Design and Technology

Years 9-12

Samoa Secondary School Curriculum

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Design and Technology. Years 9-12
Samoa Secondary School Curriculum

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Introduction

Design and technology is one of the most important subjects in the Applied Sciences. It allows children and young people to actively contribute to the creativity, culture, wealth and welfare of themselves, their community and their country. It teaches how to take risks and so become more resourceful, innovative, enterprising and capable. Students develop a critical understanding of the influence of design and technology on daily life and the wider world. Moreover, it provides excellent opportunities for students to develop and apply value judgements of an aesthetic, economic, moral, social, and technical nature both in their own designing and when evaluating the work of others.

In an increasingly technological and difficult world, it is vital that Samoan students develop knowledge and confidence to critically analyse and respond creatively to design challenges. In doing so they are able to meet the requirements of the local and global markets.

In the design and technologies curriculum, students produce excellent designed solutions across a range of technologies settings. Students consider the economic, environmental and social impacts of technological change and how the choice and use of technologies may contribute to a sustainable future.

Students also take into account the ethical, legal, aesthetic and functional factors that inform the design processes.

Scope of the Design Technology Curriculum

The National Curriculum is made up of:

- the Sämoa Curriculum Policy Document, which outlines the framework of underpinning principles and required learning areas; and
- a set of subject curriculum statements which define the learning principles and achievement aims and learning outcomes which all Sämoan schools are required to follow.

The Design and Technology curriculum sets out progressions of skills and knowledge for students in secondary schools in Sämoa. This curriculum statement applies to:

- all secondary schools in Sämoa;
- all students irrespective of gender, ethnicity, belief, ability, social or cultural background;
- Years 9-12 of secondary schooling.

Each school provides programmes of learning, which may be part, or the entire national curriculum, in response to local needs, priorities and resources. The Design and Technology Curriculum Statement provides a basis for teachers to plan programmes for teaching Design and Technology in secondary schools. The learning programmes developed by schools must provide the experiences and opportunities for students to achieve the standards that are included in the national curriculum.

Structure of the Design and Technology Curriculum

The curriculum provides information for teachers, students, parents, families and the wider community, on what students are expected to be able to do in each year of their secondary schooling.

All national subject curriculum statements are organised to show the:

1. General Aims
2. Strands
3. Sub-strands
4. Learning Outcomes

The Design and Technology Curriculum is organised into six strands:

1. Design
2. Drawing
3. Tools
4. Materials
5. Processes
6. Technology

Each strand has specific aims. These aims group progressions of learning outcomes at each year level. This subject is designed to make the most of the potential of workshop subjects to develop and educate students. It brings together the practical skills and craftsmanship as well as developing skills of finding and using information in the related study aspect of the curriculum.

The structure of the Design and Technology Curriculum is illustrated by the diagram below.

