Technology and Industrial Arts

Senior High

Grades 11 and 12

Syllabus

Standards-Based

Papua New Guinea

Department of Education

Technology and Industrial Arts
Senior High

Grades 11 and 12

Syllabus

Standards-Based

Papua New Guinea
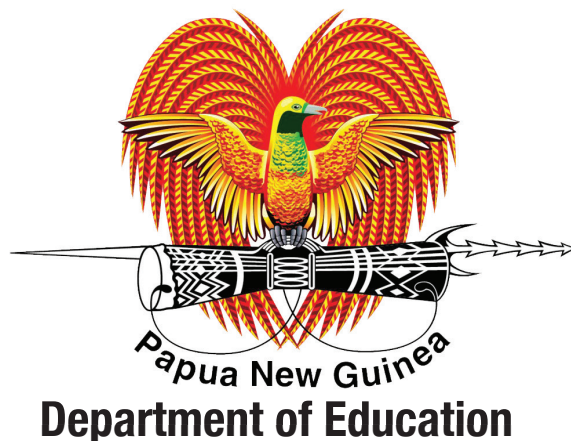**Department of Education**

Issued free to schools by the Department of Education

Published in 2019 by the Department of Education, Papua New Guinea.

© Copyright 2019, Department of Education, Papua New Guinea.

ISBN   978-9980-905-78-9

Graphic Design Layout by Rupuna Kepsy Pikita

Contents

Acknowledgements

Acronyms

AAL	Assessment As Learning
AFL	Assessment For Learning
AOL	Assessment Of Learning
AI	Artificial Intelligence
AC	Alternating current
CP	Curriculum Panel
CPU	Central Processing Unit
CS	Content Standard
DBMS	Database Management System
DRI	Dietary Requirement Index
DRV	Dietary Reference Value
DC	Direct Connection
EO	Evidence Outcome
ESD	Education for Sustainable Development
GoPNG	Government of Papua New Guinea
HTTP	Hyper Text Transmission Protocol
ICT	Information & Communication Technology
IHD	Integral Human Development
IP	Internet Protocol
IT	Information Technology
LAN	Local Area Network
Mac Os	Macintosh Operating System
MS	Microsoft
MSD	Measurement Services Division
NCSB	National Curriculum Standards and Benchmarks
NCSF	National Curriculum Standards Framework
NDoE	National Department of Education
OBC	Outcomes-Based Curriculum
OBE	Outcomes-Based Education
OS	Operating System
OSI	Open System Interconnect
PNG	Papua New Guinea
SAC	Subject Advisory Committee
SBC	Standards-Based Curriculum
SBE	Standards-Based Education
SCG	Subject Curriculum Group
STEAM	Science, Technology, Engineering, Arts and Mathematics
STEM	Science, Technology, Engineering and Mathematics
PC	Personal Computer
TCP	Transmission Control Protocol
TIA	Technology and Industrial Arts
UNCRC	United Nations Convention on the Rights of the Child

Secretary's Message

The ultimate aim of Standards-Based Education in Papua New Guinea (PNG) is to prepare students for careers, higher education, and citizenship. This means that education should focus on developing and equipping students with essential knowledge, skills, values, and attitudes that they can use in all spheres of their lives. Education must therefore aim to provide all children an equal opportunity to achieve high academic standards that are internationally comparable. Rigorous and comparable academic standards have been set and all students are expected to achieve these standards. Education must also aim to motivate and prepare students to pursue Science, Technology, Engineering, Arts, and Mathematics (STEAM) courses in higher education and pursue careers in STEAM related fields. National Curriculum Standards and grade-level benchmarks have been written to provide students with STEAM related experiences both inside and outside of the classroom.

The realignment of Technology and Industrial Arts curriculum content from Outcomes Based Curriculum to Standards Based Curriculum is aimed at improving the organisation of content and context of what the students will be studying at that level. By the end of grade 11 and 12 Technology and Industrial Arts curriculum will offer students the opportunity to develop Industrial Technological skills and the ability to be creative, innovative, productive and competitive in diverse contexts. The students will acquire the basic fundamental knowledge, skills, attitude and values to help and prepare them to progress to the next level of learning while at the same time aiming to strive and be compatible with the 21st Century competencies and demands.

This subject encourages self-reliance through enabling students to think critically and creatively and become effective problem solvers based on a model of learning that incorporates knowledge, skills and design principles in a problem- solving context. They empower students to manage their limited resources to achieve set goals and successfully make a living in their community thus sustaining their lives.

Teachers are encouraged to use the syllabus in conjunction with the Teacher Guides and other relevant resources to generate creative teaching and learning activities to deliver the Technology and Industrial Arts content in applicable contexts.

I approve and commend this Grade 11 and 12 Technology and Industrial Arts Syllabus to be used in all Senior High Schools throughout Papua New Guinea.

…………………….....

UKE W. KOMBRA, PhD
Secretary for Education

Introduction

The 21st Century is a time of rapid change. New knowledge, tools, and ways of doing and communicating continue to emerge and evolve, and impact on our lives in many different ways.

PNG needs to be on par with the rest of the world. The need to understand and be able to use Technology and Industrial Arts in everyday life, in schools, and in the workplace has never been greater. Technology and Industrial Arts knowledge, skills, values, and attitudes are essential for employment and careers, including STEAM related careers, in the 21st Century. The job market is very competitive. Those who do not possess 21st Century knowledge, skills, values, and attitudes will find it difficult to getting any sort of employment. Thus, it is important that children are encouraged, motivated, and enabled to develop an attitude of the mind to enjoy learning Technology and Industrial Arts and simultaneously achieve high academic standards and motivated to pursue STEAM academic programs in institutions of higher education and take up STEAM related careers.

In this 21st Century and beyond, those who understand and can do Technology and Industrial Arts will have more opportunities and options for determining their futures. Everyone needs to understand Technology and Industrial Arts. All students should have the opportunity and the support necessary to learn significant Technology and Industrial Arts with depth and understanding.

This Technology and Industrial Arts Curriculum was developed, encompassing the regional and global standards that are set and recognised globally. It is our hope that this curriculum standards framework will provide the basis for equipping our children with a core set of Technology and Industrial Arts knowledge, skills, values, and attitudes to effectively prepare them for careers, higher education, and citizenship in the 21st Century and beyond.

The introduction of Standards-Based Education in Papua New Guinea is an important Government directive to raise performance competencies in all aspects of education; curriculum development, teacher training, student and teacher performance, monitoring, school management and leadership. The designing of courses in the curriculum have been done to raise standards in teaching and learning at all levels of schooling through reviewing, aligning, realigning and repositioning of the existing content in order to cater for the shift in the pedagogy.

The Senior High School Technology and Industrial Arts curriculum has been revised to address current and emerging issues on technologies for sustainable development as well as cater for missing knowledge and skills gaps from Primary level to High School. The content and concepts have been re-aligned, repositioned and incorporated to cater for progressive learning by grades and levels. The strands captured in this re-aligned Technology and Industrial Arts curriculum encompass studies of many of the processes in terms of knowledge, skills, values and attitudes which are necessary for Technology subjects at High School level.

Technology and Industrial Arts is to be timetabled for 240 minutes for each strand per week in Grades 11 and 12.

Aims and Goals

The ultimate aim of education in Papua New Guinea is to prepare children for careers, higher education, and citizenship. To achieve this aim, a number of enabling aims and goals were formulated based on evidence. The ultimate aim and the enabling aims and goals are closely linked. The enabling or operational aims and goals are described below.

Ultimate Aim of Standards-Based Education in Papua New Guinea

The ultimate aim of education in PNG is to prepare children for careers, higher education, and citizenship. To achieve this aim, a number of enabling aims and goals were formulated based on evidence. The ultimate aim and the enabling aims and goals are closely linked. The enabling or operational aims and goals are described below.

Aims and Goals of Standards-Based Education and Curriculum

Curriculum aims and goals articulate the outcomes that will be achieved in the long-term and the medium-to-long term. They embed the development and educational aspirations of PNG and its citizens. These have been influenced by evidence from the analysis of context and research on teaching and learning, and on social, economic, political, technological, and cultural developments. There is a close link between the aims and goals of the curriculum. This is important for ensuring that the chain of learning results is clear.

> **Aim 1:** Students will acquire essential and relevant knowledge, skills, values, and attitudes that will prepare them for careers, higher education, and citizenship.

Goals

Students will be able to:

(a) obtain prerequisite knowledge and skills and cultivate and foster important values and attitudes required to effectively function in a higher education and training environment.

(b) achieve high language, technology , science, social science, moral, values, and ethical, creative and vocational skills, and citizenship standards that will ensure a smooth transition from secondary school to higher education and training institutions.

> **Aim 2:** Students will achieve high standards in Language, Science and Technology, Social Science, Civic and Citizenship Education, Character and Social Development, and Skills Education (Creative, Physical, and Vocational skills).

Goals

Students will be able to:

(a) acquire and use intellectual, emotional, cultural, physical, creative, vocational, recreational, and spiritual knowledge, skills, values, and attitudes as a basis for living a fulfilling and a productive life in the communities in which they choose to live.

(b) understand and apply mathematical reasoning, processes, formulas, and concepts to solve mathematical problems.

(c) examine and apply scientific reasoning, processes, and concepts to improve real life situations.

(d) aware of scientific standards and methods and their application across all branches of science.

(e) aware of logical and abstract thinking in the formulation of problems, the importance of mathematics in science reasoning, and recognize the role of science in every aspect of life.

(f) explain the connection between science and technology and recognise the importance of technology in the development of communities, the improvement of peoples' lives, in communication, and industry.

(g) acquire fundamental knowledge and skills to build and market different types of technology.

(h) communicate orally and in writing, use different approaches and modes of communication, identify different purposes of communication, and understand and appreciate PNG's languages and the languages of people from different cultures.

(i) aware of their civic and citizenship responsibilities, the importance of these responsibilities to harmonious living and maintaining social cohesion, and to community and national development and well-being.

(j) acquire knowledge, skills, values and attitudes required for learning and practice of creative arts, and the application of knowledge and skills to express themselves, promote PNG's cultures, and make a living.

(k) recognise the importance of healthy mind, body, and spirit, the importance of physical exercise and sport, balanced diet, and regular exercise in living a healthy life style.

Aim 3: Students will attain both regional and internationally comparable standards in literacy and numeracy

Goals

Students will be able to:

(a) acquire essential reading skills to enable them to learn to read and read to learn throughout their lives.

(b) learn basic skills of writing, comprehending and evaluating information, following instructions, analysing other's writing, and communicating with others.

(c) learn and apply basic mathematic skills in real life situations to improve their own personal growth and the advancement of their communities and the nation.

Aim 4: Students will develop their full potential and empowered to be dynamically involved in the process of freeing themselves from oppressive situations, contribute to promoting the common good and welfare of society, and develop a sense of responsibility for oneself and others.

Goals

Students will be able to:

(a) recognise and critically analyse the situations that oppress and marginalize them and others, and take appropriate individual and collective actions to transform these situations in order to improve their wellbeing.

(b) develop a positive attitude towards community service and responsibility for the well-being of the community while being responsible for their personal behaviour and conduct and hold others to account for their behaviour and attitudes in the interest of public good.

(c) develop effective communication and social skills, and think critically and rationally when solving problems and making decisions at different stages of their personal development.

(d) interpret language and cultural expressions attributed to oppressed and marginalized groups by dominant and powerful groups and challenge these in order to improve their situations.

Aim 5: Students will contribute towards the development of knowledge-based economy and society, and the transformation of Papua New Guinea from a developing to a middle income country by continuously learning and applying knowledge, skills, values, and attitudes to improve the prevailing social, economic, political, cultural, scientific, and technological conditions.

Goals

Students will be able to:

(a) value creativity and innovation; the spirit of autonomy and independence; and foster an attitude to knowledge creation and application to improve working and development conditions.

(b) obtain relevant knowledge, skills, values, and attitudes that will enable them to be multi-skilled, lifelong learners, and knowledge-based workers capable of functioning in a changing world and work environment.

Aim 6: Students will continue to learn throughout their lives and apply the outcomes of learning to improve their personal and collective learning, growth and development, and the quality of life for oneself and others.

Goals

Students will be able to:

(a) think sensibly for themselves and to develop as individual members of a community.
(b) develop and foster an attitude towards continuous learning as a basis for improving one's own knowledge, thinking, practice, value and belief system and hence improve life outcomes.
(c) cultivate a positive attitude towards research, reflection, and critical analysis as bases for lifelong learning.

Aim 7: Students will acquire essential knowledge, skills, values, and attitudes necessary for the building of peaceful and safe communities, living together, upholding the principles of a democratic state and society, building social cohesion, promoting equity and social justice, and ensuring economic prosperity for all.

Goals

Students will be able to:

(a) value justice, responsibility, equality between men and women, mutual respect and cooperation, and actively contribute to the building and fostering of peaceful, safe, and inclusive communities.
(b) use effective communication skills and think creatively in a rational manner and develop better problem solving and decision making skills at appropriate levels and ages.

Aim 8: Students will foster an understanding and an appreciation of PNG's many cultures and languages, their influence on the construction and representation of Papua New Guinean's identities, and the value, knowledge, and belief systems that underlie these diverse cultures and languages; while embracing the cultural and linguistic differences, and take actions to sustain the good and eliminate the bad aspects of cultures.

Goals

Students will be able to:

(a) have pride and responsibility towards their cultures and languages, and preserve and promote one's identity through language and culture while at the same time learning, appreciating, and tolerating other cultures and languages, both local and international.
(b) communicate with other people through written and spoken language, through mathematics and through other ways such as art, music and movement.
(c) investigate the underlying knowledge, value, and belief systems of different cultures and languages, and take appropriate individual and collective actions to eliminate aspects of cultures that hinder the building and fostering of

healthy relationships and peaceful and safe environments, that are oppressive and detrimental to human development, and detrimental to the promotion of inclusive development and a hindrance to promoting and safeguarding fundamental human rights.

Aim 9: Students will develop their knowledge and an appreciation and respect for the natural environment and physical and human resources, and the need to develop these in ways that are sustainable for the benefit of current and future generations.

