Design and Technology Subjects

Design and Technology
Practical Skills Technologies
Food Technology
Textiles Technology

Upper Secondary

Syllabuses

Papua New Guinea
Department of Education

Issued free to schools by the Department of Education

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Contents

Secretary's message

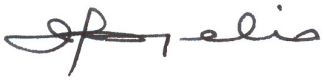
These syllabuses are to be used by trained teachers to teach Upper Secondary Design and Technology students (Grades 11 and 12) throughout Papua New Guinea. These syllabuses build upon concepts, skills and attitudes learnt in Upper Primary 'Making a Living' and Lower Secondary 'Design and Technology' and provide a sound foundation for further learning.

The Upper Secondary Design and Technology syllabuses contribute to integral human development as it is based on the students' physical environments, societies and cultures. They link to the National Education Plan's vision, which is that secondary education enables students to achieve their individual potential to lead productive lives as members of the local, national and international community. The mission of Design and Technology is aligned with the National Goals and Directive Principles in the Constitution, the *Medium Term Development Strategy 2005–2010* and the *National Plan for Education 2004–2014*.

Design and Technology equips students with practical knowledge, skills and attitudes that enable students to think critically and become effective problem solvers. It is based on a model of learning that incorporates knowledge, skills and design principles in a problem-solving context. The knowledge, skills and attitudes empower students to manage their limited resources to achieve set goals and successfully make a living in the community.

By studying Design and Technology subjects, students develop their understanding of how to use, manage, assess and understand technology and apply it in a wide range of situations, such as the home, community, industry and informal work. These subjects promote a student-centred approach to learning and an understanding and appreciation that learning is a lifelong process.

I commend and approve these syllabuses as the official curriculum for Design and Technology to be used in all schools with Grades 11 and 12 students throughout Papua New Guinea.



DR JOSEPH PAGELIO

Secretary for Education

Introduction

Design and Technology subjects sit within a framework that gives students the opportunity to specialise in an area of interest, such as 'Food' or 'Working in Wood'; or to take a more general course by studying units from the three Design and Technology areas: practical skills technologies, food technology, and textiles technology.

The Design and Technology 'framework' syllabuses provide units that include knowledge, skills and values that are relevant to and useful for all students. They are flexible in that the units allow teachers and students to study areas that are relevant to diverse contexts in Papua New Guinea. All units emphasise the development of skills. Students understand that it is not only imported 'western' technologies that are important in technology studies, but also technologies based on Papua New Guinea's traditional knowledge systems; and these are to be incorporated. The technologies of Design and Technology are offered in a framework that gives students the opportunity to experience the design process in investigating, planning, making, marketing and evaluating, through a design project approach, using a range of technologies. The framework makes it easy for teachers to replace any unit with their own school-developed units.

The framework is based on the curriculum principles from the National Curriculum Statement. It has been designed using learning outcomes that identify the knowledge, skills, attitudes and values that all students achieve or demonstrate by the end of Grade 12. It is linked to the national curriculum learning area Culture and Community and builds on the knowledge and skills students have learnt since elementary grades. These Design and Technology syllabuses offer a number of pathways to post-secondary study and the workforce.

Upper Primary Making a Living Strands	Lower Secondary Design and Technology Subjects	Upper Secondary Design and Technology Subjects
Managing Resources Better Living Community Development	Practical Skills Home Economics Computing Design and Technology	Design and Technology Practical Skills Technologies Food Technology Textiles Technology

In teaching Design and Technology, the correct technical terminology must be used. When using English as the language of instruction, the correct technical terms are used. However, under the Department of Education's language policy, any of the 875 official languages may be used to assist in the understanding of skills and knowledge.

Assessment is an important component of teaching for learning and is integrated into the learning and teaching activities of Design and Technology. Continuous assessment provides feedback to students and the teacher on students' progress towards achieving the learning outcomes. It helps students improve their standards of achievement by knowing what they do well and where they need to improve. Teachers gather evidence from students' work during the course of the term and use those continuous assessments to improve their teaching and students' learning.

The syllabuses facilitate students' entry to technical and vocational study and employment opportunities. They have potential to extend their application and relevance beyond formal schooling. They cater for students who do not go on to further study after Grade 12. Studying these units will enable students to live meaningful and productive lives by equipping them with the knowledge and skills to use the resources of the community.

Design and Technology subjects are to be timetabled for 240–250 minutes per week in Grades 11 and 12.

Rationale

The ancestors of Papua New Guinea used technologies to live; technologies which have survived and are being used in the present. As Papua New Guinea is a sovereign independent state and part of the global community, technologies from other nations have been and are being imported. With the introduction of the Design and Technology syllabuses, the potential now exists for all learners to take ownership of all of these technologies. The knowledge, skills and attitudes gained by learners will enable them to be productive members of their local, national and global communities and meet the challenges of future introduced technologies.

The use of these technologies will enable citizens to transform Papua New Guinean society from a consumer-based one to a self-sustaining one, incorporating the manufactured items that meet the needs of the individual, national and global market.

The Constitution embraces the goal of integral human development and for all citizens to have the opportunity to participate in, and benefit from, the development of the country. The Medium Term Development Strategy prioritises technical and vocational education and training (TVET) and secondary education as essential for the development and prosperity of the nation.

Whether students are male or female, single or married, living in an urban or rural area, in the highlands, coastal or islands location, Design and Technology subjects will provide skills of lifelong usefulness. Opportunities are provided to creatively design and make products that could be for personal, family or community use or sold to generate an income.

Design and Technology enables students to experiment with a range of technologies and become skilled working with different materials and techniques. Students demonstrate initiative and individuality and create appealing, high quality functional or aesthetic products in cost-effective ways. Skills are developed through problem solving, quality control and evaluation.

Design and Technology subjects investigate the nature and functions of available resources through applying enquiry, design and problem-solving methodologies. Design is a core component of the syllabuses and students are encouraged to actively participate in invention and innovation. The syllabuses are flexible and dynamic, enabling participants to use technologies from the village level to the most modern, as available to the school. Whether students go on to further studies, employment or community projects, the syllabuses have great intrinsic practical value.

Aims

The study of Design and Technology aims to enable students to:

- take a safe and active role in designing and making projects that are linked to their own interest, families, the community and industrial practices
- become responsible citizens with the qualities and skills necessary to live and serve happily and productively in their communities
- apply what they are learning to life and work-related situations for the common good
- develop a culture of enterprise and wealth creation for the benefit of themselves and their societies as a whole
- adapt new technologies directly and appropriately to their environment and their own social and economic needs
- discover their hidden talents and become creative, innovative and rational thinkers in their response to problems.

Strands

The strands describe the dimensions of the subjects. They are broad, organising structures that define ways of approaching learning in Design and Technology subjects. They incorporate cross-curriculum learning and skills and are 'woven' through the units within Design and Technology subjects.

The strands for the Design and Technology subjects are:

- 'Planning and designing'
- 'Making'
- 'Marketing'
- 'Evaluating'

Planning and designing

Planning and designing is about identifying, exploring, developing, applying, communicating and evaluating ideas. When students plan and design, they:

- identify a problem
- clarify or explain the problem
- explore and generate ideas for design solutions
- share ideas with a range of people
- make appropriate design choices in terms of cost and availability of resources
- conduct needs analysis through questioning or interviewing
- collect and collate data
- model or trial the design solution
- develop and refine the idea
- plan to develop the design solution into a product.

Making

Making is about producing and constructing products and processes to meet identified needs. When students make they:

- develop a design solution into a product
- select and work with a range of tools and materials safely and resourcefully
- manage time and resources effectively
- develop an understanding of the positive and negative consequences that the production, use and disposal of a product or process could have on a community
- develop a range of skills to work with accuracy to produce a quality outcome.

Marketing

Marketing is about advertising, selling and profit. When students market a product they:

- recognise and meet the needs of the user or buyer

- calculate production costs and determine profit
- explore ways to effectively advertise and sell products
- investigate ways to add value to products
- consider alternative ways that a product can be used effectively if it is not marketable.

Evaluating

Evaluating is about questioning, examining, assessing and reviewing. When students evaluate they:

- review the product to check that it successfully meets the needs of the design brief
- reflect on the process of designing, planning, making and marketing to see if parts of the process could be improved for future products
- determine if the product works or if it could be modified and improved.

Learning outcomes

The Design and Technology broad learning outcomes listed below identify the knowledge, skills, attitudes and values all students achieve or demonstrate at the end of Grade 12. All unit learning outcomes are based on these broad learning outcomes.

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
3. apply knowledge and understanding of processes through identifying, selecting and using various materials and/or systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways.

Content overview

Subjects

Students may choose up to two Design and Technology subjects to study. If students study two subjects, each subject must be studied for 240–250 minutes per week.

The subjects are:

Design and Technology
Practical Skills Technologies
Food Technology
Textiles Technology

If students study two Design and Technology subjects, teachers must make sure that students do not study the same unit twice.

Design and Technology

The Upper Secondary Design and Technology subjects and Practical Skills Technologies can accommodate many technologies. Schools choose those units that are appropriate for their locality, available expertise and resources.

Practical Skills Technologies

The focus of Practical Skills Technologies is on designing and making a product, using any of the technologies except food and textiles. Typical practical technology projects include working with wood, metal projects, building and construction and small engines. However, there are many other options available to be chosen, depending on the students' interests and school's resources.

Food Technology

The focus of Food Technology is on nutrition and the preparation and serving of food in the home and in the business environment. Typical Food Technology projects include learning about types of food, their properties and functions, and preparing a variety of foods for different purposes.

Textiles Technology

The focus of Textiles Technology is on fibres and fabrics, designing and making products using textiles.

TVET modules

Modules from TVET National Certificate 1 courses can be offered in place of three units only over Grades 11 and 12, provided that the modules are delivered by registered training providers.

Schools must be registered as, or in partnership with, registered TVET providers and comply with the requirements of the Quality Training Framework.