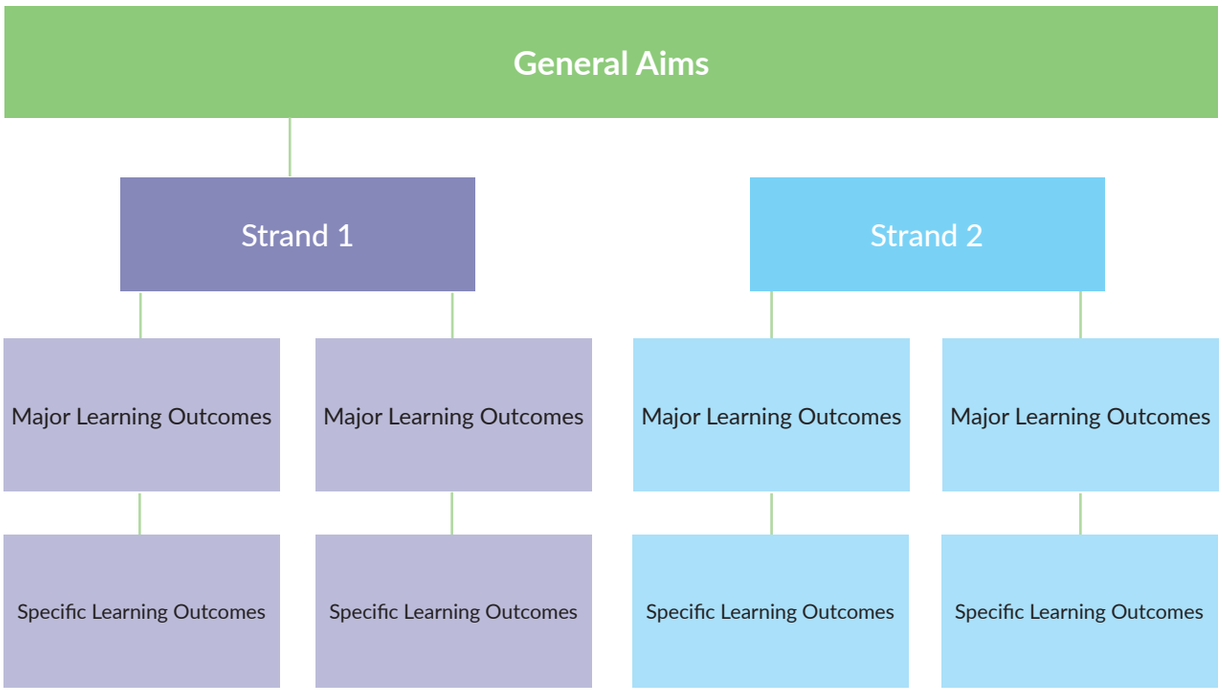

FIGURE 1

The Hierarchy of the Design and Technology Curriculum.

Key Principles

The National Curriculum Framework lists five key principles which underpin all aspects of the Samoan education including the development of the curriculum. They are:

Equity

Equity requires that the system will treat all individuals fairly and justly in the provision of educational opportunities. Policies and practices which advantage some social groups and disadvantage others will be avoided, while those which address existing inequalities in access, treatment and outcome will be promoted.

Quality

Educational quality is exemplified by high standards of academic achievement, cultural understanding and social behaviour, and results from the complex interplay of professional and technical factors, and social cultural practices. Policies promoting these will focus on the learning institutions and specifically on day to day classroom practices including monitoring, assessment and reporting of students outcomes and teaching effective.

Relevance

Relevance in education implies a system which is meaningful, recognised, applicable and useful to one's life. It should enhance individual and community well-being and ultimately national development, including cultural, humanistic and spiritual aspects. Policy decisions will address what is relevant to the individual learner, to the community and nation.

Efficiency

Efficiency in education is demonstrated by leadership and management practices which ensure optimum use of resources (human, financial and material) at all levels, efficient service delivery, effective communication and coordinated and transparent decision making. Policies will reflect the need to be both efficient and effective.

Sustainability

Sustainability requires the wise utilisation of human, financial and material resources, to ensure balanced and continual development in the system. Transparency and accountability are necessary at all levels. The collective values, trust, integrity and a sense of responsibility for the common good in community and national development will be promoted.

Curriculum Principles

This Design and Technology curriculum is based on the Principles of the Sämoa Secondary School Curriculum as stated in the Sämoa Curriculum Policy Document. The Principles are that the curriculum:

- provides a challenge for all students, reflects the need to be inclusive and allows for individual differences;
- fosters and enhances the self-concept of all learners, and encourages them to be self-directed in their learning;
- provides all learners with a broad and balanced general education; will be based on what is best in Sämoan tradition: fa'aSämoa;
- will be responsive to change so that it is relevant to the needs of the individual learner, to the well-being of the community, and ultimately to national development;
- provides for flexibility, taking into account the context in which schools operate and the resources available to them;
- establishes a direction for learning and ensures each learner's school experience progresses in a systematic and coherent way.

General Aims

The curriculum has been designed to meet the changing needs of technical education. The emphasis is on exploration and problem solving within the technical environment rather than just on training in the performance of a set of tasks. As a result the accent is on enabling the learners to develop an understanding of materials and the processes used to work them rather than the learning of set content.

The aim is to have learners engaged in the whole range of technical production activities from designing items through to producing and displaying them.

The Design and make approach that is fundamental to this curriculum:

- challenges students to search for individual solutions and to think creatively in the pursuit of satisfactory solutions to practical problems;
- involves students finding and recording relevant information about methods of construction and suitability of materials and processes;
- requires students to make practical decisions about the making and finishing of their project; and
- requires students to make their design solution to a practical problem and involves students in the critical appraisal of their work by evaluation of the finished project.

