

Rubrics	It is a scoring guide used to assess the quality of students responses in an assessment often presented in a table with evaluative criteria at certain levels of achievement.
Self–Assessment	A judgment for official purposes for teachers to make about their abilities, principles or decisions.
Standard	A standard is a level of quality or achievement, especially a level that is thought to be acceptable. It is something used to measure or estimate the quality or degree of something, for example, how good a piece of work is.
Standards-Based Curriculum	Describes **what** all students should know and be able to **do** at the end of a grade or school level. The main idea behind standards-based curriculum is **standards.**
Standards-Based Education	An academic program in which clearly defined academic content and benchmarks are aligned. It spells out what schools and communities need to do to ensure achievement of expectations. The main idea behind standards-based education is **standards.**
Standards-Based Assessment	A systematic and ongoing process of collecting and interpreting information about students' achievements.
STEAM Education	The teaching and learning in the fields of Science, Technology, Engineering, Arts, and Mathematics in both formal and informal classroom settings.
Summative Assessment	A form of assessment used after completing a unit or topic or at a specific point in time in teaching and learning to measure student's mastery of the content standards and benchmarks.
21st Century Skills	Refers to a broad set of knowledge, skills, work habits, and character traits that are believed by educators, school reformers, college professors, employers, and others to be critically important to success in today's world, particularly in collegiate programs and contemporary careers and workplaces.

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Appendices

Appendix 1: Bloom's Taxonomy

Level of Understanding	Key Verbs
Creating Can the student create a new product or point of view?	Construct, design, and develop, generate, hypothesize, invent, plan, produce, compose, create, make, perform, plan, produce, assemble, formulate,
Evaluating Can the student justify a stand or decision?	Appraise, argue, assess, choose, conclude, critique, decide, defend, evaluate, judge, justify, predict, prioritize, provoke, rank, rate, select, support, monitor,
Analyzing Can the student distinguish between the different parts?	Analyzing, characterize, classify, compare, contrast, debate, criticise, deconstruct, deduce, differentiate, discriminate, distinguish, examine, organize, outline, relate, research, separate, experiment, question, test,
Applying Can the student use the information in a new way?	Apply, change, choose, compute, dramatize, implement, interview, prepare, produce, role play, select, show, transfer, use, demonstrate, illustrate, interpret, operate, sketch, solve, write,
Understanding Can the student comprehend ideas or concepts?	Classify, compare, exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report, translate, describe, classify,
Remembering Can the student recall or remember the information?	Define, describe, draw, find, identify, label, list, match, name, quote, recall, recite, tell, write, duplicate, memorise, recall, repeat, reproduce, state,

Appendix 2: 21St Century Skills

Ways Of Thinking	**Creativity and innovation** • Think creatively • Work creatively with others • Implement innovations **Critical thinking, problem-solving and decision making** • Reason effectively and evaluate evidence • Solve problems • Articulate findings **Learning to learn and meta-cognition** • Self-motivation • Positive appreciation of learning • Adaptability and flexibility
Ways Of Working	**Communication** • Competency in written and oral language • Open minded and preparedness to listen • Sensitivity to cultural differences **Collaboration and teamwork** • Interact effectively with others • Work effectively in diverse teams • Prioritise, plan and manage projects
Tools For Working	**Information literacy** • Access and evaluate information • Use and manage information • Apply technology effectively **ICT literacy** • Open to new ideas, information, tools and ways of thinking • Use ICT accurately, creatively, ethically and legally • Be aware of cultural and social differences • Apply technology appropriately and effectively
Living In The World	**Citizenship – global and local** • Awareness and understanding of rights and responsibilities as a global citizen • Preparedness to participate in community activities • Respect the values and privacy of others **Personal and social responsibility** • Communicate constructively in different social situations • Understand different viewpoints and perspectives **Life and career** • Adapt to change • Manage goals and time • Be a self-directed learner • Interact effectively with others