TVET Training Packages

Students can study modules from the following courses at National Certificate 1 in place of Design and Technology or Practical Skills Technologies units:

Electrotechnology
Metal Fabrication and Welding
Maintenance Fitting and Machining
Automotive Servicing (Light Vehicles)
Automotive Body Repair and Finishing
Carpentry Construction
Plumbing

Students can study modules from the following courses at National Certificate 1 in place of Textiles Technology units:

Garment Production

Students can study modules from the following courses at National Certificate 1 in place of Food Technology units:

Hospitality (Commercial Cookery)

The design process

All Design and Technology subjects are based on the design process, which consists of five important processes that provide a framework for learning and teaching in any unit of technology.

The five processes are:

- investigating
- planning
- making or adapting or maintaining
- marketing
- evaluating.

Investigating

Investigating is about researching situations, looking for opportunities, looking for niches in the market that could be filled with products students produce, looking at products that students could produce better, looking at ways to vary or be innovative with designs, and surveying customer needs and preferences.

When students investigate they:

- assess the nature and circumstances of problems
- gather information to analyse the nature of problems
- conduct market surveys
- conduct needs analysis through questioning or interviewing
- identify a problem
- clarify or explain the problem
- explore social, economic, technological, ecological and aesthetic factors that have a bearing on the kind of product or the use of particular techniques.

Planning and designing

Planning and designing is about researching, identifying, exploring, developing, applying, communicating and evaluating ideas.

When students plan and design, they:

- adapt or create original designs to produce product
- generate plans or proposals for creatively solving problems
- consider options, identify priorities and constraints, experiment with different ways to achieve their aims, as well as calculate and predict consequences
- choose appropriate resources and equipment and appraise plans and actions
- develop criteria to assess how well their intended techniques and products meet the requirements of the problem
- use graphic representations and technical language to explain design processes and production processes.

Making or producing, or adapting or maintaining

Making is about producing and constructing products, or adapting or maintaining products to meet an identified need.

When students make, they:

- translate designs and plans into products or processes
- work alone or cooperatively
- apply techniques and use equipment safely and resourcefully
- manage time and resources effectively
- monitor and control quality in creating or adapting or maintaining products and processes
- adapt ideas and plans in response to constraints and difficulties
- develop a range of skills to work with accuracy to produce a quality outcome.

Marketing

Marketing is about advertising, selling and profit.

When students market a product, they:

- recognise and meet the need of the user or buyer
- calculate production costs, determine profit and keep records of sales
- explore ways to effectively advertise and sell products
- investigate ways to add value to products
- consider alternative ways that a product can be used effectively if it is not marketable.

Evaluating

Evaluating is about questioning, examining, assessing and reviewing.

When students evaluate, they:

- measure and test products using developed criteria and report their findings
- determine whether the products and processes match design requirements, provide satisfactory solutions and have social, economic or technological effects
- reflect on the process of designing, planning, making and marketing to see if the parts of the process could be improved for future products
- reflect on and reconsider their intentions, plans and actions to modify and improve the process and quality of their products.

The design brief

As an integral part of the design process, a design brief is provided for the project that students complete for assessment. When developing a design brief, teachers are required to integrate the essential content of the unit being studied. Needs and interests of students should be addressed when developing design briefs.

Tasks involve designing, making and evaluating and at times marketing functional products or items that meet needs identified in the design brief.

For each design brief, students develop a design portfolio as a document that provides ongoing evidence of application of the design process and specific technologies used in this process. A design brief outlines the task or project that students are expected to complete using the chosen technology.

A design brief consists of:

Context	The context explains content and purpose of the task or project.
Task	The task provides instruction about the task or project.
Consideration and constraints	The consideration and constraints specify directions or place limitations on the design solution.
Investigating	Investigating develops skills in seeking information about opportunities, client needs and social, economic and environmental factors

Planning	Planning encourages students to identify, explore, develop, apply and communicate their ideas.
Making	Making engages students in producing or constructing.
Evaluating	Evaluation asks students to question, examine, assess and to review.
Marketing	Marketing encourages students to think about advertising, selling and making a profit or satisfying a need.

Design and Technology

Learning outcomes: Design and Technology

The learning outcomes for Design and Technology identify the knowledge, skills, attitudes and values all students achieve or demonstrate at the end of Grade 12. These learning outcomes are listed below.

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
3. apply knowledge and understanding of processes through identifying, selecting and using various materials, equipment and/or systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways.

Learning outcomes mapped against units

Learning outcomes	Units						
	11.1	**11.2**	**11.3**	**11.4**	**12.1**	**12.2**	**12.3**
1. Use the design process to produce appropriate solutions	✓	✓	✓	✓	✓	✓	✓
2 Apply safe and appropriate codes and practices in the learning and working environment	✓	✓	✓	✓	✓	✓	✓
3. Apply knowledge and understanding of processes through identifying, selecting and using various materials, equipment and/or systems		✓	✓	✓	✓	✓	✓
4. Demonstrate a range of skills and techniques		✓	✓	✓	✓	✓	✓
5. Evaluate the process and product against the design brief	✓	✓	✓	✓	✓	✓	✓
6. Communicate ideas and information in a variety of ways.	✓	✓	✓	✓	✓	✓	✓

Unit sequence and content: Design and Technology

These units can be sequenced according to the requirements of the students and the resources of the school.

Grade 11 units	Grade 12 units
11.1 Introduction to Design and Technology • Occupational health and safety • Foundations of technology • Technology resources • The design process **11.2 Design and Technology unit** • Design and Technology project *(Practical Skills Technology unit, or Food Technology unit or Textiles Technology unit)* **11.3 Design and Technology unit** • Design and Technology project *(Practical Skills Technology unit, or Food Technology unit or Textiles Technology unit or TVET Certificate 1 module)* **11 4 Design and Technology unit** • Design and Technology project *(Practical Skills Technology unit, or Food Technology unit or Textiles Technology unit)*	**12.1 Design and Technology unit** • Design and Technology project *(Practical Skills Technology unit, or Food Technology unit or Textiles Technology unit)* **12.2 Design and Technology unit** • Design and Technology project *(Practical Skills Technology unit, or Food Technology unit or Textiles Technology unit or TVET Certificate 1 module)* **12.3 Design and Technology unit** • Design and Technology project *(Practical Skills Technology unit, or Food Technology unit or Textiles Technology unit or TVET Certificate 1 module)*

Note: Schools can decide to continue with the same unit from Term 1 to Term 4 in both Grades 11 and 12.

Grades 11 and 12 Design and Technology units

11.1 Introduction to Design and Technology

This unit provides students with an understanding of the fundamentals of occupational health and safety, design, and the design process. Occupational health and safety enhances students' awareness of the importance of safe work practices in a safety-conscious environment. They learn to assess safety standards, identify potential risks, design safety signs, identify causes of common workplace accidents, participate in emergency drills and demonstrate safe work practices and first aid techniques.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways.

To achieve these outcomes, students:

- explain the basic legal requirements covering occupational health and safety in the workshop
- describe the requirements of health and safety policies and procedures in a workplace environment
- identify potential workplace hazards in a workplace environment and outline a range of preventative and control measures
- identify the sources of pollution in a workplace and outline control measures
- list the requirements for personal safety in a workplace environment
- demonstrate knowledge of basic first aid functions in an emergency, including cardio-pulmonary resuscitation, and HIV and AIDS prevention in cases of major cuts and laceration
- describe and explain the design process
- demonstrate knowledge of design fundamentals.

Content

Students acquire knowledge and skills through the learning of this content and the making of a product.

Occupational health and safety

Occupational health and safety is incorporated into all activities associated with the design and development or maintenance of a product, and students are encouraged to transfer the need for safety into real-life situations.

Safety standards

- relevant safety standards such as Papua New Guinea's Occupational Health and Safety standards
- safety as a design factor; for example, ergonomics
- safety testing
  - stress loading
  - wear factors
- product safety: consumer protection

Current compliance standards

- legal requirements covering occupational health and safety in the workplace

Safe workshop practices

- potential workplace hazards and a range of preventive and control measures:
  - housekeeping
  - operational procedures for equipment
  - material handling, including material safety data sheets (MSDS)
  - hazard identification, and risk assessment and management

HIV and AIDS awareness in the workplace

- HIV and AIDS transmission
- treatment of blood of injuries

Personal safety

- manual handling
- protective equipment

Foundations of technology

'Technology' is defined as the skills, knowledge, tools, equipment, machines and ideas that people use to develop resources in their respective environments so that they can satisfy their needs.

So the key elements of studying technology are:

- skills, knowledge, attitudes, ideas,
- tools, equipment and machines
- people
- resources, environment
- needs.

Interrelationship of technology, industry and society

Students understand the impacts of the interrelationship of technology, industry, society and sustainability, and their influence on product design or adaptation or maintenance.

- past, present and emerging technologies
- economics
- politics

- culture
- environment
- clients
- ethics
- enterprise
- personal, community and global markets
- social considerations
- industrial manufacturing process of products
- trends

Principles and elements of design

- principles of design
  - symmetry
  - balance
  - contrast or emphasis
  - harmony or unity
  - hierarchy
  - proportion
  - rhythm
  - pattern
  - scale
- elements of design
  - line
  - shape
  - form
  - colour
  - texture
  - tone
  - point

Sustainability

- systems to ensure sustainability
- recycling
- lifecycle analysis
- principles of sustainable design.

Technology resources

Resources in the technology studied include materials, tools, processes and systems.

Materials

'Materials' refer to all substances found in our natural environment. Materials are generally extracted, refined, combined and/or processed into usable forms, such as sheet, rod, powder, granules and liquids, before use. Materials are studied in the production-ready form.