Strands and Major Learning Outcomes

The major learning outcomes related to each of the six strands provide and review of the expected learning in each strand.

From their study and practice of **DESIGN**, students will:

- understand and use the design process;
- analyse and explain the decisions in the products designed and developed by themselves and others;
- apply imagination and creativity to solve practical problems.

From their study and practice of **DRAWING** students will:

- develop the ability to communicate in graphic and verbal forms.

From their study and use of **TOOLS** students will:

- gain knowledge about the safe use and care of tools used in the workshop;
- set a good personal example in safe practice and attitudes.

From their study and use of **MATERIALS** students will:

- study and use a variety of materials that can be safely used in a school workshop with an emphasis on wood and metal;
- understand the working qualities of materials, their sources and production.

From their study and practice of **PROCESSES** students will:

- gain knowledge and understanding of the processes used when working with materials and tools in the workshop;
- understand and demonstrate good trade practice and take pride in their work.

From their study and use of **TECHNOLOGY** students will:

- understand the nature of technology and its effects on people and life around them.

Language and Communication Learning Outcomes

The language and communication learning outcomes highlighted in this curriculum statement are based on the types of texts students are required to understand and produce during a year's programme in Design and Technology. Although the achievement objectives are subject related, they are linked to language and communication skills being developed through the Sämoan Language Curriculum and English Language Curriculum. They are highlighted here because in addition to language being developed during Sämoan and English classes, there is a very real need for subject teachers to give attention to the language requirements of their subjects. Guidelines for teaching the language of different types of texts are included in the teachers' manuals.

The learning outcomes are organised under two broad strands: **Oral Language Communication and Written Language Communication.** The achievement objectives for each year level are determined by the content objectives of all the other strands. Students should achieve these objectives through the learning activities undertaken for the other strands in the year level.

Learning programmes therefore should have these features:

- a planned integration of content and language learning in interesting contexts;
- the provision of opportunities for students to use language for both social and academic purposes;
- a balanced use of listening and speaking, reading and writing, viewing and presenting through a range of activities that promote learning and the skills of communication;
- focused instruction on language structures found in Design and Technolgy from word forms and meanings, to sentence patterns and the way information or ideas are grouped and connected into longer texts;
- opportunities in learning activities for students to interact with others in both Sämoan and English;
- frequent opportunities for meaningful interaction between teachers and students in Sämoan and English;
- teachers providing good models of language use and a balanced use of Sämoan and English separately.

Approaches to Teaching and Learning

The National Curriculum is aimed at enabling students to learn. Learning is a process by which new understandings are constructed. Students learn best when they take action themselves to generate and create meaning and apply the new knowledge in meaningful situations.

Teaching practices must aim for effective learning. Students are more likely to be engaged in effective learning if teachers use interactive activities such as discussion, investigation and reflection, problem solving and peer work. These types of activities help students to think deeply about the content they are learning.

Assessment and Evaluation

Assessment is the process of gathering meaningful information to make judgements on aspects of the learning cycle such as learners' performance against the achievement objectives and the quality and effectiveness of learning programmes. Assessment and evaluation of Design and Technology teaching and learning must reflect the principles in the Sämoa Secondary School Curriculum Overview Document.

The National Curriculum recognises the relationship between the principles and purposes of the curriculum and methods of assessment. Assessment methods are an important factor in influencing and constraining teaching methods. The learning outcomes that are assessed are seen as important. The way assessment is conducted emphasises the need to gain the skills that are assessed. Written examinations focus on a narrow and selected range of knowledge and skills that can be assessed in written forms. The domination of assessment by pen and paper examinations legitimises the focus on a narrow range of skills and as a result confirms a range of teaching methods.

It is important therefore that:

- a range of assessment procedures is used to provide useful information on students' progress against the achievement objectives stated in the curriculum;
- skills and knowledge such as independent inquiry, oral language and many practical skills are assessed. These are not easily assessed by examination and need assessment through school based activities;
- assessment and evaluation is ongoing and helps to improve the ways in which Design and Technology programmes are meeting the students' needs;
- where appropriate, families and communities are involved as participants in the assessment and evaluation process;
- students are involved in the assessment of their own progress in learning.