Goals

Students will be able to:

(a) cultivate and maintain an attitude to respect life, care for nature, and contribute to the protection of the environment.
(b) help develop and sustain Papua New Guinea's environment and its physical and human resources, for the benefit of current and future generations.
(c) become wise guardians of Papua New Guinea's resources.
(d) act responsibly and within the spirit of environment sustainability in the use of natural resources with the knowledge that local actions on environment have both local and global consequences.

Aim 10: Students will develop healthy self-concepts; contribute to the establishment and sustainability of healthy communities; the eradication of common diseases; and improvement in the health status of all citizens.

Goals

Students will be able to:

(a) demonstrate an understanding of the different stages of child development from conception to childhood, adolescence to adulthood.
(b) show awareness and understanding of the importance of building and promoting healthy life-styles and healthy communities as prerequisites for healthy living and lifestyle.

(c) investigate common diseases in PNG and their causes and symptoms, appreciate the consequences and impact they have on the citizens, look at what is being done to eradicate these diseases, and know how they can contribute to eradicating these diseases.

Aim 11: Students will understand that parenthood is a lifelong responsibility however, in exercising this right they should be aware of the impact of uncontrolled population growth and its consequences on families, communities, the environment, available resources, and the nation.

Goals

Students will be able to:

(a) appreciate the importance of having a family unit and show awareness of parental responsibilities, recognize the consequences of the decisions they make regarding the size of their families, recognizing the fact that the quality of life for their children depend on the decisions they make.
(b) aware of the contributing factors to population growth and demonstrate an understanding of the consequences of uncontrolled population growth.

Aim 12: Students will acquire knowledge, skills, values, and attitudes required for social and economic development, for gainful employment and self-employment, and for transforming individual and collective livelihoods and alleviating poverty.

Goals

Students will be able to:

(a) acquire knowledge, skills, values, and attitudes required for active participation in the formal and informal economy as means for making a sustainable living.
(b) explain and apply the concepts and practices of self-reliance and personal viability to create own employment as an alternative to formal employment.
(c) foster an attitude towards work by acquiring relevant values, knowledge, and skills that will prepare them to pursue vocational skills occupations.

Aim 13: Students will develop required values and respect for oneself, others, and the community, and use these as a basis for developing effective national and global citizenships traits.

Goals

Students will be able to:

(a) learn about and show awareness about past and present outstanding and model citizens whose character, moral standing, ethical standards, and contributions have shaped PNG and the world.
(b) demonstrate awareness and understanding of their civic and citizenship roles and responsibilities, the importance of performing these responsibilities in a transparent and accountable way for the greater good of PNG and their communities, and the consequences of neglecting these roles and responsibilities.
(c) develop and foster values, behaviours, attitudes, and communication competencies required to live together and in harmony with peoples of other cultures and linguistic groupings.
(d) show awareness and concern for the welfare and the rights of others, contribute to the promotion of justice for all and the empowerment of the oppressed and marginalized people, promote gender and social inclusion as the basis for protecting and promoting the rights of all.

Overarching Curriculum Principles

Curriculum principles identify, describe and focus attention on the important concerns that must be addressed when developing the curriculum at all levels of schooling. They are based on significant cultural, social and educational values and beliefs. Curriculum principles are evidence-based and influenced by best practice. The following principles underpin the design, development, and implementation of SBC in PNG.

Relevance

The national curriculum should target the national, community, and personal social, economic, political, cultural, environmental, and spiritual, development needs and aspirations. Curriculum should aim to prepare children for careers, higher education and citizenship. Children should be equipped with essential, in demand knowledge, skills, values, and attitudes to meet the demands and challenges of working, studying, and living in a complex, knowledge-based, and technology driven economy and society of the 21st Century. This can be achieved through the development of rigorous and comparable learning standards, design, development, implementation, and monitoring of a quality SBC, and embedding of values and critical, creative, decision-making, reasoning, problem-solving, high level, 21st Century, and STEAM skills in the curriculum.

The national curriculum will enable teachers to support students' learning by encouraging teaching and learning in real-life contexts, and providing opportunities for students to address the problems posed by the natural and physical environments by developing creative and innovative solutions. This means students will relate and use the knowledge, skills, values and attitudes learnt in different subjects to real life situations.

Multiculturalism

PNG is blessed and fortunate to have so many languages and cultures. The diversity of our cultures is the source of our knowledge, skills, attitudes, and values. As a multicultural society, we must protect, promote, and respect our many cultures and languages. There are many people from our own ethnic groupings and from other countries with their own cultures living and working together in PNG. This is the most multicultural country in the world. We must ensure that we promote and share our cultures with the rest of the world. We must also critically examine and address the problematic aspects of our cultures.

Ethics, Morals, and Values

Papua New Guinea is striving to create a society in line with democratic liberal traditions. The citizens of Papua New Guinea should recognise appropriate social relationships based on sound human and religious ethics, morals and values. These are required for interaction with families, villages, and other economic groups and people from other provinces and nations. The process of socialisation requires a belief in the ethics, morals and values of the Melanesian extended family, dialogue with and respect for others and a willingness to conserve and promote those aspects of our traditions, which are consistent with integral human development. Socialisation also requires an awareness of the interdependence of individuals, societies and nations in the modern world. It requires involvement with family, school, church, community and the world beyond.

Integral Human Development

Integral human development focuses on the holistic development of every person. National curriculum should provide opportunities for all children to receive an education that will enable them to:

- be dynamically involved in the process of freeing themselves from every form of domination and oppression so that they will have the opportunity to develop integrated persons in relationship with others. This means that the national curriculum must integrate and maximise socialisation, participation, liberation and equality;
- be aware of human potential and the willingness to develop and maximize this potential so that each individual can solve his or her own problems, contribute to the common good of society and maintain, promote and improve the learning, working, and living conditions of all, and
- acquire and consistently use Biblical and spiritual values, personal, social and sustainability values, and work, relationship, health, and peace values in their lives.

Papua New Guinea is a rapidly changing society and faces many challenges. To face these effectively, an individual must strive to become an integrated person and to work with others to create a better community.

The process of integral human development calls for a National Curriculum, which helps individuals to:

- identify their basic human needs;
- analyse situations in terms of these needs;
- see these needs in the contexts of spiritual and social values of the community; and
- take responsible action in co-operation with others.

The success of a national curriculum requires the integrated involvement of all the agents of education such as the home, church, school and community.

The Right to Healthy Living

The health status of Papua New Guinea is very low. All citizens have a right to a healthy life such as clean water, a nutritious diet, improved sanitation, appropriate and better local health services. Students need to learn attitudes, skills and knowledge that will help them become productive, healthy and contented citizens of Papua New Guinea. They need to be given a set of skills that will enable them to improve their own and their community's health in order to improve the health status of Papua New Guinea. The National Curriculum will ensure that students have the opportunity to learn about healthy living.

Nation Building and National Unity

Our nation is young and there is still a great deal of nation building to be done. Students need to be given the skills to undertake this task and participate in nationally organised events. The national curriculum should enable them to understand how Papua New Guinean societies work and how they can be a useful part of these societies. Students should learn that they have a place in Papua New Guinea and that Papua New Guinea has a place in the world as a whole. They will be able to help Papua New Guinea develop a national identity as one nation if they learn to:

- work together with tolerance;
- respect one another, their traditional ways and resolve problems peacefully;
- respect and act in the spirit of the National Constitution;
- recognise their capabilities and develop their own talents;
- participate in the development of the national community and
- protect and safeguard the national wealth and resources.

Sustainability

The natural environment of Papua New Guinea is as diverse as its cultures. It is often a violent natural and physical environment, which is under threat from rapid population growth and misuse of resources such as over logging, abuses associated with mining, over fishing, dynamiting reefs and dumping toxic wastes. Our diverse cultures are also under threat from over exploitation and commercialisation of sacred cultural practices. Our cultural traditions are not being handed down from generation to generation. The national curriculum will guide students to further appreciate, respect and value their natural environment, cultures, customs and traditions. It will give them the skills and knowledge to identify problems and issues and to take action to sustain these aspects of life in Papua New Guinea.

Gender Equity and Social Inclusion

Gender is what it means to be a woman or a man. Gender refers to those behaviours and attitudes that are culturally accepted as ways of being a woman (femininity) and being a man (masculinity). Addressing gender issues goes well beyond ensuring that females have the same opportunities as males to receive an education. A person's experiences determine the way they understand and make sense of the world. Gender is also culturally determined. In Papua New Guinea, there is a need for sensitivity to local cultural practices and values, with respect to traditional roles for males and females. The national curriculum will provide students with subjects, resources, activities and experiences that value the needs of girls and boys.

Females are generally a disadvantaged group in Papua New Guinea. Papua New Guinea does not have in place a good record about gender equity for females. Violence against females is widely acknowledged as a serious problem. A number of health and other indicators of human development show that females have a lower quality of life than males. Females have lower literacy rates and lower income levels than males. Males hold nearly all positions of leadership, authority and decision making.

Men hold most senior positions in government departments and the community. It is a similar situation in the Department of Education, provincial education divisions and schools. The national curriculum will provide students with opportunities to

Inclusive Curriculum

The national curriculum is inclusive and designed to meet the needs of all students irrespective of their abilities, gender, geographic locations, cultural and language backgrounds, or their socio-economic backgrounds. The national curriculum must be implemented by teachers in ways that are inclusive of all students at all levels of schooling. Much more can be achieved if parents, community leaders, churches, and schools co-operate and communicate with each other.

Students learn in different ways. It is best to use a variety of methods to teach them. No one method is best. It is true that students are very different and even the same students learn best from different methods at different times. By using a range of teaching methods, it is more likely that the needs of all students will be met. In order to be inclusive of all students, teachers need to cater for a range of physical, social, cultural, emotional, spiritual, and intellectual needs of their students. This can be achieved through using appropriately and carefully planned learning activities, a range of teaching methods and strategies and thoughtful use of a teacher's language of communication.

To be inclusive, teachers will need to ensure that all girls and boys have the opportunity to participate. Teaching practices, including classroom organisation and management, should ensure that girls and boys are able to participate fully in all learning activities. Participation requires that individuals are motivated to achieve the goal of socialisation fully where they are encouraged to develop a sense of obligation for the opportunity to contribute.

Through participation, individual creativity can be recognised and encouraged, without losing sight of the principle of communal sharing. Participation is the key to social interaction and can lead to social mobility. It can also help to conserve and generate knowledge and cultural values for future generations.

Student-Centred Learning

Student-centred learning recognises the fact that no two classes are alike and no two children are the same with respect to their needs. A teacher who uses a student-centred approach will endeavor to create a classroom environment that will motivate students to discover new skills and knowledge. In such an environment, the teacher might focus on teaching students how to learn and help them discover relevant information. It is essential to teach students how to learn while at the same time teaching them important content. A student-centred classroom will usually involve students working together in small groups using activity centres set up in the classroom while the teacher works more closely with one or two students.

The National Curriculum describes the learning outcomes for all subjects.
A student centred approach allows teachers to be more flexible in determining the most effective ways to help all students achieve these learning outcomes.

Lifelong Learning

School is an important part of a student's education but learning continues throughout life. The initial experience that students have with the school curriculum is critical in encouraging them to continue learning throughout their lives. Going to school should be an enjoyable and satisfying experience for the students and should prepare them for life after school. Students know many things when they come to school. They will learn many things outside of school and continue to learn after they leave school. The National Curriculum should build on what students already know. Teachers should make use of this knowledge and skills. When students are learning new, unfamiliar things, teachers should relate the new things to what students already understand. This important learning will continue throughout life as students increasingly take responsibility for their own learning. Increasingly, students who leave school will look for opportunities to continue their education and to return to school or some other educational or training institutions in order to improve their qualifications.

Language Development Across the Curriculum

The national curriculum will provide opportunities for language development across the curriculum. Language development across the curriculum should be encouraged because all subject areas provide meaningful contexts purposeful learning. Specific subjects have different language requirements such as, the vocabulary and language features of science and the written and oral genres to narrate, explain, persuade, report, and discuss the particular content of various subjects. The conventions and differences must be explicitly taught in relevant contexts across the curriculum.

Knowledge, Skills, Values, and Attitudes for Careers, Higher Education, and Citizenship in the 21st Century

PNG shapes and is being shaped by the 21st century social, economic, political, cultural, religious, and environmental discourses and practices. It is important to provide opportunities for students to learn in-depth and master the 21st century knowledge, skills, values, and attitudes to prepare them for careers, higher education, and citizenship. There is an increasing demand for knowledge-based workers and workers with qualifications in STEAM globally. This cadre of workers is not available in PNG because education is not geared towards preparing this category of workers. PNG children should be equipped with the necessary 21st century skills, knowledge, values and attitudes to prepare them for careers, higher education and citizenship.

The 21st Century skills movement, which broadly calls on schools to create academic programs and learning experiences that equip students with the most essential and in-demand knowledge, skills, and dispositions they will need to be successful in higher-education programs and modern workplaces.

The term 21st Century skills refers to a broad set of knowledge, skills, work habits, and character traits that are believed - by educators, school reformers, college professors, employers, and others - to be critically important to success in today's world, particularly in collegiate programs and contemporary careers and workplaces. Generally speaking, 21st Century skills can be applied in all academic subject areas, and in all educational, career, and civic settings throughout a student's life. The skills students will learn will reflect the specific demands that will be placed upon them in a complex, competitive, knowledge-based, information-age, technology-driven economy and society.

Science, Technology, Engineering, Arts, and Mathematics

The majority of careers in the 21st Century is STEAM related. However, demand for STEAM graduates and experienced workers far exceed the supply of this cadre of workers. What is more, although a slow paradigm shift is taking place, careers in STEAM fields are dominated by males. Females are beginning to venture into these careers but at a very slow pace. There is an enormous gender parity gap in this area. Thus, it is critical for STEAM knowledge, skills, values, and attitudes to be taught from prep to post-secondary school level to provide opportunities for all students to attain STEAM related proficiencies before leaving school. The main aim of this education is to shape students' thinking, motivate, and influence them to develop an interest in careers in the STEAM field, and pursue STEAM related academic programs in institutions of higher education.