- overview of materials
  - classification of materials: metal, polymer, ceramic or organic
  - physical properties: density, conductivity, colour, lustre
  - mechanical properties: hardness, tensile strength, malleability, toughness, ductility, shear strength, compressive strength, elasticity
  - applications of materials: analysis of the classification and properties of materials used in a variety of applications (recreational, engineering, domestic, construction)
- selection of materials
  - constraints: cost, weight, availability, sustainability, machineability, weldability, recycling, adherence of surface finishes and adhesives
  - consideration of the physical and mechanical properties required for the application or for the environment: high impact, indoor, outdoor, high traffic, human interaction

Tools

A 'tool' is any natural or manufactured implement that alters the size, shape or finish of a material. Students gain knowledge of, and work with, a range of tools such as hand tools, power tools, machinery and associated equipment.

- identification
  - nomenclature, such as name, brands, variants, parts of tools, attachments
  - types: hand tools, power tools, machinery
  - function: separating, marking, measuring
- application
  - selection of appropriate tool considering material, waste removal, cost (machine and labour), expertise, quality
  - safe use of tools and equipment
  - general care and maintenance of tools and equipment

Students investigate a range of tools in each of the technologies studied.

Processes

'Processes' include all activities and procedures applied by hand, hand tool, portable power tool or machine that change the size, shape or nature of the material being worked.

Students gain knowledge of a broad range of the methods for processing materials and, through the realisation of their design activities, develop skills in processing a range of materials.

- forming materials: bending, casting, pressing and moulding
- separating materials: sawing, drilling, shearing, turning, abrading or grinding and cutting
- combining materials: fabrication or joining, mechanical fasteners, adhesives, joints and cohesive bonding
- conditioning materials: hardening, tempering, annealing and chemical treatment
- finishing materials: painting, polishing, plating and coating

Students investigate a range of processes in the technology studied.

Systems

The term 'system' describes the combination of two or more parts to create an outcome that previously was unable to be performed by the individual parts. Students investigate a range of systems in the technology studied.

- identification: structural, mechanical, electrical, electronic, pneumatic, hydraulic, energy, fabrication
- application: manufacturing, construction, control, communication, security
- performance: mechanical advantage, efficiency, quality, repeatability, flexibility, serviceability, stability, reliability, sustainability

Students gain knowledge of, and use, a range of systems.

The design process

The design process consists of:

- investigating
- planning
- making or adapting or maintaining
- marketing
- evaluating.

Investigating

Investigating is about researching situations, looking for opportunities, looking for niches in the market that could be filled with products students produce, looking at products that students could produce better, looking at ways to vary or be innovative with designs, and surveying customer needs and preferences. When students investigate, they:

- assess the nature and circumstances of problems
- gather information to analyse the nature of problems
- conduct market surveys
- conduct needs analysis through questioning or interviewing
- identify a problem
- clarify or explain the problem
- explore social, economic, technological, ecological and aesthetic factors that have a bearing on the kind of product or the use of particular techniques.

Planning and designing

Planning and designing is about researching, identifying, exploring, developing, applying, communicating and evaluating ideas. When students plan and design, they:

- adapt or create original designs to produce product
- generate plans or proposals for creatively solving problems
- consider options, identify priorities and constraints, experiment with different ways to achieve their aims, as well as calculate and predict consequences

- choose appropriate resources and equipment and appraise plans and actions
- develop criteria to assess how well their intended techniques and products meet the requirements of the problem
- use graphic representations and technical language to explain design processes and production processes.

Making or producing, or adapting or maintaining

Making is about producing and constructing products, or adapting or maintaining products to meet an identified need. When students make, they:

- translate designs and plans into products or processes
- work alone or cooperatively
- apply techniques and use equipment safely and resourcefully
- manage time and resources effectively
- monitor and control quality in creating or adapting or maintaining products and processes
- adapt ideas and plans in response to constraints and difficulties
- develop a range of skills to work with accuracy to produce a quality outcome.

Marketing

Marketing is about advertising, selling and profit. When students market a product, they:

- recognise and meet the need of the user or buyer
- calculate production costs, determine profit and keep records of sales
- explore ways to effectively advertise and sell products
- investigate ways to value add to products
- consider alternative ways that a product can be used effectively if it is not marketable.

Evaluating

Evaluating is about questioning, examining, assessing and reviewing. When students evaluate, they:

- measure and test products using developed criteria and report findings
- determine whether the products and processes match design requirements, provide satisfactory solutions and have social, economic or technological effects
- reflect on the process of designing, planning, making and marketing to see if the parts of the process could be improved for future products
- reflect on and reconsider their intentions, plans and actions to modify and improve the process and quality of their products.

Design and Technology units

Design and Technology units may be taken from Practical Skills Technologies, Food Technology or Textiles Technology and mixed and matched according to the requirements of the students and the resources of the school.

Design and Technology provides students with opportunities to design various products or undertake a project, using the technology being studied, in response to a design brief. Students put ideas into practice through practical projects. Knowledge and skills gained are applied not only to creating new products but also to adapting or maintaining existing products. For example, Small Engine Technology requires students to learn about engines, to take them apart and reassemble them, and to maintain them to keep them in good working order.

Design and Technology can accommodate many technologies. Schools choose those units that are appropriate for their locality, available expertise and resources.

The following are examples of technologies that can be taught as part of Design and Technology units. Some of these units are described in detail in the teacher guide.

- Architectural Drawing
- Auto Mechanics
- Building Construction
- Communication
- Computer-aided Drawing
- Concrete Technology
- Electrical Technology
- Fibreglass
- Food
- Land Transport Technology
- Marine Transport Technology
- Metal Technology
- Plastic
- Plumbing Technology
- Rural Technology
- School Developed Unit
- Small Engine Mechanics
- Solar and Hydro Technology
- Technical Drawing
- Textiles
- Timber
- Village Technology
- Transport
- Welding Technology
- Working with Wood

- Wood Carving Technology
- *TVET National Certificate 1 modules from the following Training Packages:*
  - *Electrotechnology*
  - *Metal Fabrication and Welding*
  - *Maintenance Fitting and Machining*
  - *Automotive Servicing (Light Vehicles)*
  - *Automotive Body Repair and Finishing*
  - *Carpentry Construction*

Students can study one technology in detail over a period of time, or they can study a different technology each term. If students spent four terms studying Building Construction, for example, it would be expected that the product made would be complex—such as a building project—and reflect the time spent studying the technology. However, if students studied Building Construction for just one term, a small project or model, such as an enclosure for an animal, would be appropriate.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
3. apply knowledge and understanding of processes through identifying, selecting and using various materials and/or systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways.

To achieve these outcomes, students:

- produce at least one product using the design process in response to a design brief, or
- undertake a project involving maintenance or adaptation of existing products, and
- produce a portfolio to accompany the product or project, showing ongoing evidence of the application of the design process. The portfolio must show all stages of the production of the item, from the design brief and initial ideas and drawing to the evaluation of the product, and the specific technologies used in the process.

Content

Students acquire knowledge and skills of chosen technologies through the learning about the properties of the technology and designing, making, marketing where appropriate and evaluating a product made from the technology.

Design and Technology Project

Design, make and evaluate a product

Students must produce at least one product using the design process in response to a design brief, or undertake a project involving maintenance or adaptation of existing products. It is suggested that if a technology is taught for one term, the product that is realised should be simple one, allowing the students to complete the project and enabling the teacher to assess the students' work. If the same technology is taught over one or even over a 2-year course then the product could be complex in nature.

A portfolio must accompany the product or project, showing ongoing evidence of the application of the design process. The portfolio must show all stages of the production of the item, from the design brief and initial ideas and drawing to the evaluation of the product, and the specific technologies used in the process.

Practical Skills Technologies

Learning outcomes: Practical Skills Technologies

The learning outcomes for Practical Skills Technologies identify the knowledge, skills, attitudes and values all students achieve or demonstrate at the end of Grade 12. These learning outcomes are listed below.

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
3. apply knowledge and understanding of processes through identifying, selecting and using various materials, equipment and/or systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways.

Learning outcomes mapped against units

Learning outcomes	Units						
	11.1	**11.2**	**11.3**	**11.4**	**12.1**	**12.2**	**12.3**
1. Use the design process to produce appropriate solutions	✓	✓	✓	✓	✓	✓	✓
2 apply safe and appropriate codes and practices in the learning and working environment	✓	✓	✓	✓	✓	✓	✓
3. Apply knowledge and understanding of processes through identifying, selecting and using various materials, equipment and/or systems		✓	✓	✓	✓	✓	✓
4. Demonstrate a range of skills and techniques		✓	✓	✓	✓	✓	✓
5. Evaluate the process and product against the design brief	✓	✓	✓	✓	✓	✓	✓
6. Communicate ideas and information in a variety of ways.	✓	✓	✓	✓	✓	✓	✓

Unit sequence and content: Practical Skills Technologies

These units can be sequenced according to the requirements of the students and the resources of the school. Schools can continue with the same unit from Term 1 to Term 4, for 2 or 4 terms, or study different units each term.

Note
All students must complete 11.1 Introduction to Practical Skills Technologies.

Grade 11 units	Grade 12 units
11.1 Introduction to Practical Skills Technologies (*required*) • Occupational health and safety • Foundations of technology • Technology resources • The design process **11.2 Practical Skills Technologies unit** *(for example: Land Transport Technology, Woodcarving, School Developed unit or Working with Wood)* • Practical Skills Technology project **11.3 Practical Skills Technologies unit** *(for example: Fibreglass, Building Construction, Small Engine Mechanics or School Developed unit)* • Practical Skills Technology project **11.4 Practical Skills Technologies unit** *(for example: Village Technology, Woodcarving, Small Engine Mechanics 2, School Developed unit or TVET National Certificate 1 module)* • Practical Skills Technologies project	**12.1 Practical Skills Technologies unit** *(for example: Wood Carving Technology, Plumbing Technology, School Developed unit or TVET National Certificate 1 module)* • Practical Skills Technologies project **12.2 Practical Skills Technologies unit** *(for example: Solar and Hydro Technology, Building Construction 2 or Electrical Technology, School Developed unit or TVET National Certificate 1 module)* • Practical Skills Technologies project **12.3 Practical Skills Technologies unit** *(for example: Building Construction 3 or Electrical Technology 2, School Developed unit)* • Practical Skills Technologies project **12.4 Practical Skills Technologies unit** *(for example: Building Construction 4, Marine Transport Technology, School Developed unit or TVET National Certificate 1 module)* • Practical Skills Technologies project

Grades 11 and 12 Practical Skills Technologies units

11.1 Introduction to Practical Skills Technologies

This unit provides students with an understanding of the fundamentals of occupational health and safety, design, and the design process. Occupational health and safety enhances students' awareness of the importance of safe work practices in a safety-conscious environment. They learn to assess safety standards, identify potential risks, design safety signs, identify causes of common workplace accidents, participate in emergency drills and demonstrate safe work practices and first aid techniques.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways.