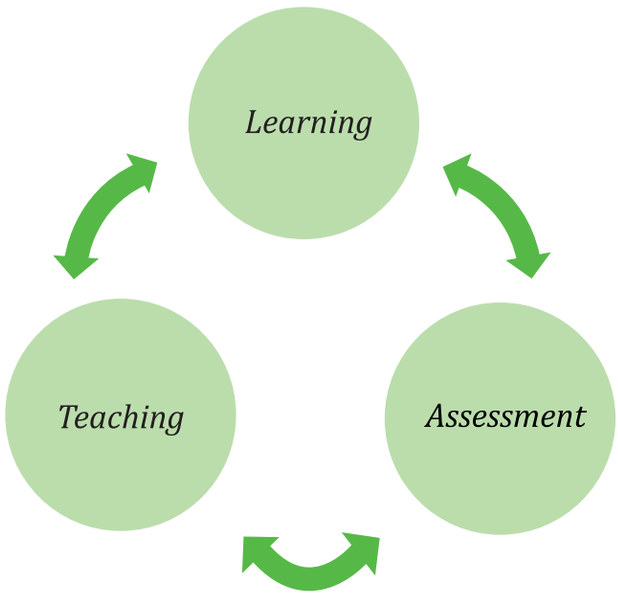

FIGURE 2

Learning-teaching-assessment cycle.

There are three purposes of assessment:

1. Assessment for learning

2. Assessment as learning

3. Assessment of learning

Assessment *for* learning

Assessment of individual learners' progress is, above all, diagnostic and informative. The purpose of such assessment is to improve teaching and learning by diagnosing learning strengths and weaknesses before teaching and learning commences, and then measuring learners' progress against defined learning outcomes, and reviewing the effectiveness of teaching programmes. The information which teachers record from these assessments enables clear profiles of individual learners' achievement to be built. These profiles are used to inform teachers about each learner's learning and development, and to provide the basis for feedback to learners and parents.

Assessment for learning is based on a variety of student activities. These include: questioning of and by students; class exercises and activities involving individual and group work; products created by learners; projects and portfolios; teacher observations of learner performance; discussion; student self-assessment and peer assessment.

Activities such as these give teachers the opportunity to give verbal or written feedback to each student. The feedback is constructive and encouraging, and aims to build confidence. It is mainly descriptive, emphasising strengths and challenges. The information also gives teachers the opportunity to adjust their own teaching to ensure students' learning is proceeding satisfactorily. No grades or scores are given.

Assessment *as* learning

A learning outcomes approach to teaching and learning requires constant classroom assessment of learner progress for each clearly defined outcome, and constant feedback to learners and parents. Assessment should be positive and encouraging and help learners understand how to improve. Assessment is only meaningful when there is a clear sense of purpose and anticipated outcome – known to both the learner and the teacher.

Students have some ownership of, and take responsibility for, their learning because they know in advance what is expected of them – what the learning goals are, and how achievement of the goals is going to be measured. Assessment tasks are explicitly linked to the curriculum and classroom programme.

Assessment *of* learning

Assessment of learning is summative. It takes place at the end of a learning unit and is usually accompanied by a grade or score. It tells the student, parents and the teacher how achievement compares with the expected outcome.

Essential Skills

Essential skills are the broad skills that should be developed and acquired throughout the years of schooling. Such skills involve, but not limited to:

i. Communicating effectively and articulately
ii. Problem solving
iii. Using aesthetic judgement or visual aids or arts
iv. Social and cultural skills and attributes
v. Work and study skills
vi. Integrating knowledge
vii. Using technology effectively

In Secondary Design and Technology, the broad skills are developed and applied in various ways as the learning progresses throughout the years of schooling at all levels.

Students experience success in learning design technology when learning programmes provide opportunities for them to build on their current knowledge and to develop essential skills as they investigate and explore design technology briefs.

Designing Processes

Designing in technology is purposeful, systematic and creative, with many possible solutions. While it is recognised that students' prior learning has equipped them with an ability to identify, manage and resolve problems, a four-part designing model: investigating, designing, producing and evaluating, is provided as a model that can be used.

Design and Technology involves working within Design Briefs or requirements to satisfy human needs and wants for a client or customer. It is an interactive decision-making process involving thinking, investigating, creating and devising with continuous evaluation and often, modification as a result of this evaluation.