Standards-Based Curriculum Principles

The principles of the Standards Based Curriculum (SBC) include the following:

- Setting of high academic standards and a careful and continuous assessment and reporting of students' performance against these standards will motivate students to perform at a much higher level.
- Standards allow every student, every parent, and every teacher to share in common expectations of what students should know, understand, and be able to do.
- Students will learn more when more is expected of them in school and at home.
- The setting of clear, measurable, and attainable standards is the key to attaining high academic standards and hence the attainment of the desired quality of education.
- All children are capable of learning and achieving high academic standards, regardless of their backgrounds.
- Students can learn in their own ways and at their own rates.

Protection of Children's Rights

It is paramount that children's rights stipulated in national legal and policy frameworks, and international conventions such as the United Nations Convention on the Rights of the Child (UNCRC) are recognised, promoted, protected, and safeguarded by everyone and every organisation working and dealing with children's welfare and well-being. A child is defined by UNCRC as a human being below the age of 18 years. However, definitions of a child may differ based on the socio-cultural contexts of different countries. Notwithstanding the differences in definitions, biologically, a child is generally anyone between birth and puberty. The four core principles of UNCRC underpinning children's rights are:

- non-discrimination.
- devotion to the best interests of the child.
- the right to life, survival and development.
- respect for the views of the child.

Children's rights are human rights and therefore they should be promoted and safeguarded by the whole of the education system. They should permeate all education plans, policies, programs, and activities, and be firmly embedded in the school curriculum, teaching and learning practices, and the overall management of the education system.

Technology and Industrial Arts Rationale, Aim and Goal, and Guiding Principles

Rationale

Papua New Guinea (PNG) like any other country in the world is also making concerted efforts to boost student achievement in literacy, numeracy and life skills. Technology and Industrial Arts is regarded as an important course aimed at improving Technology and Industrial Arts education that underpins many aspects of everyday life such as making sense of natural patterns, information in various forms to make informed decisions. The impact and influence of current development and technological trend is significant as Technology and Industrial Arts, Information, Technological Engineering and Science have become driving forces for growing job markets and sustainable development agendas for nations.

Technology has existed through-out history. Since then those traditional technologies or ways have evolved to cater for the needs and wants people have today. People used the combination of knowledge, skills and available resources to develop solutions that meet their daily needs and wants. However, the knowledge, skills and resources used to find solutions are of a different kind because of accelerating developments in technology. Some of these solutions have been in the form of products, while some have used a combination of products into working systems.

Technology is about people using available resources and tools appropriately and skilfully to improve the quality of life of individuals and communities. When used innovatively and responsibly it can lead to the design and development of new products or it can change existing products to meet society's changing needs and wants. Today's society is complicated and diverse. Economic and environmental factors and a wide range of attitudes and values need to be taken into account when developing technological solutions. The development of products and systems must show sensitivity to these issues.

Technology and Industrial Arts equip students with practical knowledge, skills, values and attitudes that enable them to contribute meaningfully in their local communities and societies. They encourage self-reliance by enabling students to think critically and become effective and innovative problem solvers based on a model of learning that incorporates knowledge, skills and design principles in problem-solving contexts. They empower students to manage resources, to achieve set goals and successfully make a living in their community.

Students develop an 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 or informal work. They develop as technical oriented and responsible citizens equipped with the 21st Century skills and knowledge.

They recognise their social responsibilities in regard to resources and materials being used.

Technology and Industrial Arts contributes to integral human development as they are based on the students' physical environments, societies and cultures. They link to the National Education Plan's vision that high school education enables students to achieve their individual potential to lead productive lives as members of the local, national and international community and partake of further quality education and training by undertaking a broad range of subjects and work related activities that can be used in everyday life.

By studying Technology and Industrial Arts students interact with new ideas, reflect and make decisions, use skills to a higher level, and realise designs through applied problem solving. The subject promotes a student-centred approach to learning and an understanding and appreciation that learning is a lifelong process.

The present economy in Papua New Guinea makes it difficult for most students to gain formal employment after they leave school. Technology and Industrial Arts

Ultimate Aim of Technology and Industrial Arts

The overall aim of Technology and Industrial Arts is to develop attitudes, concepts, intellectual and technical skills that will help the students to understand and solve problems in relevant contexts recognising their significance in the changing society of Papua New Guinea.

Goal of Technology and Industrial Arts

In studying Technology and Industrial Arts students:

- take a safe and active part in designing and making projects satisfying needs and wants that are linked to their own interests, and of the community;
- develop a culture of enterprise for the benefit of themselves and their societies as a whole and capitalise on opportunities;
- are creative, innovative and rational thinkers in their response to problems;
- adapt new technologies directly and appropriately to their environment and their own social and economic needs;
- are responsible citizens who gain the necessary qualities and skills in order to live happily and productively in the communities in which they choose to live and serve;
- apply what they are learning to life and work-related situations for the common good;
- develop creative thinking and problem solving skills and communicate ideas confidently and be free to work collaboratively with like-minded persons to produce results in response to problems.

Technology and Industrial Arts Guiding Principles

Learning Technology and Industrial Arts are foreseen to set the foundations for students to develop the skills of;

- critical thinking,
- decision making,
- authentic creativity,
- communication,
- collaboration,
- safety consciousness.

The key values and attitudes to be developed and portrayed through this learning is the appreciation of;

- the impact of past, present and future technologies on society and the environment,
- function and benefits of the design process to strengthen problem-solving strategies,
- benefits of safety regulations and recognition of the need for safety procedures,
- the consequences of quality control of products, materials and processes, and
- acceptance of responsibility considering the economic, environmental, social and ethical issues surrounding the design and making of designed solutions.

The knowledge base of the Technology and Industrial Arts will comprise the materials, tools and techniques/systems/processes of the strands; Textile Technology, Food Technology, Construction Technology, Computer Technology and Communication Technology.

The teaching and learning of the Technology strands will centre around the
- relevant situations with constraints to promote the practice of the design process to solve problems;
- the design process as a systematic process to develop research skills, communication skills, team collaboration and the use of ICT to communicate ideas, products and solutions.

The design process is an integral component of Technology and Industrial Arts. It is a creative and interactive approach used to develop solutions to identified problems or human needs. It is one of the 'technological processes where the skills associated with the design process are: investigate, design (development of initial ideas), make, evaluate, communicate. The use of the design brief to complement the design process in problem solving is essential in the learning in Technology and Industrial Arts.

During technological activities, the learner engages in investigating, designing, making, evaluating and communicating solutions. When used together, these skills are sometimes known as the 'design process' In addition to the design process, there are many other processes that can be described as technological processes.

Technology and Industrial Arts curriculum principles identify, describe and focus attention on the important concerns that must be addressed when developing and implementing the Technology and Industrial Arts Curriculum.

A Coherent and Focused Curriculum

In a coherent and focused curriculum, ideas are linked to and build upon another so that students' understanding and knowledge are deepened and their ability to apply Technology and Industrial Arts expands. An effective Technology and Industrial Arts curriculum focuses on important Technology and Industrial Arts that will prepare students to continue to study and solve problems in a variety of settings; school, home, and work. A well-articulated curriculum challenges students to learn increasingly more sophisticated ideas as they continue their studies.

Gender Equity and Social Inclusion

All children, regardless of their gender, ability, and other backgrounds, are expected to achieve high academic standards in Technology and Industrial Arts. High expectations and strong support for especially female students and children living with a disability will enable all children to be actively involved in the learning of Technology and Industrial Arts. All students come to school with expectations to learn Technology and Industrial Arts that meets their individual interest and needs. Technology and Industrial Arts standards provide a wide range of opportunities for students to acquire and apply Technological knowledge, processes, concepts, ideas, skills, values and attitudes in real life. Every student regardless of race, colour, gender and ability should have the benefit of quality instructional materials, good libraries, and adequate technology.

Evidence - Based Teaching and Learning

Assessment should support the learning of important Technology and Industrial Arts and focused on assessing and reporting children's progress towards meeting the expected Technology and Industrial Arts benchmarks and standards. Assessment, monitoring, and reporting are integral parts of Technology and Industrial Arts planning and instruction, they contribute significantly to students' Technology and Industrial Arts learning when effectively carried out. Assessment should inform and guide teachers as they make instructional decisions. The tasks teachers select for assessment convey a message to the students about what kind of Technological knowledge, skills, values, and attitudes, and performance are valued. Feedback from assessment task helps students in setting goals, assuming responsibility for their own learning, and becoming more independent learners.

Teaching and Learning Technology and Industrial Arts Using Technology

Technology is essential in the teaching and learning of Technology and Industrial Arts. It influences the way Technology and Industrial Arts is taught and contributes to enhancing students' learning of Technology and Industrial Arts. Technology can enhance the teaching and learning of Technology and Industrial Arts if used appropriately. The use of technological tools can help students learn and master essential Technological concepts, ideas, and processes. These tools can contribute to a rich learning environment for developing and applying Technological concepts.

STEAM Rationale, Aim and Goals, and Guiding Principles

Rationale

The majority of careers in the 21st Century is STEAM related. However, demand for STEAM graduates and experienced workers far exceeds the supply of this cadre of workers. What is more, although a slow paradigm shift is taking place, careers in STEAM fields are dominated by males. Females are beginning to venture into these careers but at a very slow pace. There is an enormous gender parity gap in this area. Thus, it is critical for STEAM education to be introduced and taught from prep to the higher education level to provide opportunities for students to study in-depth and master the STEAM related knowledge, skills, values, and attitudes, and engage in real life experiences to learn and have hands-on experience of applying STEAM concepts, processes, ideas, skills, values, and attitudes to solve real problems and come up with creative and innovative solutions.

Ultimate Aim

The ultimate aim of STEAM education is to develop a STEAM literate society in which all citizens have the expected level of STEAM literacy. STEAM literacy refers to an individual's:

- knowledge, skills, values, and attitudes to identify problems and questions in life situations, explain the natural and design world, and draw evidence-based conclusions about STEAM issues;
- understanding of characteristic features of STEAM disciplines as forms of human knowledge, inquiry, and design;
- awareness of how STEAM disciplines shape our material, intellectual, and cultural environments, and
- willingness to engage in STEAM related issues and with the ideas of STEAM as a constructive, concerned, and reflective citizen.

Goals

The following are the goals of STEAM.

(i) Provide students with STEAM related experiences and opportunities to use STEAM concepts, ideas, and skills to solve problems relating to the natural and physical worlds, and use the evidence to make informed decisions about the interventions.

(ii) Build positive attitudes and embed essential STEAM values in children thereby motivating them to choose STEAM related careers or undertake STEAM related academic programs or courses of study.

(iii) Provide students opportunities to work in collaboration and partnership with people engaged in STEAM related careers or disciplines to learn about how STEAM skills, concepts, processes, and ideas are applied in real life.

(iv) Build a pool of STEAM workers who can contribute to national and global development and progress.

(v) Enable children to achieve high academic standards.

Guiding Principles

Integration and application of knowledge and skills in real life situations

Integration of STEAM knowledge and skills and their application to real-life situations inside and outside of the classroom setting will enable students to explain how STEAM disciplines shape our material, intellectual, cultural, economic, social, and environmental contexts.

Emphasis is on the learning and the application of STEAM knowledge and skills to investigate, explain, and solve problems rather than on content

STEAM education emphasises the learning and the application of knowledge, and skills to investigate, explain, and solving physical and natural problems rather than on in-depth teaching and learning of STEAM content.

STEAM related knowledge and skills are used to investigate, explain, and solve problems relating to the natural and physical environments

STEAM education focuses on providing the learners real life experiences of how STEAM related skills, concepts, processes, ideas, principles, values, and attitudes are applied and used to identify problems and questions in real life situations, explain the natural and physical world, and draw evidence-based conclusions.

Core Curriculum

A core set of common learnings (knowledge, skills, values, and attitudes) have been integrated into the curriculum to provide all students an opportunity to acquire and master these before they are career, higher education, and citizenship ready. The core curriculum includes:

- Cognitive skills (critical and creative thinking);
- Reasoning, problem-solving and decision-making skills;
- High level thinking skills (analysis, evaluation and synthesis);
- 21st Century skills;
- STEAM principles and skills;
- Spiritual values and virtues;
- Reading, writing and communication skills, and
- Essential values and attitudes.

The above knowledge, skills, values and attitudes should be taught and assessed by all teachers from prep to grade 12. These are reinforced at each school grade and school level to enable students to become proficient in their application in different career, higher education and citizenship contexts.

Essential Knowledge, Skills, Values and Attitudes

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

Essential Technology and Industrial Arts Knowledge, skills, values, and attitudes have been integrated into the content standards and benchmarks. They will also be integrated into the performance standards. Teachers are expected to plan, teach, and assess these in their lessons.

Provided here are examples of different types of knowledge, processes, skills, values, and attitudes that all students are expected to learn and master as they progress through the grades. These are expanded and deepened in scope and the level of difficulty and complexity are increased to enable students to study in–depth the subject content as they progress from one grade to the next.