To achieve these outcomes, students:

- explain the basic legal requirements covering occupational health and safety in the workshop
- describe the requirements of health and safety policies and procedures in a workplace environment
- identify potential workplace hazards in a workplace environment and outline a range of preventative and control measures
- identify sources of pollution in a workplace and outline control measures
- list the requirements for personal safety in a workplace environment
- demonstrate knowledge of basic first aid functions in an emergency including cardio-pulmonary resuscitation, HIV and AIDS prevention in cases of major cuts and laceration
- describe and explain the design process
- demonstrate knowledge of design fundamentals.

Content

Students acquire knowledge and skills through the learning of this content and the making of a product.

Occupational health and safety

Occupational health and safety is incorporated into all activities associated with the design and development or maintenance of a product, and students are encouraged to transfer the need for safety into real-life situations.

Safety standards

- relevant safety standards such as Papua New Guinea's Occupational Health and Safety standards
- safety as a design factor; for example, ergonomics
- safety testing—stress loading, wear factors
- product safety—consumer protection

Current compliance standards

- legal requirements covering occupational health and safety in the workplace

Safe workshop practices

- potential workplace hazards and a range of preventive and control measures:
  - housekeeping
  - operational procedures for equipment
  - material handling, including material safety data sheets (MSDS)
  - hazard identification, and risk assessment and management

HIV and AIDS awareness in the workplace

- HIV and AIDS transmission; treatment of blood of injuries

Personal safety

- manual handling; protective equipment

Foundations of technology

'Technology' is defined as the skills, knowledge, tools, equipment, machines and ideas that people use to develop resources in their respective environments so that they can satisfy their needs. So the key elements of studying technology are:

- skills
- knowledge
- attitudes
- ideas
- tools, equipment and machines
- people
- resources
- environment
- needs.

Interrelationship of technology, industry and society

Students understand the impacts of the interrelationship of technology, industry, society and sustainability, and their influence on product design or adaptation or maintenance.

- past, present and emerging technologies; economics; politics; culture; environment; clients; ethics; enterprise; personal, community and global markets; social considerations; industrial manufacturing process of products; trends

Principles and elements of design

- principles of design: symmetry, balance, contrast or emphasis, harmony or unity, hierarchy, proportion, rhythm, pattern, scale
- elements of design: line, shape, form, colour, texture, tone, point

Sustainability

- systems to ensure sustainability; recycling; lifecycle analysis; principles of sustainable design

Technology resources

Resources in the practical technology studied include *materials, tools, processes, systems*.

Materials

'Materials' refer to all substances found in our natural environment. Materials are generally extracted, refined, combined and/or processed into usable forms, such as sheet, rod, powder, granules and liquids, before use. Materials are studied in the production-ready form.

- overview of materials
  - classification of materials: metal, polymer, ceramic or organic
  - physical properties: density, conductivity, colour, lustre
  - mechanical properties: hardness, tensile strength, malleability, toughness, ductility, shear strength, compressive strength, elasticity
  - applications of materials: analysis of the classification and properties of materials used in a variety of applications (recreational, engineering, domestic, construction)
- selection of materials
  - constraints: cost, weight, availability, sustainability, machineability, weldability, recycling, adherence of surface finishes and adhesives
  - physical and mechanical properties required for the application or for the environment: high impact, indoor, outdoor, high traffic, human interaction

Tools

A 'tool' is any natural or manufactured implement that alters the size, shape or finish of a material. Students gain knowledge of, and work with, a range of tools such as hand tools, power tools, machinery and associated equipment.

- identification (nomenclature): name, brands, variants, parts of tools, attachments; types: hand tools, power tools, machinery; function: separating, marking, measuring
- application: selection of appropriate tool considering material, waste removal, cost (machine and labour), expertise, quality; safe use of tools and equipment; general care and maintenance of tools and equipment

Students investigate a range of tools in each of the technologies studied.

Processes

'Processes' include all activities and procedures applied by hand, hand tool, portable power tool or machine that change the size, shape or nature of the material being worked. Students gain knowledge of a broad range of the

methods for processing materials, and through the realisation of their design activities, develop skills in processing a range of materials.

- forming materials: bending, casting, pressing and moulding
- separating materials: sawing, drilling, shearing, turning, abrading or grinding and cutting
- combining materials: fabrication or joining, mechanical fasteners, adhesives, joints and cohesive bonding
- conditioning materials: hardening, tempering, annealing and chemical treatment
- finishing materials: painting, polishing, plating and coating

Students investigate a range of processes in the technology studied.

Systems

The term 'system' describes the combination of two or more parts to create an outcome that can not be performed by the individual parts. Students investigate a range of systems in the technology studied.

- identification: structural, mechanical, electrical, electronic, pneumatic, hydraulic, energy, fabrication
- application: manufacturing, construction, control, communication, security
- performance: mechanical advantage, efficiency, quality, repeatability, flexibility, serviceability, stability, reliability, sustainability

Students gain knowledge of, and use, a range of systems.

The design process

The design process consists of investigating, planning, making or adapting or maintaining, marketing and evaluating.

Investigating

Investigating is about researching situations, looking for opportunities, looking for niches in the market that could be filled with products students produce, looking at products that students could produce better, looking at ways to vary or be innovative with designs, and surveying customer needs and preferences. When students investigate, they:

- assess the nature and circumstances of problems
- gather information to analyse the nature of problems
- conduct market surveys
- conduct need analysis through questioning or interviewing
- identify a problem
- clarify or explain the problem
- explore social, economic, technological, ecological and aesthetic factors with a bearing on the kind of product or use of particular techniques.

Planning and designing

Planning and designing is about researching, identifying, exploring, developing, applying, communicating and evaluating ideas. When students plan and design, they:

- adapt or create original designs to produce product
- generate plans or proposals for creatively solving problems
- consider options; identify priorities and constraints; experiment with different ways to achieve their aims; calculate and predict consequences
- choose appropriate resources and equipment and appraise plans and actions
- develop criteria to assess how well their intended techniques and products meet the requirements of the problem
- use graphic representations and technical language to explain design processes and production processes.

Making or producing, or adapting or maintaining

Making is about producing and constructing products, or adapting or maintaining products to meet an identified need. When students make, they:

- translate designs and plans into products or processes
- work alone or cooperatively
- apply techniques and use equipment safely and resourcefully
- manage time and resources effectively
- monitor and control quality in creating or adapting or maintaining products and processes
- adapt ideas and plans in response to constraints and difficulties
- develop a range of skills to work with accuracy to produce a quality outcome.

Marketing

Marketing is about advertising, selling and profit. When students market a product, they:

- recognise and meet the need of the user or buyer
- calculate production costs, determine profit and keep records of sales
- explore ways to effectively advertise and sell products
- investigate ways to add value to products
- consider other ways a product can be used effectively if not marketable.

Evaluating

Evaluating is about questioning, examining, assessing and reviewing. When students evaluate, they:

- measure and test products using developed criteria; report their findings
- determine whether the products and processes match design requirements, provide satisfactory solutions and have social, economic or technological effects
- reflect on the process of designing, planning, making and marketing to see if the parts of the process could be improved for future products
- reflect on and reconsider their intentions, plans and actions to modify and improve the process and quality of their products.

Practical Skills Technologies units

Practical Skills Technologies units give students opportunities to learn about and use various technologies in response to a design brief. Students put ideas into practice through practical projects. The knowledge and skills gained are applied not only to creating new products, but also to the adaptation or maintenance of existing products, machines or items. In each unit students must produce at least one product using the design process in response to a design brief, or undertake a project involving adaptation of existing products or items. A portfolio must accompany the product or project, showing all stages of the production of the item, from the design brief and initial ideas, drawings and patterns, to the evaluation of the product and the specific technologies used in the process.

Practical Skills Technologies can accommodate many technologies. Schools choose those technologies to teach as units that are appropriate for their locality, available expertise and resources, except food and textiles. The following are examples of technologies that can be taught as Practical Skills Technologies units. Some are described in detail in the teacher guide.

- Architectural Drawing
- Auto Mechanics
- Building Construction
- Communication
- Computer-aided Drawing
- Concrete Technology
- Electrical Technology
- Fibreglass Technology
- Land Transport Technology
- Marine Transport Technology
- Metal Technology
- Plastic
- Plumbing Technology
- Rural Technology
- School Developed Unit
- Small Engine Mechanics
- Solar and Hydro Technology
- Technical Drawing
- Timber
- Village Technology
- Transport
- Welding Technology
- Working with Wood
- Wood Carving Technology
- *TVET National Certificate 1 modules from these Training Packages:*
  - *Electrotechnology*
  - *Metal Fabrication and Welding*

- *Maintenance Fitting and Machining*
- *Automotive Servicing (Light Vehicles)*
- *Automotive Body Repair and Finishing*
- *Carpentry Construction*

Students can study one technology in detail over a period of time, or a different technology each term. If students spend four terms studying Building Construction, for example, it is expected that the product made is complex—such as a building project—reflecting the time spent studying the technology. However, if they study Building Construction for just one term, a small project or model, like an enclosure for an animal, is appropriate.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
3. apply knowledge and understanding of processes through identifying, selecting and using various materials, equipment and/or systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways.