Investigating

Investigating can include activities such as:

- specifying plans and purposes from a need analysis and identifying tasks;
- establishing outcomes;
- researching, analysing and communicating information;
- searching for solutions;
- critical analysis of a product's structural characteristics.

Designing

Designing can include activities such as:

- devising flexible, imaginative, innovative and enterprising outcomes;
- preparing sketches, concept drawings and working drawings;
- testing, modifying and validating ideas;
- selecting appropriate solutions.

Producing

Producing can include activities such as:

- making articles to chosen standards and specifications;
- developing skills and applying them to new situations;
- controlling quality, reliability, safety and cost;
- devising and using procedures, processes or sequences;
- working alone or collaboratively;
- using resources, equipment or materials.

Evaluating

Evaluating can include activities such as:

- evaluating how well the requirements of the design brief have been met;
- redeveloping or improving plans, ideas or procedures;
- preparing reports on outcomes;
- considering personal achievement and learning against criteria;
- involving other people in the evaluation process;
- communicating with people about outcomes and expectations;
- critiquing outcomes of prototypes against similar retail products;
- taking action based on what has been learned.

Design and Technology is the means by which people turn ideas into reality. It involves the application of knowledge and processes to develop systems and products that solve problems and extend human capabilities.

The power of ideas, innovation and enterprise are central to the design and development of a sustainable, socially responsible and preferred future.

Design and Technology seeks to empower and energise learners to participate actively in:

- creating opportunities for innovation;
- fostering the power of ideas;
- recognizing and capitalizing on opportunities;
- designing solutions to respond to and meet human needs;
- enhancing practical knowledge and capabilities;
- critiquing past, present and emerging technologies;
- developing appropriate products;
- evaluating and embedding values for environmental sustainability.

Design and Technology is about generating ideas to solve problems that result in a product.