Types of Knowledge

There are different types of knowledge. These include:	
• Public and private (privileged) knowledge • Specialised knowledge • Good and bad knowledge • Concepts, processes, ideas, skills, values, attitudes • Theory and practice • Fiction and non-fiction • Traditional, modern, and postmodern knowledge	• Subject and discipline-based knowledge • Lived experiences • Evidence and assumptions • Ethics and Morals • Belief systems • Facts and opinions • Wisdom • Research evidence and findings • Solutions to problems

Types of Process

There are different types of processes. These processes will be used to develop students' knowledge and understanding, thinking, and communication, and enable them apply and connect what they learn to different contexts. These include:	
• Problem-solving • Logical reasoning • Decision-making • Design process thinking • Engineering design process • Creative design process • Reflection	• Cyclic processes • Mapping (e.g. concept mapping) • Modelling • Simulating • Replication

Types of Skills

There are different types of skills. These include:

1. Cognitive (Thinking) Skills
Thinking skills can be categorised into critical thinking and creative thinking skills.
(i) Critical Thinking Skills

A person who thinks critically always evaluates an idea in a systematic manner before accepting or rejecting it. Critical thinking skills include:	
Analysis Skills – Analysis skills involve examining in detail and breaking down information into parts by identifying motives or causes, underlying assumptions, hidden messages; making inferences, and finding evidence to support generalisations, claims, and conclusions.	Evaluation Skills – Evaluation skills involve justifying and presenting and defending opinions by making judgments about information, validity of ideas or quality of work based on set criteria.
Key Words	**Key Words**
Analyse, compare, contrast, classify, distinguish, infer, explain, separate, select, categorise, connect, differentiate, discriminate, divide, order, point out, prioritise, sub-divide, survey, advertise, appraise, breakdown, calculate, conclude, correlate, criticise, devise, deduce, arrange, discover, establish, examine, organise, outline, investigate, examine, simplify, see, research, recognise, highlight, in-depth, discuss, list, find, group, divide, focus, question, experiment, test, illustrate, identify, deconstruct, and simplify.	Evaluate, criticize, order, appraise, judge, support, compare, decide, discriminate, recommend , summarise, assess, choose, convince, defend, estimate, find errors, grade, measure, predict, rank, score, select, test, argue, conclude, consider, monitor, check, debate, determine, justify, explain, give reasons, interpret, opinion, validate, and value.

(ii) Creative Thinking Skills

A person who thinks creatively has a high level of imagination, able to generate original and innovative ideas, and able to modify ideas and products. Creative thinking skills include;
Synthesis/Creative Skills – Synthesis skills involve changing or creating something new, compiling information together in a different way by combining elements in a new pattern proposing alternative solutions.
Key Words
Categorise, combine, compose, create, devise, design, explain, generate, modify, organise, plan, rearranges, construct, deconstruct, reconstruct, relate, reorganise, revise, rewrite, summarise, tell, write, formulate, invent, hypothesise, develop, compile, prepare, produce, arrange, rearrange, assemble, role-play, anticipate, make, predict, act-out, model, build, convert, discuss, elaborate, solve, propose, visualize, imagine, extend, tabulate, transform, integrate, innovate, maximise, and minimise.

2. Reasoning Skills
Reason is a skill used in making a logical, just, and rational judgement.

3. Decision-Making Skills
Decision-making involves selection of the best solution from various alternatives based on specific criteria and evidence to achieve a specific aim.

4. Problem Solving Skills
Problem solving skills involve finding solutions to challenges or unfamiliar situations or unanticipated difficulties in a systematic manner.

5. High Level Thinking Skills

High level thinking skills include analysis, synthesis, and evaluation skills.

(i) Analysis Skills	Analysis skills involve examining in detail and breaking information into parts by identifying motives or causes, underlying assumptions, hidden messages; making inferences and finding evidence to support generalisations, claims, and conclusions.
(ii) Synthesis Skills	Synthesis skills involve changing or creating something new, compiling information together in a different way by combining elements in a new pattern proposing alternative solutions

Types of Values

1. Personal Values

Core Values	Sustaining Values
• Sanctity of life • Truth • Aesthetics • Honesty • Human • Dignity • Rationality • Creativity • Courage • Liberty • Affectivity • Individuality	• Self-esteem • Self-reflection • Self-discipline • Self-cultivation • Principal morality • Self-determination • Openness • Independence • Simplicity • Integrity • Enterprise • Sensitivity • Modesty • Perseverance

2. Social Values

Core Values	Sustaining Values
• Equality • Kindness • Benevolence • Love • Freedom • Common good • Mutuality • Justice • Trust • Interdependence • Sustainability • Betterment of human kind • Empowerment	• Plurality • Due process of law • Democracy • Freedom and liberty • Common will • Patriotism • Tolerance • Gender equity and social inclusion • Equal opportunities • Culture and civilisation • Heritage • Human rights and responsibilities • Rationality • Sense of belonging • Solidarity • Peace and harmony • Safe and peaceful communities

Types of Attitudes

Attitudes - Ways of thinking and behaving points of view	
• Optimistic • Participatory • Critical • Creative • Appreciative • Empathetic • Caring and concern • Positive • Confident • Cooperative	• Responsible • Adaptable to change • Open-minded • Diligent • With a desire to learn with respect for self, life, equality and excellence, evidence, fair play, rule of law, different ways of life, beliefs and opinions, and the environment.

Content Standards, Benchmarks, and Evidence Outcomes

Content standards, benchmarks, and evidence outcomes are all curriculum standards. However, they have specific curriculum purposes. Despite this, these curriculum standards are interconnected and enable the intended learning outcomes to be attained.

Content Standards

Content Standards are broadly stated expectations of what students should know, understand, and be able to do in a particular subject, grade, or school level. They embed essential knowledge, skills, values, and attitudes that all students are expected to learn and master in each strand or unit to prepare them for the next grade or level of schooling.

Benchmarks

Benchmarks are specifications of content standards or more detailed descriptions of a specific level of performance expected of students at particular ages, grades, or levels of development. Benchmarks focus on the essential knowledge, skills, values and attitudes that all students are expected to learn, master and demonstrate proficiency.

Evidence Outcomes

Evidence outcomes are indicators that indicate students' progress towards meeting an expectation at the mastery level. They measure students' mastery and application of knowledge, skills, values, and attitudes at each grade and cluster levels or school levels. They indicate that a student is meeting an expectation or achieving a benchmark at the mastery level. They enable teachers to know if a student can do what he/she was expected to know, understand, and do in real life or relevant situations. Evidence outcomes are given for each strand in each grade to describe what all students should do at the end of the different strands of Technology and Industrial Arts.

Content Standards and Benchmarks Coding

The following is the coding system used to code the content standards and benchmarks to not only make it easier to interpret and understand the relationship between these two standards but also to help with lesson planning and assessment and reporting of students' performance in relation to a content standard. The coding system is used across all grades from prep-grade 12.

Content Standard Coding

Strand: Strand is indicated by the first digit (for example, 1)
Content Standard: Content Standard is indicated by the second digit (for example, 1.1)
The content standard thus, will read as: Content Standard 1.1

Benchmark Coding

Grade: Grade is indicated by the first digit (for example, 11)
Strand: Strand is indicated by the second digit (for example, 11.1)
Content Standard: Content Standard is indicated by the third digit (for example, 11.1.1)
Benchmark: Benchmark is indicated by the fourth digit (for example, 11.1.1.1)
The grade level benchmark thus, will read as 11.1.1.1

Content Overview

The content overview is the description of what students will learn in each grade prescribed in the syllabus content.

The grade 11 and 12 syllabus is organised by strands. Strands are broad frameworks that define and describe the subject matter to be taught and learned. They incorporate cross-curriculum learning as well. Each strand and unit has a rationale that justifies its inclusion in the Technology and Industrial Arts curriculum.

The Technology and Industrial Arts strands for Grade 11 and 12 are as follows; (1) Textile Technology (2) Food Technology (3) Construction Technology (4) Communication Technology and (5) Computer Technology.

Each strand embeds a particular aspect of Technology and Industrial Arts and articulates the subject matter to be learned. Strands are broken down into teachable units to allow content standards and benchmarks to be effectively taught and learned. Units are aligned and connected to each other and to the strands.

Table of Strands and Units

The table below outlines the strands and units for grade 11 and 12 Technology and Industrial Arts subject. This helps teachers understand how to deal with units per strand when they are expanded into evidence outcomes and benchmarks at each grade.

The strands and units of content standards explain the progression from Grade 11 to Grade 12, linking the senior high school Technology and Industrial Arts content. The order and linkage of units signifies what the students will achieve from one grade to the next.

STRANDS	UNITS
Textile Technology	Fibres and Fabrics
	Textiles and Clothing
Food Technology	Food and Nutrition
	Food Science
Construction Technology	Building Technology
	Electrical Technology
	Plumbing Technology
	Welding Technology
	Engineering Technology
Communication Technology	Data Communication and Network
	Computer Security and Safety
Computer Technology	Computer Architecture
	Computer Software

STRAND 1: TEXTILE TECHNOLOGY

Rationale

Textiles Technology will contribute to the overall education of students by enabling them to confidently use a range of technologies and create an awareness of related career pathways and leisure pursuits. The course encourages students to be proactive, competent, creative, responsible and reflective learners able to take part in further study, work or training.

Textiles have played a significant role throughout human history, satisfying both functional and aesthetic needs. Textiles continue to satisfy needs in society by being a means of self-expression, by having social meaning and cultural significance, and by performing specific functions in commercial, industrial and personal settings.

Textiles Technology acknowledges and embraces an understanding of cultural diversity by examining the ways in which different groups have used textiles as an expressive and functional medium. These historical and cultural uses of textiles continue to influence contemporary designers today. Students therefore, will examine design features characteristic of a variety of different cultures and use them appropriately as sources of inspiration in textile projects.

Students will research to investigate the work of textile designers and make judgments about the appropriateness of design ideas, the selection of materials and tools, and the quality of textile items. Students will be challenged to transfer knowledge to new situations and projects, building on technical skills and past experiences. Textile projects will give students the opportunity to be creative, independent learners and to explore functional and aesthetic aspects of textiles, demonstrate responsibility in decision-making and encourage individuals to express ideas and opinions

Evidence Outcomes

At the end of Grade 11 and 12, all students can master the following knowledge, skills, values and attitudes to prepare them for the next grade:

• Apply health and safety procedures and practices
• Display the principles and techniques of pattern making and fashion designs to construct patterns and garments
• Make an awareness of informed consumer choices for the selection of fibre and fabrics, tools and equipment for clothing construction
• Construct and   model a textile, clothing or fashion product using the concept of remodeling and reconstruction
• Integrate elements of design, printing and dyeing techniques in product development
• Produce and model a variety of garments incorporating current fashion trends, designs and illustrations, elements and principles of design and decorating techniques

- Put into practice sustainable action plans to protect the environment and its resources
- Transform or create a garment or accessory with recycled garments or material
- Compare and contrast the environmental impact of synthetic and natural fibres.
- Utilise the elements of design and design process to produce and evaluate the effectiveness of textile products and items.
- Compile portfolios that compliment a design process with textile products and items.

Unit 1: Fibres and Fabrics

Fibres and fabrics deal with the study of the natural and manmade fibres and the processes involved in the production of fibre and filaments to fabrics. This involves the investigation of natural and manufactured fibres (e.g. physical and chemical properties, testing),fabric construction and fabric finishes. Students will be able to understand the performance and properties of fibres and fabrics and make their choice in choosing the appropriate fabrics for the construction of certain selected textile items

Content Standard 1.1 Investigate the evolution, characteristics, designs and trends of fabrics and fabric designs, their construction, production, representation, regulation and marketing.	
Grade 11 Benchmark	**Grade 12 Benchmark**
11.1.1.1; Display the processes of the fashion design, construction, production and marketing of textiles and clothing	**12.1.1.1;** Apply adherence to safe practices and procedures for facilities, processes, tools and equipment
11.1.1.2; Analyse social, economic, cultural, environmental and technological factors influencing consumer selection of textiles and garments	**12.1.1.2;** Collaborate consumers behavior in choices of clothing and textile products
11.1.1.3; Distinguish the various physical, thermal, chemical and biological properties of fabrics	**12.1.1.3;** Describe the fashion industry's sustainability practices and impact on the environment
11.1.1.4; Explore and describe a range of fabric construction processes in patterns, garments and accessories	**12.1.1.4;** Demonstrate an awareness of the relationship between fashion and self esteem
11.1.1.5; investigate and outline the regulation of the construction of fibres and marketing of fabrics and fabric design	**12.1.1.5;** Demonstrate an awareness of the need for businesses to understand customer demographics

Unit 2: Textiles and Clothing

Textiles and clothing is the study of the process and production of fibre and filaments to fabrics and construction of textiles and garments. It is essential for students to know the process of various textiles productions in-order to select and utilise appropriate fabrics to construct garments or clothing, apply elements of fashion design and be attired for different occasions and purposes or decorate facilities for different occasions. Textiles and fashion design relate to the self-esteem of the individual thus the importance in this study to be creative, critical and collaborative in the design and construction of textile items. Elements of design incorporated into the design process will result in the construction of items that are pleasing, desirable and marketable.

Content Standard 1.2 Integrate and apply principles and techniques in presenting fashion ideas and illustrations in pattern making and garment construction for a variety of needs and occasions	
Grade 11 Benchmark	**Grade 12 Benchmark**
11.1.2.1; Evaluate the historical influences, technological progression, and emerging trends as inspirational sources for design. **11.1.2.2;** Design a variety of patterns and garments incorporating the trends in fashion, textiles and clothing **11.1.2.3;** Apply appropriate principles and techniques in designing fashion ideas. **11.1.2.4;** Present fashion ideas and illustrations in pattern and garment construction for specific requirements and occasions **11.1.2.5;** Develop an aesthetic sense and creativity through the design and production processes of fashion, clothing and textile products	**12.1.2.1;** Apply historical influences, technological processes and the emerging fashion trends in the creation of a range of fabric items. **12.1.2.2;** investigate and apply the design, material and technology on clothing for functional needs **12.1.2.3;** integrate and combine ideas, emerging technological techniques and contemporary cultural illustrations in the construction of fabrics and fabric products **12.1.2.4;** design and construct a fibres and fabric portfolio for trends of fashion in design, illustration, construction and the end processes in the fashion industry **12.1.2.5;** Assess and appraise the standards in the fashion industry according to the materials, skills and processes, and techniques.

STRAND 2: FOOD TECHNOLOGY

Rationale

The food industry is growing in importance, in providing employment opportunities and increasing the relevance of Food Technology for the individual and society. There are increasing community concerns about food issues; hygiene and safety in food handling and meal preparation, nutritional claims and the nutritional quality of food, genetic engineering, functional food, diets, diseases and the environmental impact of food production processes.

Students will explore food-related issues through a range of practical experiences, allowing them to make informed and appropriate choices.