To achieve the outcomes, students:

- design and make an item or product using the design process in response to a design brief, or
- undertake a project involving adaptation or maintenance of existing products, machines or textile items, and
- produce a portfolio to accompany the product or project.

Content

Students acquire knowledge and skills through learning about the properties of the technology and designing, making and evaluating a product.

Practical Skills Technology project

Design, make and evaluate a product
Students must produce at least one product using the design process in response to a design brief, or undertake a project involving maintenance or adaptation of existing products. If a technology is taught for one term, the product should be a simple one, allowing students to complete the project and enabling the teacher to assess their work. If the same technology is taught over a 1 or 2-year course then the product can be complex. A portfolio must accompany the product or project, showing ongoing evidence of the application of the design process. The portfolio must show all stages of production, from the design brief and initial ideas and drawing to product evaluation and specific technologies used in the process.

Food Technology

Learning outcomes: Food Technology

The learning outcomes for Food Technology identify the knowledge, skills, attitudes and values all students achieve or demonstrate at the end of Grade 12. These learning outcomes are listed below.

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and hygienic practices when handling food
3. apply knowledge and understanding of processes through identifying, selecting and using various foods, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways
7. demonstrate knowledge and understanding of food technology principles.

Learning outcomes mapped against units

Learning outcomes	Units						
	11.1	**11.2**	**11.3**	**11.4**	**12.1**	**12.2**	**12.3**
1. Use the design process to produce appropriate solutions	✓	✓	✓	✓	✓	✓	✓
2. Apply safe and hygienic practices when handling food	✓	✓	✓	✓	✓	✓	✓
3. Apply knowledge and understanding of processes through identifying, selecting and using various foods, equipment and systems	✓	✓	✓	✓	✓	✓	✓
4. Demonstrate a range of skills and techniques	✓	✓	✓	✓	✓	✓	✓
5. Evaluate the process and product against the design brief	✓	✓	✓	✓	✓	✓	✓
6. Communicate ideas and information in a variety of ways	✓	✓	✓	✓	✓	✓	✓
7 demonstrate knowledge and understanding of food technology principles	✓	✓	✓		✓	✓	

Unit sequence and content: Food Technology

Grade 11 units	Grade 12 units
11.1 Introduction to Food Technology • Occupational health and safety • The design process • Technology resources • Food Technology project **11.2 Planning and Preparation of Food** • Safe storage of food • Safe preparation and presentation of food • Sensory characteristics of food • Functional properties of food • Food Technology project **11.3 Food Availability and Selection** • Influences on food availability • Factors affecting food selection • Food Technology project **11.4 Food Technology unit** Food Technology project *(for example: Food to Sell or Catering for the School Canteen, School-developed unit or TVET module from National Certificate 1 Hospitality: Commercial Cookery*	**12.1 Nutrition** • Food nutrients • Diets for optimum nutrition • Food Technology project **12.2 Food Manufacture** • Production and processing of food • Preservation • Packaging, storage and distribution • Impact of food manufacturing technologies • Food Technology project **12.3 Food Technology unit** • Food Technology project *(for example: Baking, Seafood Cookery, School-developed unit or TVET module from National Certificate 1 Hospitality (Commercial Cookery)* **12.4 Food Technology unit** • Food Technology project *(for example: Food to Sell, Food Catering for Special Events, School-developed unit or TVET module from National Certificate 1 Hospitality (Commercial Cookery*

Grades 11 and 12 Food Technology units

11.1 Introduction to Food Technology

This unit introduces students to occupational health and safety in the food industry and the design process in relation to selecting, preparing, presenting and evaluating food.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and hygienic practices when handling food
3. apply knowledge and understanding of processes through identifying, selecting and using various foods, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways
7. demonstrate knowledge and understanding of food technology principles.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Occupational health and safety

Occupational health and safety is incorporated into all activities associated with the preparation and production of food, and students are encouraged to transfer the need for hygiene and safety into real-life situations.

Safety standards

- relevant safety standards such as Papua New Guinea's Occupational Health and Safety standards
- safety as a design factor; for example, ergonomics
- product safety—consumer protection

Current compliance standards

- legal requirements of occupational health and safety in the workplace

Safe workshop practices

- potential kitchen hazards and a range of preventive and control measures: housekeeping; operational procedures for equipment; safe and hygienic handling of food; personal hygiene; kitchen hygiene; garbage disposal; equipment safety; appropriate food packaging; food additives and product labelling

HIV and AIDS awareness in the workplace

- HIV and AIDS transmission; treatment of blood of injuries

Personal safety

- manual handling; protective clothing

The design process

Designing, making and appraising is a process through which students develop ideas and create imaginative solutions for learning tasks associated with foods. They should participate in decisions about what, why, and how projects should be undertaken and how the product might be improved. When students design, make and appraise in food technology, they:

- investigate issues and situations; devise proposals and alternatives; communicate ideas and actions; produce food products; evaluate impacts and consequences.

Preparation and presentation of a variety of foods forms an important part of making and appraising of food.

Technology resources

- resources include: materials, equipment, processes and systems

Materials

'Materials' refer to all substances used in food production, raw or refined.

- overview of materials: classification; physical properties; applications
- selection of materials: constraints: cost, weight, availability, sustainability
- consideration of material from technical, social and ecological viewpoints

Tools

A 'tool' is any natural or manufactured implement that is used in food preparation and production. Students gain knowledge of, and work with, a range of equipment such as hand utensils, electrical appliances and associated equipment.

- identification: nomenclature—name, brands, variants, appliances, equipment; function: separating, mixing, measuring, cooking
- application: selection of appropriate equipment considering material, waste removal, cost (machine and labour), expertise, quality; safe use of utensils and equipment; general care and maintenance of kitchen equipment and appliances

Processes

'Processes' include all activities and procedures applied by hand, hand utensils, appliances or equipment that changes the nature of the food being used. Students gain knowledge of a broad range of methods for processing food, and develop skills in processing and producing food.

Systems

Systems in food technology are a series of steps, recipes, sequences, or combinations of elements that work together to achieve specified outcomes. Working with systems in food technology gives students opportunities to:

- observe procedures, include or remove ingredients, make products, modify recipes
- operate appliances, control equipment, make projects, assemble meals, organise processes and manage activities
- examine how systems are designed and applied
- control and monitor the efficient and effective operation of systems.

Food Technology project

Use the design process to make food products, and produce a portfolio showing all the steps undertaken in the making of the products.

11.2 Planning and Preparation of Food

This unit provides students with the opportunity to investigate the best methods and equipment to use for optimum results, and what to prepare for a range of situations. Quality food products result from safe and hygienic handling of food in domestic, commercial and industrial settings. Students research, analyse and apply the most suitable food preparation and cooking methods to optimise the sensory, physical and chemical properties of food.

Students work both independently and as members of a team to research and implement solutions to a design brief, and to respond to the exciting challenges of preparing food for a range of contexts. These contexts include nutritional considerations, cultural beliefs, and resource access and availability.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and hygienic practices when handling food
3. apply knowledge and understanding of processes through identifying, selecting and using various foods, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways
7. demonstrate knowledge and understanding of food technology principles.

To achieve these learning outcomes, students:

- identify and explain the sensory characteristics and functional properties of food
- identify sensory characteristics that constitute quality in a variety of foods
- describe methods of storing foods to maintain sensory characteristics and ensure safety
- explain some of the functional properties of food
- identify the factors that affect the functional properties of food
- investigate through experimentation the factors that affect the functional properties of foods
- apply an understanding of the sensory characteristics and functional properties of food to the preparation of food products.
- prepare a range of foods that demonstrate functional properties of food
- select appropriate equipment and utensils to produce quality food products across a range of settings
- implement safe and hygienic work practices when handling food
- select and apply suitable preparation methods to produce quality food products and plate meals for service across a range of settings
- evaluate the appeal of foods using sensory assessment.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Safe storage of food

- methods of storing foods to maintain quality such as dry storage, cold storage and freezing
- methods of preservation of food

Safe preparation and presentation of food

- equipment and utensils to produce quality food products across a range of settings
- safe and hygienic work practices when handling food
- preparation methods to produce food products across a range of settings
- layout of food for visual appeal, including styling for photography and plating for service

Sensory characteristics of food

- sensory characteristics of foods, including appearance, odour, taste (flavour) and texture (mouth feel)
- sensory assessment of a variety of foods

Functional properties of food

- functional properties of food, including the roles of:
  - minerals and vitamins
  - water
  - proteins in denaturing, coagulation, gelation, foaming and browning
  - carbohydrates in gelatinising, dextrinising, caramelising and crystallising
  - fats in emulsifying and aerating
- factors that affect the functional properties of food, including:
  - oxygen
  - temperature
  - acidity
  - agitation
  - enzymes
  - addition of other ingredients
- presentation techniques to optimise sensory properties

Food Technology project

Use the design process to make food products that demonstrate the functional properties of food, and produce a portfolio showing all the steps undertaken in the making of the products.

11.3 Food Availability and Selection

In this unit students are introduced to the history of food availability and how this has determined food selection by communities. Communities try to obtain enough food for their needs. Throughout human history, the availability of food has been determined by local and/or external influences. Selection of food is influenced by physiological and psychological factors as well as broader social and economic factors.

Emphasis is placed on safe handling practices and how to apply these practices in the preparation of food. Food storage practices that maximise quality of raw and cooked food are also investigated.