Appendix 3: Teaching and Learning Strategies

Strategy	Teacher	Students
Case Study Used to extend students' understanding of real life issues	Provide students with case studies related to the topic of the lesson and allow them to analyse and evaluate.	Study the case study and identify the problem addressed. They analyse the problem and suggest solutions supported by conceptual justifications and make presentations. This enriches the students' existing knowledge of the topic.
Debate A method used to increase students' interest, involvement and participation	Provide the topic or question of debate on current issues affecting a bigger population, clearly outlining the expectations of the debate. Explain the steps involved in debating and set a criteria/ standard to be achieved.	Conduct researches to gather supporting evidence about the selected topic and summarising the points. They are engaged in collaborative learning by delegating and sharing tasks to group members. When debating, they improve their communication skills.
Discussion The purpose of discussion is to educate students about the process of group thinking and collective decision.	The teacher opens a discussion on certain topic by asking essential questions. During the discussion, the teacher reinforces and emphasises on important points from students responses. Teacher guide the direction to motivate students to explore the topic in greater depth and the topic in more detail. Use how and why follow-up questions to guide the discussion toward the objective of helping students understand the subject and summarise main ideas.	Students ponder over the question and answer by providing ideas, experiences and examples. Students participate in the discussion by exchanging ideas with others.
Games and Simulations Encourages motivation and creates a spirit of competition and challenge to enhance learning.	Being creative and select appropriate games for the topic of the lesson. Give clear instructions and guidelines. The game selected must be fun and build a competitive spirit to score more than their peers to win small prices.	Go into groups and organize. Follow the instructions and play to win

Observation Method used to allow students to work independently to discover why and how things happen as the way they are. It builds curiosity.	Give instructions and monitor every activity students do	Students possess instinct of curiosity and are curious to see the things for themselves and particularly those things which exist around them. A thing observed and a fact discovered by the child for himself becomes a part of mental life of the child. It is certainly more valuable to him than the same fact or facts learnt from the teacher or a book. Students • Observe and ask essential questions • Record • Interpret
Peer Teaching and Learning *(power point presentations, pair learning)* Students teach each other using different ways to learn from each other. It encourages; team work, develops confidence, feel free to ask questions, improves communication skills and most importantly develop the spirit of inquiry.	Distribute topics to groups to research and teach others in the classroom. Go through the basics of how to present their peer teaching.	Go into their established working groups. Develop a plan for the topic. Each group member is allocated a task to work on. Research and collect information about the topic allocated to the group. Outline the important points from the research and present their findings in class.
Performance-Related Tasks (dramatization, song/lyrics, wall magazines) Encourages creativity and take on the overarching ideas of the topic and are able to recall them at a later date	Students are given the opportunity to perform the using the main ideas of a topic. Provide the guidelines, expectations and the set criteria	Go into their established working groups. Being creative and create dramas, songs/lyrics or wall magazines in line with the topic.
Project (individual/group) Helps students complete tasks individually or collectively	Teacher outline the steps and procedures of how to do and the criteria	Students are involved in investigations and finding solutions to problems to real life experiences. They carry out researches to analyse the causes and effects of problems to provide achievable solutions. Students carefully utilise the problem-solving approach to complete projects.
Use Media and Technology to teach and generate engagement depending on the age of the students	Show a full movie, an animated one, a few episodes form documentaries, you tube movies and others depending on the lesson. Provide questions for students to answer before viewing	Viewing can provoke questions, debates, critical thinking, emotion and reaction. After viewing, students engage in critical thinking and debate

Appendix 4: Lesson Plan Template

Strand: ……

Unit: ……..

Content Standard: .....

Benchmark: ……..

Topic 1: ……..

Lesson Topic: ……

Grade: ……

Length of Lesson: ……

Essential KSAVs

Knowledge: ……

Skill(s): ……

Values: ……..