Food habits change as a result of economic, social, cultural, technological and environmental factors. People are confronted by an increasing array of food products designed to complement our changing lifestyles. Making informed food decisions requires an explicit understanding of nutritional principles in both theory and practice, and this is embedded in the study of Food Technology. This is essential to the development of sound food habits and contributes significantly to the healthy lifestyles in Papua New Guinea. Lifestyle diseases such as diabetes, obesity and hypertension are increasing while malnutrition is common among children in Papua New Guinea

This study provides students with a broad knowledge and understanding of food properties and processing, preparation and their inter-relationships with the nutritional requirements for people and their consumption patterns. It addresses the importance of hygiene and safe working practices and legislation in the production of food.

This knowledge and understanding is fundamental to the development of food product using specific skills, which can then be applied in a range of contexts enabling students to produce quality food products. Students develop practical skills in preparing and presenting food that will enable them to select and use appropriate ingredients, methods and equipment.

Integral to this study is the ability to design, produce and evaluate solutions to situations involving food.

Evidence Outcomes

At the end of Grade 11 and 12, all students can master the following knowledge, skills, values and attitudes to prepare them for the next grade:

- Explain the role of food nutrients in human nutrition and assess the nutrient value of meals/diets for particular individuals and groups
- Describe the mechanical process of absorption and metabolism of food in the body, roles of nutrients in food sources and the impact and relevance of nutrients to the wellbeing of individual needs and occasions
- Identify the food source, plan, prepare a menu to satisfy; DRI (dietary requirements), 5 food group, food composition table in producing a food and beverages product to alleviate nutritional disorders or needs, occasions and health
- Ascertain food management skills in food preparations, meal preparation, product development, storage and quality assurance
- Demonstrate knowledge application in hygiene, safety, ethical values and etiquettes in meal preparation, food handling, product development and meal presentation
- Discuss impacts of globalization on cultural food practices
- Innovate new product using local food and technology integrating concepts of product development processes, nutrition and biological characteristics of food
- Explore emerging technologies in food science
- Apply management skills and create consumer awareness in food selection, meal preparation and food storage, food packaging and food labeling.
- Generate ideas and develop solutions to a range of food situations and presenting ideas in written, graphic and oral form using computer software where appropriate.
- Investigate and develop food products appropriately using food preservation techniques.
- Evaluate and compile a design portfolio composed of researched information, techniques and processes on food preservation.

Unit 1: Food and Nutrition

There is an increasing community concern about food issues including the nutritional quality of food and the environments impact of food manufacturing and food preparation

Food and nutrition is developed to focus on the knowledge, understanding and skills related to food hygiene, safety and the provision of the quality of food. This involves the knowledge and understanding of food properties, processing and preparation and an appreciation of their interrelationship to produce quality food for the wellbeing of individuals. In addition a clear focus on nutrition and food consumption and the appreciation of the consequences of food choices on health.

Students need to understand the importance of a variety of foods, sound nutrition principles and the food preparation skills when making food decisions to help better prepare them for their future lives. Students should progressively develop knowledge and understanding about the nature of food safety and how to make informed and appropriate food choices when experimenting with and preparing food in a sustainable manner. Food service and catering in addition are important aspects of food and nutrition.

Content Standard 2.1 Examine and analyse the characteristics and properties of different types of food and the social, economic, political, cultural and technological influences on their production and compliance with ethical principles and standards.

Grade 11 Benchmark	Grade 12 Benchmark
11.2.1.1; Analyse the nature and properties of food	12.2.1.1; Describe the processes that transform raw materials into manufactured food products
11.2.1.2; Plan to develop a product using the food product development process and discuss the economic, social and technological influences	12.2.1.2; Describe the processing techniques, equipment, storage and distribution systems used in industry and compare with those used domestically.
11.2.1.3; Practice application in hygiene, safety, ethical values and etiquettes in meal preparation, food handling, product development and meal presentation	12.2.1.3; Identify critical control points and describe quality control procedures in food production systems
11.2.1.4; Solve nutritional problems using the design process and communicate ideas in written, oral and graphical form	12.2.1.4; Apply the principles of food preservation to create safe food products.
11.2.1.5; Investigate the recommended dietary intake of energy, protein, vitamins and minerals for particular individuals and groups using appropriate data such as RDI tables in print or electronic format	12.2.1.5; Investigate, through experimentation, the suitability of packaging materials for different food products

Unit: 2. Food Science

The Food Science study draws from the science disciplines in an attempt to better understand food processes and ultimately improve food products. Food Science therefore is the study of food in the context of the understanding of the physical, biological and chemical makeup of food and the responsibility towards safety, taste, acceptability when developing new food products, considering overarching concepts of waste management, sustainability and food protection.

The unit is based on the understanding that the ability to reason, to think critically and creatively, and to reflect on one's actions, will empower students to act responsibly toward themselves, their families, their peers, and the larger society. As technology advances and societies change, the basic need for food remains.

Food Science is designed to reinforce and enhance the student's knowledge of scientific principles and processes through the study of foods and nutrition. An in-depth understanding of science as it applies to food will assist students with interest in career and technical education, to understand the food industry as well as food preparation in their daily lives. Whenever possible, students should be involved in hands-on laboratory activities which verify the scientific concepts presented. The ability to think critically about food production and related issues of food security or food shortage may well lead to modifying recipes and creating nutritious food products and creating a whole new food environment that will still remain authentically Papua New Guinean.

Content Standard : 2.2 Investigate and analyse the cultural, physical, chemical, nutritional, biological and sensory characteristics of food and how they influence the development and production of food to meet different demands (eg, health, occasions, lifestyle, business)	
Grade 11 Benchmarks	**Grade 12 Benchmarks**
11.2.2.1; Recognise the significance of food science as a relevant science including current and historical developments and advancements of global food production **11.2.2.2**; Explain the role of science in food science as it relates to research practices and practical scientific experiments **11.2.2.3**; Distinguish between the different kinds of chemical reactions in food and understand the factors that affect them. **11.2.2.4**; Describe methods of food preservation and their relationship to food safety **11.2.2.5**; Investigate microorganisms in terms of classification , their growth and their application to food science	**12.2.2.1**; Investigate useful and harmful microorganisms and their effects on food products **12.2.2.2**; Analyse and describe methods of food preservation and their relationship to food safety **12.2.2.3**; Explore and analyse food additives, the types, functions, and their roles in food products. **12.2.2.4**; Establish a safe working environment within the food industry **12.2.2.5**; Explore and describe technological advances in food science

Strand 3: Construction Technology

Rationale

This study introduces students to concepts and skills in construction technology, which encompasses plumbing, electrical and network wiring, masonry, heating/cooling, carpentry, woodworking, engineering application, and methodology and processes of structures. It is a cluster of technologies in the construction and maintenance of buildings. It enables students' knowledge and skills in building materials and processes through opportunities to design and build various construction projects.

Students will learn to create and read working drawings; become familiar with common construction materials, components, and processes; and perform a variety of fabrication, assembly, and finishing operations engineering skills and procedures of design. They will learn about building design and planning construction projects; create and interpret working drawings and sections; and learn how the building code, wiring rules and other regulations and standards apply to construction projects. They will use a variety of hand and power tools and apply knowledge of imperial and metric systems of measurement, as appropriate. They will use drawings to represent design ideas and solutions to technological challenges, and interpret drawings accurately when working on construction projects.

Students will develop an awareness of environmental and societal issues related to construction technology, and will explore pathways leading to careers in the industry.
Construction technology will develop skills and knowledge in the study of the technologies; building, electrical, plumbing, welding, and engineering.

Evidence Outcomes

At the end of Grade 11 and 12, all students can master the following knowledge, skills, values and attitudes.

Building Technology

- Observe Occupational Health and Safety standard procedures in the Industrial environment
- Apply personal safety when operating machinery.
- Assess different emergency procedures in the workplace.
- Assess and manage major hazards and risks in the workplace.
- List and analyse main building construction components from foundation, setting out, framing and roof construction.
- Define Building Project Management concepts and processes
- List and outline the Building Project Management components and processes
- State the role of a Project Manger
- Apply various techniques in pictorial drawing.
- Demonstrate ability to perform perspective drawings.
- List the main steps and procedure of down loading AUTO CAD program

- State and discuss the techniques on 2D or 3D drawings on Domestic Building using the CAD program
- Apply drawing skills in surface development and inter-sectioning of solids.
- Identify appropriate computer aided designing programs suitable for Building and woodwork designs
- Analyse and categorise the process of construction.
- Apply the steps of transitioning from 2D to 3D and producing a completed computer designed product.
- Interpret a building design and symbols in the building process.
- Familiarise the types of building regulations and procedures in building construction.
- Read, interpret, or make simple sketches that are descriptive of objects and activities to be manufactured.
- Select wisely, care for, and use properly and safely, the various tools and materials that are used in the manufacture of a product
- Demonstrate work habits and attitudes that will enable students to live as productive citizens in society.
- Design and Construct Domestic Building using AUTO CAD Program

Electrical Technology

- Comprehend and apply OHS legislation and regulations in any electrical activity.
- Manage hazards and be equipped with PPE before carrying out any electrical work.
- Demonstrate safe working procedures when dealing with electricity
- Administer emergency procedure in emergency situations.
- Read, interpret and apply wiring rules in electrical wiring system.
- List the types of electrical licensing, the regulation of each licensing and the scope of work they cover.
- Outline how electrical licenses are obtained.
- Use correct terminologies for materials, tools, components, and accessories used in the electrical installation.
- Differentiate single phase from three phase.
- Demonstrate knowledge of motors, generators and transformers and explain power generation and distributing systems.
- Perform tasks using appropriate hand and power tools
- Read and use electrical diagrams in wiring installations.
- Install circuit breakers, meter boxes and different switching circuits.
- Use earthing system to protect against the harmful effects of electricity.
- Conduct and evaluate dead and live tests on installed circuits
- Troubleshoot, repair and maintain conditions of tools, equipment, products and systems.

Plumbing Technology

- State and describe the fundamental concepts of Water Distribution System and Drain, Waste, Vent System, sanitation system to the existing plumbing system
- Define the Hazard Communication On-Site
- State and explain the types of Hazard communication On- Site
- observe Occupational Health and Safety standard procedures in the Industrial environment
- Apply personal safety when operating machinery.
- List and describe corrugated stainless steel tubing and their uses
- Define fixtures and faucets
- List and describe the types of fixtures and faucets and their uses
- Apply various techniques in pictorial drawing.
- Demonstrate ability to perform perspective drawings.
- Apply drawing skills in surface development and inter-sectioning of solids.
- dentify appropriate computer aided designing programs
- List the main steps and procedure of down loading AUTO CAD program
- State and discuss the techniques on 2D or 3D drawings on simple plumbing system using the CAD program
- Assess different emergency procedures in the workplace.
- Identify product-specific tools and their applications.
- Discuss and practice Blue print and sketches of pipes system using AUTO CAD Program
- Define Plumbing Project Management concepts and processes
- List and outline the project Management components
- Assess and manage major hazards and risks in the workplace
- Design and Install plumbing system (DWV) system and water Distribution system using AUTO CAD program

Welding Technology

- Demonstrate safe work practices and management drills, be fully equipped with PPE and observe OHS legislations and regulations.
- Describe the economic costs, social and environmental impacts in the designing of products from start to the end product.
- Explain functions and components of lathe and milling machines.
- Apply geometry and trigonometry in engineering drawings.
- Demonstrate dimensioning, sectional drawings, and assemble drawings with correct welding symbols in detailed drawings.
- Construct projects using correct handling techniques of tools and machines in welding and machining operations.
- Identify materials and metals to construct fabrication projects with correct welding techniques and cutting processes.
- Perform drilling, soldering, riveting, and seaming in metalwork.
- Employ the use of computer applications in processing of materials
- Evaluate and produce welding and machining projects to quality for inspections according to job specifications and industry standards.

Engineering Technology

- Read, interpret, or make simple sketches that are descriptive of objects and activities to be manufactured.
- Apply various techniques in pictorial drawing.
- Demonstrate ability to perform perspective drawings.
- Apply drawing skills in surface development and inter-sectioning of solids.
- Identify appropriate computer aided designing programs
- Select wisely, care for, and use properly and safely, the various tools and materials that are used in the manufacture of a product.
- Demonstrate work habits and attitudes that will enable students to live as productive citizens in society.
- Understand the fundamental concepts of engineering in various fields
- Demonstrate understanding of the importance of engineering and their functions.
- Understand the engineering principles and practices.
- Analyse engineering field issues and find solutions.
- Adapt the basic engineering management and problem solving skills.
- Apply engineering concepts to address problems that arise.
- Apply engineering techniques and skills to draw environmental causes and effects.
- Analyse materials, equipment in logical report and presentation.
- Use high level of management and administration project management skills.

Unit 1: Building Technology

The Building and Construction focus area provides opportunities for students to develop knowledge, understanding and skills in relation to the building and associated industries.

This study develops knowledge and skills in the use of materials, tools and techniques related to building and construction. These are enhanced and further developed through practical and applied knowledge and skills in the construction and maintenance of parts of buildings.

Practical projects should reflect the nature of the Building and Construction focus area and provide opportunities for students to develop specific knowledge, understanding and skills related to building and construction-related technologies. They may include: construction of small structures, scale models, elementary repairs and renovations, development of garden and recreational areas work undertaken on isolated building models and mock-ups.

Projects should promote the sequential development of skills and reflect an increasing degree of student autonomy as they progress through the course.

Content Standard : 3.1 Investigate the history and theory of buildings and analyse the components and systems of buildings, occupational health and safety procedures, the properties of building materials and the processes in which those materials and equipment are used according to industry standards.

Grade 11 Benchmarks	Grade 12 Benchmarks
11.3.1.1; Explore and analyse the main fundamentals of building structures, and basic building project management procedures.	**12.3.1.1;** Explore and apply scientific fundamentals in building structure
11.3.1.2; Investigate and analyse appropriate materials and specification in building structure.	**12.3.1.2**; Apply and analyse building project management, principles and processes.
11.3.1.3; Apply drawing skills in surface development and inter-sectioning of solids related to project drawings and specifications using computer-aided drafting program.	**12.3.1.3**; Practice auto-cad or auto-desk program in designing a building structure.
11.3.1.4; Describe and apply appropriate health and safety practices pertaining to wood and non- wood products	**12.3.1.4**; Apply the fundamentals of occupational health and safety on site in building construction.
11.3.1.5; Explore and describe the fundamental building project procedures.	**12.3.1.5**; Design and construct a building structure (gable roof) with the correct procedures and regulations of building.
11.3.1.6; Estimate and apply building materials using auto-cad computer aided drafting of the building	**12.3.1.6**; Explore and apply appropriate trade math in building to estimate costs of building projects.