Students discover the links between classification of foods and their properties and how their enjoyment of food is associated with different cooking methods and properties of foods. They examine changes in properties of food when different preparation and processing techniques are used. Students apply this knowledge when preparing food.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and hygienic practices when handling food
3. apply knowledge and understanding of processes through identifying, selecting and using various foods, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways.
7. demonstrate knowledge and understanding of food technology principles

To achieve these outcomes, students:

- outline the historical changes to food availability in Papua New Guinea
- identify and discuss a range of contemporary factors which influence the availability of particular foods
- explain how various factors influence selection of food by individuals and groups such as physiological, psychological, social and economic factors
- plan, prepare and present foods which reflect a range of the influences on food selection.
- investigate current food consumption and expenditure patterns in Papua New Guinea
- analyse the eating patterns of a selected group to identify influences on food selection.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Influences on food availability

- historical changes to the availability of food, including:
  - global migration of cultural groups
  - use of local foods in Papua New Guinea
- technological developments influencing food availability, including:
  - production and manufacturing processes and equipment techniques
  - storage and distribution techniques
  - marketplace practices
- social, economic and political influences on food availability, including:
  - effects of poverty and affluence
  - type and state of the economy
  - government policy; for example, taxation, tariffs, embargoes, subsidies, war, export strategies

Factors affecting food selection

- physiological factors, including:
  - hunger, appetite, satiety
  - nutritional requirements, such as age, gender, size, activity level
  - reactions to food; for example, to appearance, odour, taste, allergy
- psychological factors, including:
  - values, beliefs, habits, attitudes, emotions, self-concept, experiences
- social factors, including:
  - traditions and culture
  - lifestyle; for example, employment, education, household structures, roles, geographic location, interests
  - social interaction; for example, peer group, family hospitality
  - media
- economic factors, including:
  - the marketplace (retail and purchasing practices)
  - resource availability, such as food processing equipment and food preparation skills
  - occupation and finances

Food Technology project

Use the design process to make food products that reflect a range of the influences on food selection, and produce a portfolio showing all the steps undertaken in the making of the products.

11.4 Food Technology unit

The food technology units provide students with the opportunity to prepare and cook a variety of food items or meals in response to a design brief. Students put ideas into practice through practical projects. The knowledge and skills gained are applied not only to creating new food products, but also to adapting existing recipes and dishes.

In each unit students must produce food items, products or meals using the design process in response to a design brief, or undertake a project involving group work in a catering context.

A portfolio must accompany the project, showing ongoing evidence of the application of the design process. The portfolio must show all stages of the development of the food product, item, meal or event from the design brief and initial ideas and drawings and making of the food.

Food Technology units can accommodate many options. Schools choose those options that are appropriate for their locality, available expertise and resources.

The following are examples of units that can be taught as Food Technology units. Some of the units are described in the teacher guide.

- Baking
- Catering for Special Events
- Food to Sell
- Catering for Special Food Needs
- School Developed Unit
- Seafood Cookery
- Traditional Cookery
- Cooking with Local Produce
- Catering for Parties or Functions
- Catering for School Students
- Catering for the School Canteen
- *TVET modules from the National Certificate 1 Hospitality (Commercial Cookery)*

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and hygienic practices when handling food
3. apply knowledge and understanding of processes through identifying, selecting and using various foods, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways.

To achieve the outcomes, students:

- plan, prepare and cook a food item (or items, products or meals) using the design process in response to a design brief
- produce a portfolio to accompany the product or project.

Content

Students acquire knowledge of and skills in working with food through learning about the properties of the technology and planning, preparing, producing and evaluating foods.

Food Technology project

Design, make and evaluate food items or products

Students must produce a number of food items or product items using the design process in response to a design brief, or undertake a project involving individual or group work for a catering project.

A portfolio must accompany the product or project, which shows ongoing evidence of the application of the design process. It must show all stages of the planning, preparation, production, serving or marketing of the item from the design brief and initial ideas, drawings and recipes to the evaluation of the food produced and the specific techniques used in the process.

Grade 12 units

12.1 Nutrition

Nutrition is a significant factor contributing to the health of the individual and to the economic and social future of the people of Papua New Guinea. This unit introduces students to the importance of planning diets to meet the requirements of the family and particular individuals. Preparing foods that are nutritious and assessing the nutritional value of products requires knowledge of nutrition and skills in food preparation.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and hygienic practices when handling food
3. apply knowledge and understanding of processes through identifying, selecting and using various foods, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways
7. demonstrate knowledge and understanding of food technology principles.

To achieve these learning outcomes, students:

- identify food nutrients
- identify types of carbohydrates, proteins, fats, vitamins and minerals
- identify the nutrient composition of various foods
- identify the importance of water
- explain the functions of food nutrients in human nutrition
- combine foods to demonstrate nutritionally beneficial interrelationships between foods
- describe the process of digestion, absorption and metabolism of food
- investigate the recommended dietary intake (RDI) of energy, protein, vitamins and minerals for particular individuals and groups using appropriate data such as RDI tables in print or electronic format
- select foods to provide a balanced intake of nutrients for particular individuals and groups to meet a variety of nutritional needs
- use suitable preparation methods to optimise nutritional value of foods
- assess meals and diets in regard to meeting nutritional needs throughout the life cycle
- investigate food status of individuals (current eating habits, food preferences, activity, lifestyle) and set appropriate goals
- assess the nutrient value of meals and diets for particular individuals and groups

- plan or design and calculate costs for a suitable healthy daily and weekly menu to meet needs of specific people
- follow recipes to make nutritious and attractive food items (safely and hygienically) within a time frame; selecting a variety of appropriate food, utensils and appliances to prepare quality food items for the design project.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Food nutrients

- food nutrients: carbohydrates, proteins, lipids, vitamins, minerals and water
- structure of carbohydrates, proteins, lipids and fats
- sources of carbohydrates, proteins, lipids, vitamins, minerals and water
- functions of carbohydrates, proteins, lipids, vitamins, minerals and water in the body
- significant interrelationships between nutrients, including:
  - iron and vitamin C
  - iron and fibre
  - calcium and phosphorous
  - calcium and vitamin D
  - calcium and fibre
  - calcium and lactose
  - folate and vitamin B12
  - sodium and potassium
  - digestion, absorption and metabolism of food

Diets for optimum nutrition

- nutritional requirements throughout the life cycle
- current food selection guides and nutritional information that assist in planning and evaluating meals and diets
- nutritional deficiencies
- preparation techniques to produce nutritious foods

Food Technology project

Use the design process to make food products that provide a balanced intake of nutrients for a particular individual or group and meet a variety of nutritional needs, and produce a portfolio showing all the steps undertaken in the making of the products.

12.2 Food Manufacture

Developments in food manufacture have an impact on society and the environment. A knowledge and understanding of manufacturing processes and their social and ecological impacts enables students to make informed choices and encourages responsible patterns of consumption.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and hygienic practices when handling food
3. apply knowledge and understanding of processes through identifying, selecting and using various foods, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways
7. demonstrate knowledge and understanding of food technology principles.

To achieve these learning outcomes, students:

- identify food nutrients
- describe processes that transform raw materials into manufactured food products
- compare the processing techniques, equipment, storage and distribution systems used in industry with those used domestically
- identify critical control points and describe quality control procedures in food production systems
- identify food safety hazards and risks
- prepare food using the principles of food preservation to ensure a safe product
- investigate, through experimentation, the suitability of packaging materials for different food products
- analyse the impact of food manufacturing technologies on individuals, groups and society

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Production and processing of food

- quality and quantity control in the selection of raw materials for food processing
- role of food additives in the manufacturing process

- characteristics of equipment used in different types of production and the factors influencing their selection
- production systems used in the manufacture of food; for example, small scale, large scale, manual, automated, computerised
- quality management considerations in industrial practices to achieve safe foods for public consumption; for example, hazard analysis and critical control point (HACCP); occupational health, safety and hygiene

Preservation

- reasons for preserving foods; for example, safety, acceptability, nutritive value, availability and economic viability
- causes of food deterioration and spoilage:
  - environmental factors (infestation, oxygen, light and water)
  - enzymatic activity
  - microbial contamination (mould, yeast and bacteria)
- principles behind food preservation techniques, such as temperature control and restriction of moisture
- preservation processes, including canning, drying, pasteurising, freezing and fermenting food nutrients: carbohydrates, proteins, lipids, vitamins, minerals and water

Packaging, storage and distribution

- functions of packaging and types of materials available
- current developments in packaging; for example, active packaging, modified atmosphere packaging, sous vide (or vacuum cooking)
- legislative requirements for packaging and labelling
- storage conditions and distribution systems at various stages of food manufacture

Impact of food manufacturing technologies

- environmental issues, such as waste management, packaging practices, production techniques
- social implications, such as lifestyle changes, employment opportunities
- nutritional implications
- appropriate use of technology

Food Technology project

Use the design process and food preservation methods to make long lasting food products, and produce a portfolio showing all the steps undertaken in the making of the products.

Food Technology units 12.3 and 12.4

The food technology units provide students with the opportunity to prepare and cook a variety of food items or meals in response to a design brief. Students put ideas into practice through practical projects. The knowledge and skills gained are applied not only to creating new food products, but also to adapting existing recipes and dishes.

In each unit students must produce food items, products or meals using the design process in response to a design brief, or undertake a project involving group work in a catering context.

A portfolio must accompany the project, showing ongoing evidence of the application of the design process. The portfolio must show all stages of the development of the food product, item, meal or event from the design brief and initial ideas and drawings to making of the food.

Food Technology units can accommodate many options. Schools choose those options that are appropriate for their locality, available expertise and resources.

The following are examples of units that can be taught as Food Technology units. Some of the units are described in the teacher guide.

- Baking
- Catering for Special Events
- Food to Sell
- Catering for Special Food Needs
- Seafood Cookery
- Meat Cookery
- Traditional Cookery
- Cooking with Local Produce
- International Cookery
- Catering for School Students
- Catering for the School Canteen
- *TVET modules from the National Certificate 1 Hospitality (Commercial Cookery)*

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and hygienic practices when handling food
3. apply knowledge and understanding of processes through identifying, selecting and using various foods, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways.

To achieve the outcomes, students:

- plan, prepare and cook a food item (or items, products or meals) using the design process in response to a design brief
- produce a portfolio to accompany the product or project.

Content

Students acquire knowledge and skills of working with food through learning about the properties of the technology and planning, preparing, producing and evaluating foods.

Food Technology project

Design, make and evaluate food items or products

Students must produce a number of food items or product items using the design process in response to a design brief, or undertake a project involving individual or group work for a catering project.