Attitudes: ……

Performance Indicator:

Materials:

Instructional (lesson) Objective(s): By the end of the lesson, students will be able to:

- ……
- ……
- ……

Essential Questions:

- ……
- ……

Lesson Procedure

Teacher Activities	Student Activities
Introduction (time in minutes)	
Body (time in minutes)	
Modeling	
Guided Practice	
Independent Practice	
Conclusion (time in minutes)	

Appendix 5: Assessment Strategies

Strategy	Description
Analogies	Students create an analogy between something they are familiar with and the new information they have learned. When asking students to explain the analogy, it will show the depth of their understanding of a topic.
Classroom presentations	A classroom presentation is an assessment strategy that requires students to verbalize their knowledge, select and present samples of finished work, and organize their thoughts about a topic in order to present a summary of their learning. It may provide the basis for assessment upon completion of a student's project or essay.
Conferences	A conference is a formal or informal meeting between the teacher and a student for the purpose of exchanging information or sharing ideas. A conference might be held to explore the student's thinking and suggest next steps; assess the student's level of understanding of a particular concept or procedure; and review, clarify, and extend what the student has already completed.
Discussions	Having a class discussion on a unit of study provides teachers with valuable information about what the students know about the subject. Focus the discussions on higher level thinking skills and allow students to reflect their learning before the discussion commences.
Essays	An essay is a writing sample in which a student constructs a response to a question, topic, or brief statement, and supplies supporting details or arguments. The essay allows the teacher to assess the student's understanding and/or ability to analyse and synthesize information.
Exhibitions/ demonstrations	An exhibition/demonstration is a performance in a public setting, during which a student explains and applies a process, procedure, etc., in concrete ways to show individual achievement of specific skills and knowledge.
Interviews	An interview is a face-to-face conversation in which teacher and student use inquiry to share their knowledge and understanding of a topic or problem, and can be used by the teacher to explore the student's thinking; assess the student's level of understanding of a concept or procedure and gather information, obtain clarification, determine positions, and probe for motivations.
Learning logs	A learning log is an ongoing, visible record kept by a student and recording what he or she is doing or thinking while working on a particular task or assignment. It can be used to assess student progress and growth over time.
Observation	Observation is a process of systematically viewing and recording students while they work, for the purpose of making programming and instruction decisions. Observation can take place at any time and in any setting. It provides information on students' strengths and weaknesses, learning styles, interests, and attitudes.
Peer assessment	Assessment by peers is a powerful way to gather information about students and their understanding. Students can use set criteria to assess the work of their classmates.

Performance tasks	During a performance task, students create, produce, perform, or present works on "real world" issues. The performance task may be used to assess a skill or proficiency, and provides useful information on the process as well as the product.
Portfolios	A portfolio is a collection of samples of a student's work, and is focused, selective, reflective, and collaborative. It offers a visual demonstration of a student's achievement, capabilities, strengths, weaknesses, knowledge, and specific skills, over time and in a variety of contexts.
Questions and answers (oral)	In the question–and-answer strategy, the teacher poses a question and the student answers verbally, rather than in writing. This strategy helps the teacher to determine whether students understand what is being, or has been, presented, and helps students to extend their thinking, generate ideas, or solve problems.
Quizzes, tests, examinations	A quiz, test, or examination requires students to respond to prompts in order to demonstrate their knowledge (orally or in writing) or their skills (e.g., through performance). Quizzes are usually short; examinations are usually longer. Quizzes, tests, or examinations can be adapted for exceptional students and for re-teaching and retesting.
Questionnaires	Questionnaires can be used for a variety of purposes. When used as a formative assessment strategy, they provide teachers with information on student learning that they can use to plan further instruction.
Response journals	A response journal is a student's personal record containing written, reflective responses to material he or she is reading, viewing, listening to, or discussing. The response journal can be used as an assessment tool in all subject areas.
Selected responses	Strictly speaking a part of quizzes, tests, and examinations, selected responses require students to identify the one correct answer. The strategy can take the form of multiple-choice or true/false formats. Selected response is a commonly used formal procedure for gathering objective evidence about student learning, specifically in memory, recall, and comprehension.
Student self-assessments	Self-assessment is a process by which the student gathers information about, and reflects on, his or her own learning. It is the student's own assessment of personal progress in terms of knowledge, skills, processes, or attitudes. Self-assessment leads students to a greater awareness and understanding of themselves as learners.
Posters	
Video analysis	
Reflective writing	
Projects	
Observation reports	