Unit: 2. Electrical Technology

Modern civilization as we know it would not exist without electricity and the attendant technologies that have arisen out of it, for example, communications (voice, data, Internet), computer and electronic technologies. Just imagine the world without electricity and, therefore, without refrigeration, television, hi-fi stereo, computer, Internet or telephones. Electrical and electronic technology is the common thread that connects these diverse areas and those of air travel, transportation, manufacturing, mining, construction, agriculture, sports, education, medicine, entertainment, food preservation and preparation.

None of these modern marvels of the world is possible without the use of electrical and electronic technology. Therefore, it is imperative that persons, wishing to understand the rapid pace of technological advancement, have a good grasp of the fundamentals of electrical and electronic technology.

Electrical Technology focuses on the understanding and application of electrical and electronic principles and the technological processes inherent in the production of products, services and systems in order to improve the quality of life. This unit focuses on the principles and characteristics of circuit functions and operations. This deals with the "design, application, installation, manufacturing, operation or maintenance of electrical/electronic(s) systems. The practical component involves actual circuit construction where students will manipulate knowledge and skills to design electrical circuits using basic electrical items. Safety precautions and dangers of working with electricity are stressed.

Content Standard : 3.2 Analyse and apply the technological processes, concepts, principles and practices related to Electrical Technology and its social contribution with regard to economic growth, entrepreneurship, sustainability and as a tool for change, improving the quality of life responsive to individual ,community and industrial needs	
Grade 11 Benchmarks	**Grade 12 Benchmarks**
11.3.2.1; Discover and interpret licensing and standard wiring requirements for an electrician in electrical technology.	**12.3.2.1;** Read, analyse and interpret electrical circuit in design and construction
11.3.2.2; Assess and apply standard safety, health and environmental practices.	**12.3.2.2;** Describe the reasons for an earthing system and show how MEN system works to protect against the harmful effects of electricity.
11.3.2.3; Distinguish between single-phase and three-phase system	**12.3.2.3;** Employ correct handling and maintenance techniques in performing tasks using hand and power tools.
11.3.2.4; Explore the concepts and principles used in the electrical field with a relevant knowledge of motors, generators and transformers and their use in power generation and distribution systems**.**	**12.3.2.4;** Analyse the process of installing a circuit breaker and a meter box and Install the different types of switching circuits for switch points to control light points.
11.3.2.5; Explore and analyse materials, tools, components and accessories used in the electrical installation process.	**12.3.2.5;** Safely conduct dead and live tests on circuits and apply electrical energy to assess and evaluate circuits.
11.3.2.6; Compare and analyse electronic and electrical drawings and illustrations and the skills according to engineering standards.	**12.3.2.6;** Apply knowledge and skills in troubleshooting, repairing and maintenance of electrical products, appliances and components of electrical systems.

Unit 3: Plumbing Technology

Plumbing technology focuses on understanding general concepts of the construction industry. Students study the role of plumbing in construction. Skills are developed in plumbing fundamentals such as basic drainage system structures, water supply and code requirements. Engaging students in plumbing will enable them to develop knowledge, skills and experiences in water supply systems, sanitation systems to enable them to construct plumbing systems or repair and maintain existing systems.

Content Standard : 3.3 Investigate and analyse fundamental concepts of plumbing and theories, Occupational Health and safety Regulations and standards ,trade drawing, demonstrations and applications of tools and materials specifications, installation of plumbing fittings and accessories in Drain, waste, vent (DWV) system, and water distribution system.

Grade 11 Benchmarks	Grade 12 Benchmarks
11.3.3.1; Explore and analyse concepts on water distribution system, drain, waste, vent system in plumbing.	**12.3.3.1;** Explore and apply basic plumbing management principles and processes.
11.3.3.2; Identify and analyse hazards communication in plumbing trade.	**12.3.3.2;** Describe and apply OHS-On Site according to the OHS regulations.
11.3.3.3; Explore and categorise corrugated stainless steel tubing, fixtures and faucets.	**12.3.3.3;** Adapt installations of fittings and accessories on Drain, Waste, Vent (DWV) System and water system.
11.3.3.4; Read and analyse blueprints and sketches of pipe system using AUTO-CAD programs.	**12.3.3.4;** Design and install water distribution system, Drain, Water, Vent (DWV) system using AUTO-CAD programs.

Unit 4: Welding Technology

Welding Technology will provide students with an introduction into the welding field. The practical experiences in the shop are designed to broadly qualify the student for employment in the construction and repair industry. Students are trained in the use of the oxy-acetylene process, which includes metal cutting, welding, brazing and soldering. The various types of arc welding such as shielded metal ARC (SMAW) metal inert gas (MIG) and tungsten inert gas (TIG) are taught in depth. The practical component involves the safe use and maintenance of welding tools and equipment and safety in welding shops. Students use welding techniques to make products using the design process.

Content Standard : 3.4 Investigate and analyse safety procedures, print reading, measurement and layout, identify properties of metals, the welding techniques, cutting processes according to welding codes, inspections, testing principles and apply fundamentals of fabrication

Grade 11 Benchmarks	Grade 12 Benchmarks
11.3.4.1; Identify and apply fundamental principles of OHS when working with materials, tools and machines.	**12.3.4.1;** Observe health and safety practices when handling materials, tools and equipment
11.3.4.2; Explain functions and components of lathe and milling machines and describe material properties and elements of metals in lathe machining	**12.3.4.2;** Describe the design for the life cycle: taking into account economic costs, and social and environmental impacts of the product, from the extraction of raw materials to eventual reuse or recycling of component materials
11.3.4.3; Create and interpret engineering drawings and blueprints with the application of geometry and trigonometry related to machining	**12.3.4.3;** Practice identification and selection of suitable metal material for machining or welding processes, forms of welding and precision measurement
11.3.4.4; Analyse the properties of metals and the welding techniques and cutting processes according to safety regulations and standards**.**	**12.3.4.4;** Use computer applications for planning, preparing and processing of material
11.3.4.5; Analyse and select suitable material for machining or welding processes, identifying forms of welding with, precision measurement for quality output.	**12.3.4.5;** Assess procedures and standards for inspection of welding and machining quality
11.3.4.6; Apply safe working procedures, correct processes and techniques in handling lathe and milling machines.	**12.3.4.6;** Evaluate welding and machining project creation in accordance to industry standards

Unit 5: Engineering Technology

Engineering Technology is to develop students' understanding and appreciation of the nature and significance of engineering and its impact on society with an emphasis on the application of engineering methodology. The goals of engineering and technology education are focused on enabling students to become more technologically literate with in-depth experiences geared to career preparation.

Students develop deeper problem-solving skills leading to consumer awareness and personal enrichment as well as occupational readiness. Engineering and technology education strives to develop critical-thinking skills in such ways that students become more discriminating with regard to technology and its impact on society

This study will develop knowledge and skills in the use of materials, tools and techniques related to structures and mechanisms. Application of the knowledge and skills is through Practical projects that should reflect the nature of the Engineering and provide opportunities for students to develop specific knowledge, understanding and skills related to engineering. These may include: small structures, small vehicles, a range of devices and appliances, robotics projects, electronic and mechanical control systems.

Content Standard : 3.5 Investigate and analyse the historical and societal influences in Engineering by understanding the engineering principles, practices, the design process, the management, problem-solving and communication skills appropriate to any engineering field.

Grade 11 Benchmarks	Grade 12 Benchmarks
11.3.5.1 Explore and analyse concept of technology systems in determining practical applications for learning and technical problem solving. **11.3.5.2** Describe the types of materials ,component and process and explain their implication for engineering development **11.3.5.3** Develop Written, oral and Presentation skills and apply these to engineering reports with application of graphics as a communication tool. **11.3.5.4** Apply appropriate computer Aided designing program to create detail designs **11.3.5.5** Describe the developments in technology and their impact in engineering products	**12.3.5.1;** Describe and analyse the nature of engineering in specific field and its importance to society. **12.3.5.2;** Evaluate the scope of engineering and recognise current innovations and describe the relationship between properties , uses, applications of materials in engineering **12.3.5.3;** Apply Mathematical, scientific and graphical methods to solve problem of engineering practice **12.3.5.4;** Demonstrate ability to scale drawing designs and employ architectural drafting skills to create design structures **12.3.5.5;** Identify and evaluate the social environmental and cultural implications of technological change in engineering

Strand 4: Communication Technology

Rationale

The way people communicate has completely transformed over time. No longer beholden to pen and parchment, people can now deliver massive amounts of data with the push of a button. New communication technologies have connected not only people but also businesses, changing the way people interact on a daily basis. Communication is the transfer of information and receiving. Technology increases the ways in which information can be communicated, the speed of transmission, and the total volume that can be handled at any one time. Students need to experience firsthand how technology helps people communicate more information to more people in less time, with greater accuracy and fewer inconveniences.

This strand introduces students to communications technology from a media perspective. Students will work in the areas of TV/video and movie production, radio and audio production, print and graphic communications, photography, and interactive new media and animation.

Student projects may include multimedia activities such as desktop publication, creating videos, editing photos, working with audio, cartooning, developing animations, and designing web pages. Students will also develop an awareness of environmental and societal issues related to communications technology, and will explore secondary and postsecondary education and training pathways and career opportunities in the various communication technology fields.

Students will demonstrate an understanding of core concept, techniques, and skills required to produce a range of communications media products or services. These projects will integrate the STEAM approach in which students will demonstrate the understanding of technical terminology employing scientific, mathematical, artistic concepts and processes used in communication technology and apply them to the creation of media products or prototypes.

Evidence Outcomes

At the end of Grade 11 and 12, all students can master the following knowledge, skills, values and attitudes.

- Illustrate and interpret the appropriate computing terminology in the correct context
- Interpret the conversion of storage units and data
- Apply knowledge and understanding of processes through designing and setting up various materials or systems in communication technology.
- Employ concepts in hardware with image resolutions to create Graphics element in a graphical setting.
- Assess and oversee the impacts of computer disposal on environment and humans.
- Apply skills to work with data through technology and electronics communication
- Set up resources to operate modulations and simulations through simple communication devices utilizing WAN, LAN and cloud technology

- Describe communication services with explicit explanations of each service and how they work.
- Apply skills and knowledge to construct and arrange the program development cycle to identify problems and create programs.
- Create and integrate web components, other applications for special effects, hyperlinks and other web components.
- Use computer skills and knowledge to secure data by performing backups, data encryption and setting passwords.
- Describe and set up communication hardware and software to build a simple local area network.
- Use computer security skills to secure computers, networks and data
- Gain knowledge in the areas of 2-Dimensional Design, 3-Dimensional Design, rendering and Animation.
- Exploring the fields of engineering, architecture, and graphic communication design.
- Apply the skills acquired in math, reading, writing, and science to industrial technology.
- Employ the problem solving process to reach technical solutions through computers and technology activities.
- Use computer skills and knowledge to secure data by performing backups, data encryption and setting securities.
- Apply knowledge to create a simple peer-to-peer network using LAN and WAN
- Apply the concepts of layering in TCP/IP reference model and use appropriate network utilities to solve TCP/IP problems.
- Describe the services provided by network servers and appreciate network applications.
- Demonstrate an understanding of the core concepts, techniques, and skills required to produce a range of communications media products or services
- Demonstrate the knowledge of technical terminology, basic scientific concepts, and mathematical concepts used in communications technology and apply them in creating media products
- Apply appropriate communication design principles in published and presented projects to communicate with others, incorporating emerging technologies
- Formulate advanced search strategies, demonstrating an understanding of the strengths and limitations of the Internet, and evaluate the quality and appropriate use of Internet resources
- Apply appropriate technology tools and resources to produce creative works and to construct technology enhanced Models.
- Integrate and Apply multimedia elements into a cohesive multimedia product in a given context
- Explain the impact of computing on business, manufacturing, commerce, and society.
- Define devices and technologies used to improve data and computer security.
- Apply proper health and safety measures
- Determine and give reasons to justify the concepts of computer and data security
- Create a model of how embedded systems sense, process, and actuate in a given environment
- Explain responsible citizenship relative to technology
- Describe and apply appropriate file maintenance practices to organise and safeguard data
- Exemplify ethical and legal technology issues and formulate solutions and strategies that foster responsible technology usage.
- Explain and implement various encryption schemes that are used to secure data and communication over networks.

- Distinguish the competing forces of privacy policies and their legal, social, ethical, and economic consequences
- Explain network security threats and formulate effective measures to improve security on LAN and WAN networks
- Identify and evaluate devices and technologies used to improve data and computer security.
- Apply proper health and safety measures
- Explain the concepts of computer and data security
- Apply appropriate file maintenance practices to organize and safeguard data

Unit 1: Data Communication and Network

Data Communication and Network offers concepts that will provide students the foundation in the study of the unit. The topics include Basic Elements of Data Communication, Fundamentals of Networking, Network Protocols and Telecommunication & Mobile Devices and Smart Devices.

The students will be able to display their skills in installing, configuring and managing very simple networks. They will define the basic elements of data communication system and describe the functions of the different components of a network. In addition expand on the OSI (Open Systems Interconnect) model and how it functions.

Students will identify and define the network topologies and the functions, properties and characteristics of protocols. They will describe the concepts, properties and characteristics of different IP addresses and the basic functions of devices and technologies in telecommunication smart and mobile technology.

It is necessary for students to explore and understand the essential knowledge, skills and values in Network Protocols, Telecommunication and Mobile Devices and Smart Devices which will prepare them for further learning and for usage in communication technology.

Content Standard : 4.1 Investigate and analyse communication technology utilising multi-media and the practices and systems in designing, installing, configuring and managing networks.