A portfolio must accompany the product or project, which shows ongoing evidence of the application of the design process. It must show all stages of the planning, preparation, production, serving or marketing of the food item from the design brief and initial ideas, drawings and recipes to the evaluation of the food produced and the specific techniques used in the process.

Textiles Technology

Learning outcomes: Textiles Technology

The learning outcomes for Textiles Technology identify the knowledge, skills, attitudes and values all students achieve or demonstrate at the end of Grade 12. These learning outcomes are listed below.

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
3. apply knowledge and understanding of processes through identifying, selecting and using various textiles, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways
7. demonstrate knowledge and understanding of textiles technology principles.

Learning outcomes mapped against units

Learning outcomes	Units						
	11.1	**11.2**	**11.3**	**11.4**	**12.1**	**12.2**	**12.3**
1. Use the design process to produce appropriate solutions	✓	✓	✓	✓	✓	✓	✓
2 Apply safe and appropriate codes and practices in the learning and working environment	✓	✓	✓	✓	✓	✓	✓
3. Apply knowledge and understanding of processes through identifying, selecting and using various textiles, equipment and systems	✓	✓	✓	✓	✓	✓	✓
4. Demonstrate a range of skills and techniques	✓	✓	✓	✓	✓	✓	✓
5. Evaluate the process and product against the design brief	✓	✓	✓	✓	✓	✓	✓
6. Communicate ideas and information in a variety of ways.	✓	✓	✓	✓	✓	✓	✓
7 Demonstrate knowledge and understanding of textiles technology principles	✓	✓	✓	✓	✓		

Unit sequence and content: Textiles Technology

Grade 11 units	Grade 12 units
11.1 Introduction to Textiles Technology • Occupational health and safety • The design process • Technology resources • Textiles Technology project **11.2 Design** • Design • Manufacturing methods • Textiles Technology project **11.3 Properties and Performance of Textiles** • Yarn structure and characteristics • Yarn properties • Fibre structure • Fibre types and classification • Fabric structure • Fabric types and classification • Fabric and fibre properties and testing • Textiles Technology project **11.4 Design 2** • Fabric structure • Fabric decoration • Contemporary designers • Textiles Technology project	**12 1 Textiles Technology unit** • Textiles Technology project *(for example: A Garment Pattern Collection, Garment Making, Sewing for Special Groups, school-developed unit or TVET module from National Certificate 1 Garment Making)* **12 2 Textiles Technology unit** • Textiles Technology project *(for example: Hats and Bags, Designing and Making a Uniform, Sports Clothes, school-developed unit or TVET module from National Certificate 1 Garment Making)* **12 3 Textiles Technology unit** • Textiles Technology project *(for example: Garment Making, Home and Office Furnishings, school-developed unit or TVET module from National Certificate 1 Garment Making)* **12 4 Textiles Technology unit** • Textiles Technology project *(for example: Garment Making, Home and Office Furnishings, Sewing for a Wedding, school-developed unit or TVET module from National Certificate 1 Garment Making)*

Grades 11 and 12 Textiles Technology units

11.1 Introduction to Textiles Technology

This unit introduces students to occupational health and safety in the textile industry and the design process in relation to textiles and technology.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
3. apply knowledge and understanding of processes through identifying, selecting and using various textiles, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways
7. demonstrate knowledge and understanding of textiles technology principles.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Occupational health and safety

Occupational health and safety is incorporated into all activities associated with the design and production of fibres, fabrics and textile products, and students are encouraged to transfer the need for hygiene and safety into real-life situations.

Safety standards

- relevant safety standards such as Papua New Guinea's Occupational Health and Safety standards
- safety as a design factor; for example, ergonomics
- product safety—consumer protection

Current compliance standards

- legal requirements covering occupational health and safety in the workplace

Safe workshop practices

- potential workshop hazards and a range of preventive and control measures:
  - housekeeping

  - operational procedures for equipment
  - safe handling of equipment such as scissors
  - personal hygiene
  - disposal
  - recycling
  - appropriate packaging
  - product labelling
  - HIV and AIDS awareness in the workplace
- HIV and AIDS transmission
- treatment of blood of injuries

Personal safety

- manual handling
- protective clothing

The design process

Designing, making and appraising is a process through which students develop ideas and create imaginative solutions for learning tasks associated with textiles. They should participate in decisions about what, why, and how projects should be undertaken and how the product might be improved.

When students design, make and appraise in Textiles Technology, they:

- investigate issues and situations
- devise proposals and alternatives
- communicate ideas and actions
- produce products.

Design and manufacture of a variety of textile products forms an important part of making and appraising.

Technology resources

Resources in Textiles Technology include:

- materials
- equipment
- processes
- systems.

Materials

The term ‘materials’ refers to all substances used in textile manufacture. Materials may be raw or refined.

- overview of materials
  - classification of materials
  - physical properties
  - applications of materials
- selection of materials
  - constraints: cost, weight, availability, sustainability

- consideration of the material from the technical, social and ecological point of view

Tools and equipment

A 'tool' is any natural or manufactured implement that is used in textile design and manufacture. Students gain knowledge of, and work with, a range of tools such as hand tools, electrical tools and associated equipment.

- identification
  - nomenclature, such as name, brands, variants, parts of tools, attachments
  - types: hand tools, power tools, equipment
  - function: cutting, joining, finishing
- application
  - selection of appropriate tool considering material, waste removal, cost (machine and labour), expertise, quality
  - safe use of tools and equipment
  - general care and maintenance of tools and equipment

Processes

'Processes' include all activities and procedures applied by hand, hand tool, power tool or equipment that change the nature of the textiles being worked.

Students gain knowledge of design and develop skills in making garments and textile products.

Systems

Systems in textile studies are a series of steps, sequences, or combinations of elements that work together to achieve specified outcomes.

Working with systems in Textiles Technology studies gives students opportunities to:

- observe procedures, design, produce patterns, make articles, modify products
- operate machines, control equipment, make projects, assemble parts, organise processes and manage activities
- examine how systems are designed and applied
- control and monitor the efficient and effective operation of systems.

Textiles Technology project

Use the design process to make a textile item and produce a portfolio showing all the steps undertaken in the making of the item.

11.2 Design

Students studying Design develop knowledge and understanding of the functional and aesthetic aspects of design applied to a variety of textile materials, methods, techniques and purposes. Practical design investigations, experiments and product manufacturing activities contribute to the development of student's creative ability, while analysis and evaluation activities develop the skills students need to become discriminating individuals and consumers.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
3. apply knowledge and understanding of processes through identifying, selecting and using various textiles, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways
7. demonstrate knowledge and understanding of textiles technology principles.

To achieve the outcomes, students:

- identify the functional and aesthetic requirements and features of a range of textile items
- describe the elements and principles of design and use them in a variety of applications
- design and make an item using textiles
- select and use appropriate manufacturing techniques to assemble textile products
- interpret, use and modify patterns for specific purposes
- apply the elements and principles of design to the analysis and development of the project
- select, analyse and record design idea development for a textile project.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Design

Elements of design

- line and direction
- shape and size

- texture
- colour and value

Principles of design

- proportion
- balance
- rhythm
- emphasis
- contrast and harmony
- unity

Types of design

- functional: items designed for a specific purpose that may include examples from the following focus areas:
  - apparel
  - furnishings
  - costume
  - textile arts
  - non-apparel
- aesthetic: surface decoration or design that enhances the appearance of textile related items
- factors determining appropriate design, such as
  - economics
  - environment
  - manufacturing techniques
  - sustainability
  - decoration

Communication techniques

- graphic, such as:
  - object drawing: views of items from different perspectives, including orthogonal (2-D) and pictorial (3-D) representations
  - fashion drawing: figure sketching, rendering using a range of appropriate media
  - industry production drawing specifications: correct dimensions and proportions, accurate details on drawings and pattern pieces
  - computer-aided drawing: appropriate software to assist in design development

Manufacturing methods

- skills relating to:
  - seams, seam finishes, opening and closure treatments and other appropriate manufacturing techniques
  - fabrics, using woven, non-woven and knit materials with light, medium and heavy weight fabrics
  - pattern modification
  - interpreting, using and modifying patterns

Textiles Technology project

Use the design process to make textile products, and produce a design portfolio showing all the steps undertaken in the making of the products.

- documentation
  - communication of ideas
  - modification of designs or patterns
  - evaluation of ideas and project
  - management of time and resources
- project construction using appropriate methods, techniques and equipment (manipulative skills)

11.3 Properties and Performance of Textiles

In this unit students understand and appreciate the properties and uses of textiles and learn about fabrics, yarns and fibres. They experiment with a range of fabrics and have the opportunity to select appropriate fabrics for a textile item.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
3. apply knowledge and understanding of processes through identifying, selecting and using various textiles, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways
7. demonstrate knowledge and understanding of textiles technology principles.

To achieve the outcomes, students:

- identify properties of a variety of fabrics, yarns and fibres
- describe fabric properties affected by fabric structure
- explore current trends in fashion fabrics
- select fabrics for specific purposes
- evaluate fabric properties using classroom testing procedures
- use and apply appropriate yarn terminology when analysing specific purposes
- identify the characteristics of yarn structure that affect fabric properties
- describe yarn properties and their effect on fabric performance
- demonstrate an understanding of yarn properties when selecting fabrics for specific purposes
- describe the properties of at least two natural, one regenerated, two synthetic fibres and two fibre blends
- identify and classify fibres using the microscope and burning tests
- design and construct a textile item
- select and use appropriate manufacturing techniques to assemble the textile item
- interpret, use and modify patterns for specific purposes
- apply the elements and principles of design to the analysis and development of the project
- select, analyse and record design idea development for a textile project
- use a range of manufacturing techniques appropriate to the fabric selected and the purpose.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Yarn structure and characteristics

- spun staple
  - carded and combed, woollen and worsted yarns
- filament
  - smooth and textured yarns
- twist level
  - low and high twist levels
- novelty yarns
  - slub, bouclé and core spun yarns

Yarn properties

- aesthetic
- durability
- strength
- comfort
- care

Fibre structure

- molecular, including amorphous, crystalline, monomer, polymer
- morphological, including surface characteristics and cross sectional appearance, staple fibre, filament, multifilament

Fibre types and classification

- natural fibres
  - cellulosic: cotton
  - protein: wool
- regenerated
  - viscose rayon
- synthetic
  - polyester
  - nylon
- fibre blends
  - cotton and polyester
  - nylon and elastomeric

Fabric structure

- woven
  - warp, weft, selvedge
- knitted
  - course, wale

- non-woven

Fabric types and classification

- woven, including plain, twill, sateen and satin, Jacquard, crepe and pile weaves
- knitted, including single knit, double knit, tricot, rachel, pile knit, lace and net
- non-woven, including felts, staple and filament webs and films

Fabric and fibre properties and testing

- using a range of functional and aesthetic tests, record and evaluate results
  - aesthetic, including lustre, drape
  - durability, including abrasion resistance, strength
  - comfort, including absorbency, elongation, thermal properties, cooling properties
  - appearance, including resiliency, dimensional stability, elasticity
  - care, including the effect of chemicals, sun resistance, colour fastness, shrink resistance

Textiles Technology project

Use the design process to make textile products, and produce a design portfolio showing all the steps undertaken in the making of the products.

- documentation
  - experimental procedures
  - analysis and evaluation of fabric, yarn and fibre properties
  - product design and fabric choice
  - communicating and recording information
  - management skills
- construction of a textile item or textile fabric and item
  - manufacturing techniques

11.4 Design 2

In this unit students learn to understand and appreciate the influences of historical, cultural and contemporary aspects of design in society.

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment
3. apply knowledge and understanding of processes through identifying, selecting and using various textiles, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways
7. demonstrate knowledge and understanding of textiles technology principles.

To achieve the outcomes, students:

- identify the principles of colouration for specific purposes
- investigate, through experimentation, the basic principles of dyeing and printing textiles
- select and apply appropriate methods of fabric decoration for a specific purpose
- investigate and analyse the influence of one culture on contemporary design
- analyse significant cultural and historical influences on garment production
- undertake an investigation of at least one contemporary designer, analysing the designer's influence on current trends
- design and make a textile item(s) that demonstrates an understanding of functional and aesthetic requirements
- select and use appropriate manufacturing techniques to assemble textile products
- interpret, use and modify patterns for specific purposes
- apply the elements and principles of design to the analysis and development of the project
- demonstrate proficiency in the manufacture of a textile item(s)
- select, analyse and record design idea development for the project.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Fabric structure

Historical design development

- overview of design developments in society through one of the following:
  - apparel, furnishings, cultural dress, sport uniforms or apparel

Fabric decoration

- principles of applying colour to fabrics, yarns and fibres
- methods of fabric decoration, including printing, dyeing, appliqué and embroidery

Influence of culture on design

- textile production and textile art forms
- textiles as a medium for self-expression and communication between people
- effects of culture on textile design in traditional and contemporary society
- external factors that have influenced textile design
- cultural influences, including geographic location, technological development, resources available, religious practices, workers' skills and status

Contemporary designers

- factors that determine the success or failure of designers:
  - external factors, including economic, political, social, ecological and technological
  - internal factors, including expertise, facilities and financial
- changing trends in society that influence: apparel designers; sport uniforms or sports designers; textile art designers
- sources of inspiration for designers

Textiles Technology project

Use the design process to make textile products, and produce a design portfolio showing all the steps undertaken in the making of the products. The design project is to be selected from one of the following: *apparel*, *furnishing*, *costumes*, *sport uniform or apparel*, *non-apparel*.

Visual design development

- inspiration, development and evaluation of design ideas
- functional and aesthetic design

Manufacturing specifications

- description: written description, pattern company and pattern number (if applicable)
- production drawings: front and back views, pattern shapes and markings
- technical production plans: fabric swatches, quantity of material, notions required, itemised cost, total cost, order of construction

Grade 12 units

Textiles Technology units 12.1, 12.2, 12.3 and 12.4

The Grade 12 Textiles Technology units provide students with the opportunity to design a variety of textile items in response to a design brief. Students put ideas into practice through practical projects. The knowledge and skills gained are applied not only to creating new products, but also to adapting or maintaining existing garments or textile items.

In each unit, students must produce at least one product using the design process in response to a design brief, or undertake a project involving adaptation of existing garments or items.

A portfolio must accompany the product or project, showing ongoing evidence of the application of the design process. The portfolio must show all stages of the production of the item, from the design brief and initial ideas, drawings and patterns to the evaluation of the product, and the specific techniques used in the process. If the product or garment is complex, the unit can be extended to take two to four terms.

Textiles Technology units can accommodate many options. Schools choose those options that are appropriate for their locality, available expertise and resources.

The following are examples of units that can be taught as Textiles Technology units. Some of the units are described in the teacher guide.

- A Garment Pattern Collection
- Altering Second-hand Clothes
- Curtain Making
- Designing and Making a Uniform
- Garment Making
- Hats and Bags
- Home or Office Furnishings
- School Developed Unit
- Sewing for Special Groups of People
- Sports Clothes
- Sewing for a Wedding
- Designing and Making Toys
- *TVET modules from National Certificate 1 Garment Making*

Learning outcomes

Students can:

1. use the design process to produce appropriate solutions
2. apply safe and appropriate codes and practices in the learning and working environment

3. apply knowledge and understanding of processes through identifying, selecting and using various textiles, equipment and systems
4. demonstrate a range of skills and techniques
5. evaluate the process and product against the design brief
6. communicate ideas and information in a variety of ways.

To achieve the outcomes, students:

- design and make a textile item or product using the design process in response to a design brief or
- undertake a project involving adaptation of existing garments or textile items
- produce a portfolio to accompany the product or project.

Content

Students acquire knowledge of and skills for working with textiles through learning about the properties of the technology and designing, making and evaluating a textile item.

Textiles Technology project

Design, make and evaluate a textile item or product

Students must produce at least one item using the design process in response to a design brief, or undertake a project involving adaptation of existing garments or textile items. The garment or item(s) made can be a simple one, allowing the students to complete it in one term and enabling the teacher to assess the student's work. If the garment or textile product is complex in nature, it could take two or more terms to complete.

A portfolio must accompany the product or project, which shows ongoing evidence of the application of the design process. It must show all stages of the production of the item, from the design brief and initial ideas, drawings and patterns to the evaluation of the product and the specific techniques used in the process.

Assessment

Assessment components, weighting and tasks

Grade 11 and Grade 12 assessment

The internal assessment mark for Design and Technology subjects is to be based on the Grade 11–12 syllabus only. Final assessment should be based on a range and balance of assessment instruments.

The components, weighting and tasks for Grade 11 and 12 Design and Technology subjects are detailed in the table below.

Components, weighting and tasks for Grade 11 and 12

Component	Weighting	Tasks
Practical work in response to design brief	280 marks (60%)	Development and application of design ideas and safe and skilful use of materials, tools and equipment to make a product
Design folio with outcomes of research, investigation and planning	60 marks (20%)	Folio showing results of investigation in response to design brief, rough notes or sketches of design ideas, timelines, final drawings or plans, processes used to make the product and evaluation report
Tests	60 marks (20%)	These may include theory work
Marks	**300 marks (100%)**	**A combination of design folios, practical applications and tests**

Assessment and certification

Assessment and reporting practices described here are detailed further in the *National Assessment and Reporting Policy for Papua New Guinea* (2003) and in other support materials produced by the Department of Education.

Assessment

The main purpose of assessment is to improve student learning.

Assessment needs to be *for* learning as well as *of* learning. It is used to evaluate and improve learning and teaching, report achievement and provide feedback to students on their progress.

Assessment measures students' achievement of learning outcomes as described in the syllabus. It is the ongoing process of identifying, gathering and interpreting information about students' achievement of the learning outcomes.

Learning and teaching using an outcomes approach requires teachers to plan their teaching and assess learner performance in relation to outcomes, using criteria derived from those outcomes. Assessment involves focusing less on whether a learner has 'passed' or 'failed' and more on what outcomes a learner has achieved and in which areas further support is required.

Assessment in Design and Technology

A student's achievement in Design and Technology at the end of Grade 12 will be assessed against the learning outcomes. Assessment of student progress towards achieving these learning outcomes is cumulative throughout Grades 11 and 12.

It is important that teachers plan the learning and teaching sequence so that there is a balanced spread of assessment during the year. Some tasks, such as research investigations and design projects, can be designed so that they are completed over a period of time rather than at the end of the unit. Other tasks can be done immediately the relevant section of the unit or topic has been covered.

Assessment for certification

A student's overall achievement in Design and Technology will be internally assessed. Successful completion of the subject will be recorded on the national certificate.

Internal assessment

Internal assessment provides a measure of a student's achievement based on a wide range of syllabus content and outcomes. For Design and Technology, the internal assessment marks will provide a summation of each student's achievements in Grades 11 and 12. The assessment tasks

used to determine the internal assessment mark must comply with the components, weightings and types of tasks specified in the table on page 70. A variety of tasks gives students the opportunity to demonstrate all the learning outcomes in different ways to improve the validity and reliability of the assessment.

All schools must meet the requirements for internal assessment as specified in the Grade 12 *Assessment, Examination and Certification Handbook*.

Recording

All schools must meet the requirements for maintaining and submitting student records as specified in the Grade 12 *Assessment, Examination and Certification Handbook.*

Certification

Candidates will be awarded the national certificate only if they meet all requirements for internal assessment. Eligibility rules for the award of certificates are specified in the Grade 12 *Assessment, Examination and Certification Handbook.*

TVET qualification

Students who successfully complete TVET modules will be issued with a Statement of Attainment indicating the modules and the TVET National Qualification from which they come by the registered provider of the training.