Grade 11 Benchmarks	Grade 12 Benchmarks
11.4.1.1; Apply knowledge to create a simple peer-to-peer network using WAN and LAN –	**12.4.1.1;** Implement, document and present the design process as applied to a particular product, process or problem.
11.4.1.2; Evaluate the concepts of layering in TCP/IP reference model and use appropriate network utilities to solve TCP/IP problems.	**12.4.1.2;** Apply appropriate communication design principles in published and presented projects to communicate with others, incorporating emerging technologies
11.4.1.3; Describe the services provided by network servers and appreciate network applications.	**12.4.1.3**; Formulate advanced search strategies, demonstrating an understanding of the strengths and limitations of the Internet, and evaluate the quality and appropriate use of Internet resources
11.4.1.4; Demonstrate an understanding of the core concepts, techniques, and skills required to produce a range of communications media products or services	**12.4.1.4;** Identify, select and apply appropriate technology tools and resources to produce creative works and to construct technology enhanced models
11.4.1.5; Demonstrate the knowledge of technical terminology, basic scientific concepts, and mathematical concepts used in communications technology and apply them in creating media products	**12.4.1.5;** Integrate multimedia elements into a cohesive multimedia product in a given context
	12.4.1.6; Responsibly, competently, confidently and creatively use communication technology
	12.4.1.7; Explain the impact of computing on business, manufacturing, commerce, and society.

Unit: 2. Computer Security and Safety

Computer Security and Safety explores basic concepts that students should value such as; Ergonomics in Information Communication Technology (ICT), Environmental, social and ethical issues. They will be able to confidently display their skills and knowledge in using the Monitoring and Control System, Hardware and Software Security and Communication System.

The unit furthermore, offers some concepts in avoiding cybercrime and data theft while keeping the data safe and identity secure. Students will learn to apply skills in preventing intrusions to data, transactions, and privacy through some safety guidelines and security techniques.

Students will identify and investigate safety and health computer issues, widespread use of computers and associated technological effects and describe the impact of technologies on individuals, society and environments.

It is necessary for students to explore and understand the essential knowledge, skills and values in Ergonomics in ICT, Environmental, social and ethical issues which will prepare them for further learning in the next grade.

Content Standard : 4.2 Investigate and analyse the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society

Grade 11 Benchmarks	Grade 12 Benchmarks
11.4.2.1; Identify and evaluate devices and technologies used to improve data and computer security.	**12.4.2.1;** Analyse the social and economic implications and the use of computers.
11.4.2.2; Explore and apply proper health and safety measures	**12.4.2.2;** Evaluate and apply appropriate file maintenance practices to organize and safeguard data
11.4.2.3; Determine and give reasons to justify the concepts of computer and data security	**12.4.2.3;** Analyse ethical and legal technology issues and formulate solutions and strategies that foster responsible technology usage.
11.4 2.4; Evaluate and create a model of how embedded systems sense, process, and actuate in a given environment	**12.4.2.4;** Explain and implement various encryption schemes that are used to secure data and communication over networks.
11.4.2.5; Define responsible citizenship relative to technology	**12.4.2.5;** Examine and evaluate the competing forces of privacy policies and their legal, social, ethical, and economic consequences
	12.4.2.6; Evaluate the network security threats and formulate effective measures to improve security on both wired and wireless networks LAN and WAN

Strand 5: Computer Technology

Rationale

The use of Computer Technology is now the integral part of today's modern society. Development in technology has progressed rapidly.

The strand is expected to be 'hands-on' or practical oriented. The skills and concepts in this strand can be integrated with other strand in the Industrial Arts and Technology subject.

The purpose of the Computer Technology strand is to equip students with the necessary skills in computer technology to apply to aspects of life in the ever changing society. It will enable students to use their knowledge and skills to compete with the technological surroundings in order to integrate well within their society.

Furthermore, it will involve the application of skills to gather information from multiple sources and select relevant materials that is useful for the user to make decisions or take specific actions to solve authentic problems.

The students will apply knowledge and creative processes that are involved in the development of hardware and software tools that will help us to meet needs and global demands from personal to business, education and other organization.

Under the strand Computer Technology in the subject, Technology and Industrial Arts students from Grade 9 to Grade 12 will cover the units namely Computer Architecture and Computer Software.

What is learnt should develop the students to know and master all the concepts in dealing with computer resources, computer aids, software and systems that exist today with technology.

Students will apply the skills and concepts in creating solutions to Computer Technology problems using a range of software, they will design and create programs and application to meet the needs of society and solve problems, demonstrate the knowledge and understanding of the legal and ethical issues of using and producing IT solutions and the effects on the society.

Evidence Outcomes

At the end of Grade 11 and 12, all students can master the following knowledge, skills, values and attitudes.

- Stimulate and foster Artificial Intelligence (AI) to create sensors that mimic humans and design intelligent systems for robotics.
- Use computer hardware and software resources to demonstrate and apply skills to create and edit graphics using Authoring software or simple software
- Apply advanced computer skills and concepts to evaluate and modify existing database and designing new database to meet the efficiency of the organisation.
- Apply principle in monitoring and controlled systems with the understanding of the software role in the society.
- Create and integrate web components, other applications for special effects, hyperlinks and other web components.

- Create and produce graphical product using computer aided programs.
- Demonstrate an understanding of the software development process**.**
- Classify different types of robots.
- List and Define basic electronics components.
- Create basic designs using specific software.
- Read, write, and modify existing algorithms or code.
- Explain the steps in the development of a computer programs
- Apply skills in coding and compiling simple computer programs.
- Apply skills to work with data through technology and electronics.
- Explain the basics of computer fundamentals, and apply the skills to manage and maintain; diagnose, troubleshoot and solve issues
- Interpret competencies in computer systems, installations and configuration and the identification of basic electronics components.
- Analyse and modify existing algorithms or code to design and create simple robots
- Diagnose and perform basic maintenance and repair hardware and software with appropriate documentation of maintenance and repair problems
- Identify different types of models used for simulations
- Illustrate electronics components to create designs using specific software.
- Demonstrate conceptual knowledge of technology systems in determining practical applications for learning and technical problem-solving.
- Analyse and illustrate how the physical, informational and bio-related technological systems of the designed world are brought about by the design process.
- Evaluate and explain the critical roles of individuals in the designed world; its processes, products, standards, services, history, future, impacts issues and career connections.
- Apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms and data representation
- Analyse problems in computational terms, and have repeated practical experiences of writing computer programs in order to solve such problems.
- Evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems.
- Apply typing skills with speed and accuracy
- Analyse the specifications of computer components to user requirements and produce graphical products using computer aided programs.
- Illustrate knowledge of the software development process and the creation of graphical products using computer aided programs
- Explain and illustrate the steps in the development of computer programs and the application of skills in coding and compiling computer programs.
- Describe the characteristics of client-site scripting and creating interactive menus

Unit 1: Computer Architecture

This unit explores basic concepts that students should comprehend in computer fundamentals, computer system design, data representation, Artificial Intelligence (AI) and computer electronics and robotics. Students will be able to display their skills and knowledge in setting up computers and software, model and simulate system and troubleshoot hardware and software.

At this level, students will understand the evolution of computers, explore and describe computer types, design ideas and solutions. Students should be able to solve problems, describe the work and responsibilities of designers and the factors affecting their work, identify innovative, enterprising and creatively design ideas and solutions and understand the management strategies when developing design solutions.

It is necessary for students to explore and understand computer fundamentals and system designs which will prepare them for further learning in the next grade.

Content Standard : 5.1 Explore and analyse computer fundamentals, the skills to manage and maintain; diagnose, troubleshoot and solve issues that encompass computer systems, networking, interfacing and programming as well as electronics and robotics and be aware of related environmental and societal issues.	
Grade 11 Benchmarks	**Grade 12 Benchmarks**
11.5.1.1 Explore the basics of computer fundamentals, and apply the skills to manage and maintain; diagnose, troubleshoot and solve issues	**12.5.1.1** Identify different types of models used for simulations
11.5.1.2 Demonstrate competencies in computer systems, installations and configuration and the identification of basic electronics components.	**12.5.1.2** Define and analyse electronics components to create designs using specific software.
11.5.1.3 Read, write and modify existing algorithms or code to design and create simple robots	**12.5.1.3** Integrate conceptual knowledge of technology systems in determining practical applications for learning and technical problem-solving.
11.5.1.4 Explore and describe hardware and software troubleshooting principles	**12.5.1.4** Analyse how the physical, informational and bio-related technological systems of the designed world are brought about by the design process.
11.5.1.5 Diagnose and perform basic maintenance and repair hardware and software with appropriate documentation of maintenance and repair problems	**12.5.1.5** Evaluate the critical roles of individuals in the designed world; its processes, products, standards, services, history, future, impacts issues and career connections.

Unit: 2. Computer Software

This unit explores basic concepts that students should comprehend in System and Application Software, Web Design, Algorithm and Programming, Multi-media and Database. Students will be able to confidently display their skills and knowledge in using the Internet and computer software application such as office application and create solutions using Specific Software (Authoring Software) such as Graphics, Designs & Construction, and Security Systems.

Students will classify system and application software, understand Operating Systems and File Management, design and create documents, presentations and Spread sheet.

It is necessary for students to explore and understand the essential knowledge, skills and values in System Software and Application Software which will prepare them for further learning in the next grade.

Content Standard : 5.2 Investigate and analyse computer system and application software, programming, algorithm, web design and databases, and develop and apply the skills and knowledge in the various software.

Grade 11 Benchmarks	Grade 12 Benchmarks
11.5.2.1; Explore and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms and data representation	**12.5.2.1;** Relate and analyse the specifications of computer components to user requirements and produce graphical products using computer aided programs.
11.5.2.2; Analyse problems in computational terms, and have repeated practical experiences of writing computer programs in order to solve such problems.	**12.5.2.2;** Demonstrate an knowledge of the software development process and the creation of graphical products using computer aided programs
11.5.2.3; Evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems.	**12.5.2.3;** Communicate the steps in the development of computer programs and the application of skills in coding and compiling computer programs.
11.5.2.4; Explore and analyse the specific computer applications and appreciate the applications of multimedia and graphics	**12.5.2.4;** Describe the characteristics of client-site scripting and creating interactive menus
11.5.2.5; Design and construct webpages for an intended audience and upload on to the www	**12.5.2.5;** Explain the impact of computing on business, manufacturing, commerce, and society.
11.5.2.6; Apply typing skills with speed and accuracy	

Assessment, Monitoring and Reporting

The relationship between content standards, benchmarks and performance standards is that they all define students' expected levels of proficiency or education quality but at different levels of schooling. Content standards describe the national expectations that all Papua New Guinean children are expected to meet while benchmarks describe the grade-level expectation that all students in a particular grade must meet before proceeding to the next grade. Conversely, performance standards describe the levels of proficiency or quality students should attain to indicate their meeting of grade-level expectations and the national content standards. Effective instruction and assessment are aligned to performance standards, lesson objectives, topic objectives, grade-level expectations, and national content standards.

What is Assessment?

The term "assessment" is generally used to refer to all activities that teachers use to assess students' mastery of what is learned, and to measure and monitor students' progress towards meeting grade-level expectations and the national content standards. Assessment is an on-going process of gathering and interpreting information about students' performance and progress towards meeting grade- level expectations as well as the achievement of the national content standards described in the subject syllabuses. Data should also be used to help and guide students who are yet to meet grade-level and national expectations to make the required progress towards meeting these expectations.

What is Standards-Based Assessment?

In standards-based curriculum, assessment is used to assess students' level of competency or proficiency of a specific knowledge, skill, value, or attitude taught using a set of performance standards (indicators or descriptors) and measuring, monitoring, evaluating, and reporting their progress towards meeting grade and national-level expectations. Assessment is viewed not only as a measurement activity that is performed after a course or a curriculum topic has been taught (summative), but more importantly, as a continuous process (formative) that provides students' performance data to teachers and students regarding their progress towards achieving the intended learning standards. Timely and ongoing assessment of student's learning and mastery of what is learned are key to the learning process and the attainment of the desired learning outcomes.

Throughout the year, teachers will be assessing students' performance and progress towards meeting each grade-level benchmark (grade-level expectation) and each content standard (national-level expectation), and using the data to identify areas where a student or a group of students need more attention, and monitor their progress towards meeting the required standards.

Purpose of Assessment

The primary purpose of assessment is to improve students' learning and teachers' teaching. The other purposes of assessment are to:

- improve students' learning, levels of proficiency, and progress towards meeting the expected standards;
- provide data that teachers, schools, and NDoE can use to make informed decisions about how to improve the quality of teaching and learning in the education system;
- inform teachers about the progress of students towards meeting grade-level and national expectations (standards) and enable them to adjust their lesson planning, instruction, and assessment to improve student learning and proficiency levels;
- inform parents and guardians about their children's achievements and status of progress towards meeting national standards; and what needs to be done to close the gaps and enable children to make the progress required to meet these standards, and
- provide information for schools and systems about teaching strategies, resource allocation and curriculum; and other educational institutions, employers, and the community about the achievements of students in general or of particular students.

Whatever its purpose, assessment is seen as an integral part of the teaching and learning program rather than a separate process.

Types of Assessment

The following types of assessment have been adopted to assess and monitor students' achievement of the education standards.

- Assessment FOR learning
- Assessment OF learning
- Assessment AS learning

Assessment for and assessment of learning are also known as formative and summative assessments.

Assessment For Learning (AFL)

Assessment for learning, also known as classroom assessment, is different. It is an ongoing process that arises out of the interaction between teaching and learning. It is not used to evaluate learning but to help learners learn better. It does so by helping both students and teachers to understand:

- the performance standards, grade-level benchmarks and content standards that students are expected to meet to achieve the desired level of proficiency or level of education quality;
- where each learner is in relation to the national curriculum standards;
- where they need to be, and
- what they need to do to make progress towards meeting the expected standards.

Assessment Of Learning (AOL)

Assessment of learning is the use of a task or an activity to measure, record, and report on a student's level of achievement in regards to specific learning expectations such as unit tests and end of term or year exams. It is normally referred to as Summative Assessment.

Assessment As Learning (AAL)

Assessment as learning is the use of an assessment task or an activity by the teacher in his/her everyday teaching. These strategies provide students with opportunities to understand what they have learnt or are having difficulties with. Self and peer assessments allow students to reflect on their own learning and identify areas of strengths and weaknesses. These tasks offer students the chance to set their own personal goals to improve their own learning.

Diagnostic Assessment

Apart from these three main types of assessment, teachers are expected to do the diagnostic test/assessment to identify strengths and weaknesses in students. This can be done before any teaching and learning of a new content and for new entry levels for students.

Diagnostic assessment is a form of pre-assessment that allows a teacher to determine students' individual strengths, weaknesses, knowledge, and skills prior to instruction. It is primarily used to diagnose student difficulties and to guide curriculum and lesson planning.

Assessment Methods

These are some methods that teachers can use to assess students' performances, products, and processes:

- Observing students during the lesson;
- Conferencing with students;
- Students' Portfolios;
- Tests, and
- Assignments (projects/reports/quizzes/presentations/practical work samples)

Reporting and Recording

Recording

Teachers must keep accurate records of students' performances and achievements. They must report these achievements in fair and accurate ways to parents, guardians, and students. Examples of recording methods include:

- anecdotal notes in a journal or diary;
- checklists;
- portfolios of students' work;
- progressive records, and
- work samples with comments written by the teacher.

Reporting

Reporting is communicating clearly to students, parents, guardians, teachers, and others the information gained from assessing students' learning.

Students' reports should be based on assessment information collected from ongoing assessments. Schools will decide on how best the reports will be presented to suit the needs of their communities. Methods will include interviews and written reports. Written reports should include:

- a written record of progress made towards meeting grade-level expectations and the attainment of content standards by each student since the previous report;
- a written record of each student's learning and mastery problems and what needs to be done to make the required progress towards meeting grade-level benchmarks and national content standards, and
- information about students' attitudes, values and general behaviour.

Monitoring and Evaluation

Assessment information should be used to make judgments about students' achievements and monitor their progress towards meeting grade-level expectations and national content standards.

Monitoring

Data from performance assessment should be used to monitor and report on students' performance towards meeting grade-level and national expectations. Performance standards or indicators should be used to report and keep a tab on each students' progress towards meeting the expected level of proficiency or competency. Teachers should develop a clear and measurable set of performance standards or indicators to monitor and report on students' progress and achievements on a regular basis.

Evaluation

Teachers should use assessment data to evaluate the effectiveness of their teaching and the quality their students' learning, and make improvements to their teaching practices in order to improve student learning outcomes. Evaluation tools such as written records, questionnaires, logs and diaries, submissions or records of meetings and discussion with general staff members, teaching staff, parents, and other community members should be used to evaluate students' and teachers' competency levels, and make informed decisions about how these could be improved.

Glossary

Term	Definition
Absorption	The process of liquid, gas or other substance being taken in
Algorithm	*Algorithm* is a logical sequence of steps for solving a problem, often written out as a flow chart that can be translated into a computer program.
Application	An *application* is any program, or group of programs designed for end-users to perform specific tasks.
Application Software	An *application software* also called *end-user programs* includes such things as word processors, database programs, web browsers and spreadsheets. (See also Application)
Applique	A type of needlework in which small pieces of cloth are sewn or stuck in a pattern onto a large piece
Artificial Intelligence	*Artificial Intelligence* a branch of computer science that develops programs to allow machines to perform functions normally requiring human intelligence
Backup	A copy of computer data that is stored on a second storage device for safe keeping, e.g. a copy stored on an external hard drive.
Bias	The bias of a piece of cloth is an edge cut diagonally across the fabric
Bit	A single binary digit, 0 or 1 that is used to represent data. It is the smallest unit of data.
Byte	The common measure of memory or storage capacity, that is, eight bits makes a byte,.
Circuit breakers	A device that controls the flow of current or it is a device that trips like a switch to open the circuit when overloaded.
Circuits	A path for current flow.
Computer Architecture	Software standards, hardware instructions and technology infrastructure that defines how computer systems, platforms and programs operate.
Computer Interface	The standard by which two or more separate components of a computer system exchange information such as the exchange between software, computer hardware, peripheral devices, humans and/or combinations of these.
Computer Security	The protection of computer systems and information from harm, theft, and unauthorised use. Computer hardware can be protected by the same means used to protect other valuable or sensitive equipment, namely, serial numbers, doors and locks, and alarms.
Computer System	A basic, complete and functional computer, including all the hardware and software required to make it functional for a user. It should have the ability to receive an input, process data, and with the processed data, create information for storage and/or output.
Conductors	Materials that allow electricity to flow through them

Criterion	A property or characteristic by which the quality of something maybe judged. Specifying criteria nominates qualities of interest and utility but does not have anything to offer or make any assumptions about actual quality
Current	The flow of electrons. It is measured in Amperes
Cybercrime	*Cybercrime* is the criminal activities carried out by means of computers or the Internet.
Cyberspace	The notional realm in which electronic information exists or is exchanged.
Data Communication	Data communication is the active process of transporting data from one point to another. Network is the system designed to convey such information.
Data Representation	The manner in which data is expressed symbolically using the binary digits (that is 0 or 1) in a computer.
Database	A self-describing, structured collection of a related set of data, generally stored in a computer system that can easily be accessible in various ways.
Database Software	A software that is primarily designed to create database and to store, manage, analyze, change, search, and retrieve data typically in a structured format.
Dead circuit	A circuit that is isolated from the electrical energy or source
Dead test	A circuit assessment conducted while the circuit is isolated from the source or power supply using a multimeter.
Device Driver	A device driver is a software that allows a device such as a printer, to communicate with the operating system in order to perform the functions of a printer.
Digestive System	The series of organs inside the body that digest food
Electric shock	A reflex response to the passage of electric current through the body in some cases leave exit wounds.
Electrical Energy	The energy made available by the flow of electric charge through a conductor.
Electricity	The flow of electric current.
Electrocution	Death caused by severe internal burns in the body tissues due to electric shock
Embellish	To make something more beautiful by adding decorations to it
Embroidery	Patterns that are sewn into cloth using threads of various colours

Ergonomics	It is the study of how an ICT work environment and the equipment used can be best designed for health, efficiency, safety, and productivity.
Etiquette	The formal rules of correct or polite behaviour in society or among members of a particular profession
Extension lead	An electric cord used to extend the length of a power cord
Facing	A layer of stiff material sewn around the inside of the neck armhole, etc of a piece of clothing to make them stronger
Facings	The collar, cuffs etc of a piece of clothing that are made In a different colour or material
Fastener	A device such as a button or zippers used to close a piece of clothing
Fibre	Part of food that helps to keep a person healthy by keeping the bowels working and moving other food quickly through the body A material such as cloth or rope that is made from a mass of natural or artificial threads
Floor joist	A horizontal structural member that supports and distributes floor loads.
Framing	The wood or steel construction of a building's framework
Garment	A piece of clothing
Installation	The act of setting up electrical circuits or parts or components.
Insulators	Materials that deny or stop current flow.
Light	Luminaires used as load to produce light energy.
Live circuit	A circuit that has current running through it.
Live test	A circuit assessment conducted while the circuit is powered by an electrical energy using a multimeter.
Local Area Network	A local area network covers a small local area such as a home, office, other building, or small group of buildings to share resources such as printers, server, and file sharing. LANs can use wired or wireless (also called Wi-Fi) technologies.
Measuring apparatus	Devices that are used measuring quantities of units.
Metabolism	The chemical processes in living things that change food into energy and materials for growth
Meter box	It is a measuring device that measures voltage supply into house provided by PNG Power upon payments.
Network	The interconnection of two or more computers, terminals, and communications devices linked by wires, cables, or a telecommunications system in order to exchange data or share resources.
Operating System	An Operating System is software that provides an environment for the hardware and software to work together. Examples of OS includes Windows OS, Linux, Ubuntu, Susie and Mac OS.

OSI Model	OSI (Open System Interconnect) is a conceptual model that characterizes how applications communicate over a computer network.
Posture	The position in which you hold your body when standing or sitting
Power	It is the rate of work done. The supply of force of power. It is measured in Watts.
Power tool	A power tool is any machine that uses electricity in order to operate
Privacy	Exclusive legal right that prohibits copying of intellectual property with the permission of the copyright holder.
Programming	Programming is the designing and writing of computer programs in various programming languages
Resistance	The opposition to the current flow. The unit of resistance is Ohms
Robotics	Robotics is the science and technology relating to computer-controlled mechanical devices such as the automated tools commonly found on automobile assembly lines
Seams	A line a long which two edges of cloth, etc are loined or sewn together
Sensory	Connected to your physical senses
Single-phase	This explains domestic installations where there is one live wire in socket outlets.
Software	Software is the set of instructions that a computer requires to perform various tasks, such as managing hardware components and/or creating documents. Software is categorized as system or application.
Source	The part of the circuit that produces electrical energy to power up a circuit.
Standard	Standards are about a definite level of achievement aspired to or attained. Definite levels of quality (or achievement, or performance)
Switch	Device that control the flow of current into a circuit.
Switching circuits	Circuit that are sketched for switch points to control light points.
System Software	Software that controls hardware components, ensuring that the instructions received from a user are correctly interpreted and performed.
TCP/IP	The primary network protocol used on the Internet and was created to provide a network link between computer hardware and software platforms for various computer brands. By standardizing on a single set of protocols, each of which serves a specific function; TCP/IP can be used to create a network, no matter what underlying hardware is used.
Telecommunication	the transmission of encoded sound, pictures, or data over significant distances, using radio signals or electrical or optical lines
Textile	Any type of cloth made by weaving or knitting
Textiles	The industry that makes clothes

Troubleshooting	A problem resolution cycle designed to solve the immediate problem that prevents the computer system/computer network from working, and to provide insights as to the cause of the problem so that it can be avoided or quickly resolved in the future.
Voltage	The force that pushes current to flow around the circuit to reach or power up a load. It is measured in volts
Wireless Communication	A network technology that uses radio waves or infrared light instead of cables or wires to connect computer or other devices.
Wood molding	Wood assemblies curved or angled in various convex or concave shapes used for trim.
Yarn	Thread that has been spun, used for knitting, making cloth etc

References

Curriculum Reform Implementation Project. (2006). Impact study 6: Final report. Faculty of Education, Deakin University, Victoria, Australia.

Curriculum Reform Implementation Project. (2003). Outcome-based planning and programming. National Department of Education, Port Moresby, Papua New Guinea: Government Printery.

Curriculum Reform Implementation Project. (2002). Unit 1: Curriculum reform in lower primary curriculum. National Department of Education, Port Moresby, Papua New Guinea: Government Printery.

Czuba. J (2013) Report of the Taskforce for the Review of Outcomes Based Education, Port Moresby PNG

Norman P, Salley K (2010) Outcomes Edition for PNG- Home Economics Book 1 Grade 9/10, Oxford University Press, Melbourne

Norman P, Salley K (2010) Outcomes Edition for PNG- Home Economics Book 2 Grade 9/10, Oxford University Press, Melbourne

NDoE (2007) Design and Technology Teacher Guide – Lower Secondary

Down J, (1999)Textiles Technology to GCSE, Oxford University Press, New York

Holland S.K, (1987) All about Fabrics, An introduction to Needlecraft, Oxford University Press, New York

Keller.M, et.al (2010), Whole Food 1- Design / Produce / Evaluate, Oxford University Press, Melbourne

Norman P, (1988), Home Economics for PNG 3 Pearson Education, Melbourne

Tull A. (1998) Food Technology to GCSE, Oxford University Press, New York

Heath G, McKenzie H, Tully L (2016) Food Solutions – Food Technology Units 1&2,Cenage Learning Australia, Melbourne

Tull A. (1996) Food and Nutrition, Oxford University Press, New York

Glaister R. (1987) Catering Towards a Career Second Edition, Pearson Education, Melbourne

Rwanda Ministry of Education, (2015),ICT Essentials For Teachers Based on the UNESCO ICT Competency Framework for Teachers

Baker, G and Bowen,(2005) T First Byte: Using Information Technology, 6th edn, McGraw Hill Technology Education, New York.

Dominick, JR, Messere, F and Sherman, B L (2004), Broadcasting, Cable, the Internet, and Beyond: An Introduction to Modern Electronic Media, McGraw Hill, New York.

Hage, S and Cummings, M (2006), Information Systems Essentials, McGraw Hill, New York.

LMC Professional Development Centre(2003), HR Computer Training

Minhas D S (2003) Microsoft Word 2003 Module 1-4, New Dawn Press, New Delhi

Minhas D S (2003) Microsoft Excel 2003 Module 1-4, New Dawn Press, New Delhi

Minhas D S (2003) Microsoft Access 2003 Module 1-4, New Dawn Press, New Delhi

Minhas D S (2003) Microsoft Database 2003 Module 1-4 New Dawn Press, New Delhi

Minhas D S (2003) Microsoft PowerPoint 2003 Module 1-4. New Dawn Press, New Delhi

Long, L and Long, N (2001), Computers 8th edn, Prentice Hall, New Jersey.

O'Leary, T J and O'Leary, L (2005), Computing Essentials, McGraw-Hill Technology Education, New York.

Potts, C et al. (1996), Information Technology, Nelson ITP, South Melbourne.

Sawyer, SC and Williams, BK (2005), Using Information Communication

McGraw-Hill (2003) Technology, Technology Education, New York.

Silberman, M (1996), Active Learning: 101 Strategies to Teach Any Subject, Allyn and Bacon, Boston.

Uren, M et al. 2007, Study on Information Technology: VCE Information Technology Units 1 and 2, John Wiley and Sons Australia Ltd, Milton Queensland.

Ware, CB, Fraser, G and Consult, C 2005, Introducing Computer Studies7-10, Jacaranda Wiley Ltd, Milton Qld.

Jenneson J, (2003) Electrical Principles for Electrical Trades 5th Edition, McGraw Hill, New York