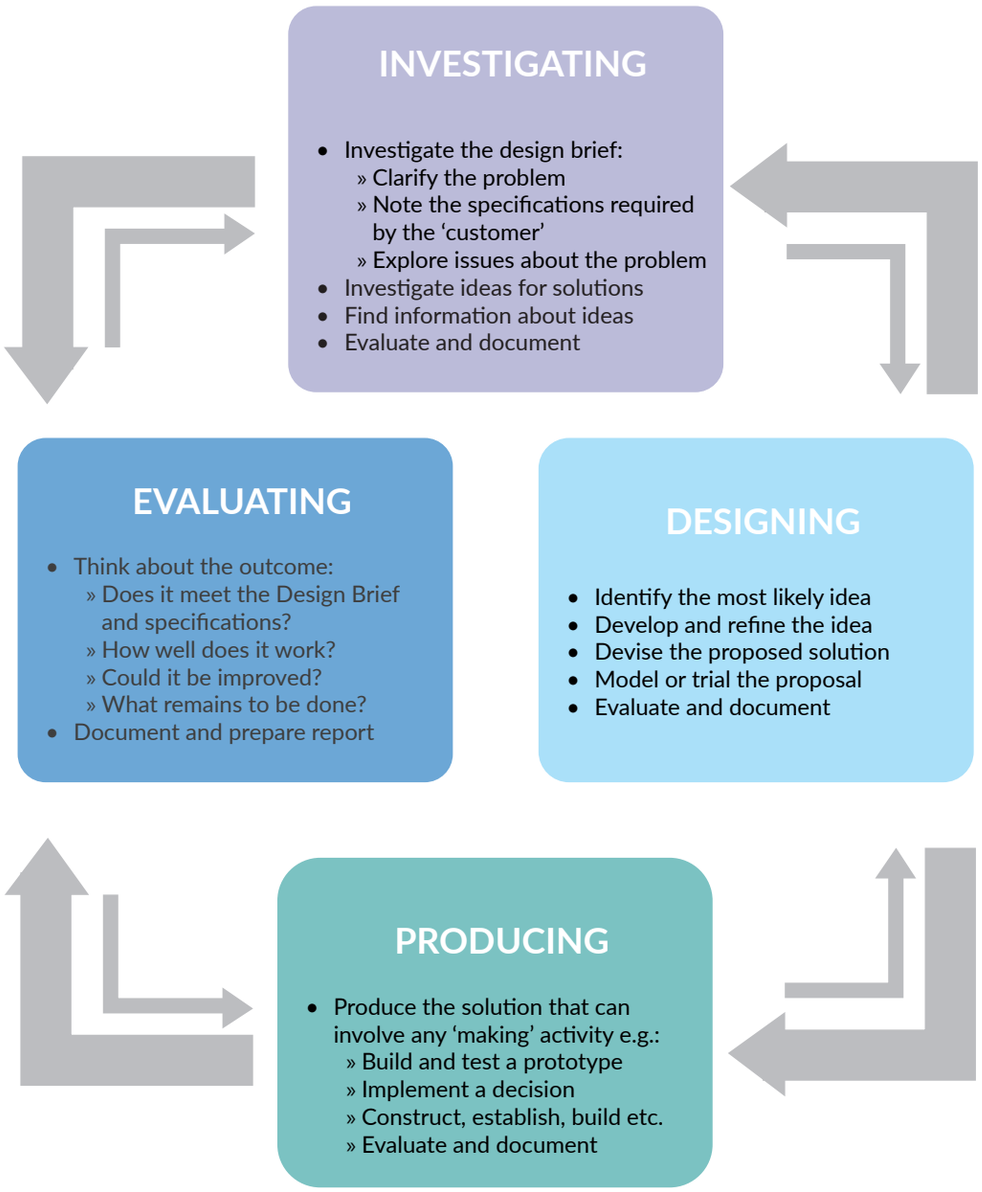

FIGURE 3

The Designing Process

The large arrows indicate the main direction of activities in the process. The small arrows indicate the usual and expected movement backwards and forwards between the stages.

Note: At Year 12 the 2 Stages of Investigating and Designing are combined into one stage called Designing.

Students who do well in Technology will be observant of the world in which they live. They will see the 'made' world. They will see examples of good design, good workmanship, clever use of available materials, but they will also see poor design, poor workmanship and poor use of materials. They will see products as a response to a need. The need may be quite basic or it might be quite complex. It might serve a personal need or it might serve a need expressed by others - family or community.

Students learn to use, manage, assess and understand technology. They will recognise their social responsibility for the resources and materials being used including recycling, waste disposal and effects on the environment. A technologically literate student is empowered to interact with innovations and ideas developed through other disciplines. This is achieved through the ability to reflect and make informed judgements, the enhancement of manipulative skills and the ability to realise designs through applied problem-solving.

Language Learning

The language associated with learning in subject areas is often abstract and demanding for any learner. Learning is even more complex for students who must learn through the medium of their second language, English. Second language learners of English are required to develop their English language for school learning at the same time as learning the subject content. They are expected to use English to reason through to conclusions, read and understand expository texts, develop arguments, analyse, synthesise and evaluate ideas. Furthermore, they are assessed in English on how well they express themselves either orally or in writing. Students who learn English as their second language may take at least 5 to 7 years to develop English language skills for academic learning compared to their peers for whom English is the first language.

Language Across Subject Areas

Language functions refer to the purposes for which language is being used. For example, language can be used to express and respond to greetings, give reasons, give instructions, ask for help and so on. There are a number of language functions necessary for understanding content across the curriculum. A lot of language functions are common to all subjects. For example, whether students are learning about soil erosion in Agricultural Science or food spoilage in Food and Textiles Technology, central to both topics is the concept of cause and effect and the language function involved is expressing cause and effect. The words and sentence structures used to express the same language function e.g., cause and effect will be the same in different subjects.

The table below lists language functions as required in the achievement objectives within and across the applied subject areas.

Language Functions	Agricultural Science	Food and Textiles	Business Studies	Design & Technology
Defining	✓	✓	✓	✓
Expressing cause and effect	✓	✓	✓	✓
Classifying	✓	✓	✓	✓
Describing: features, behaviours, properties, functions, roles	✓	✓	✓	✓
Comparing and contrasting	✓	✓	✓	✓
Giving reasons	✓	✓	✓	✓
Giving instructions	✓	✓	✓	✓
Asking questions as in interviews	✓	✓	✓	✓
Describing change	✓	✓	✓	✓
Explain how a natural process, a mechanical process etc.	✓	✓	✓	✓
Stating principles	✓		✓	
Expressing relative importance	✓	✓		
Making a judgment	✓	✓	✓	✓
Explain why e.g., a phenomenon	✓		✓	✓
Giving examples	✓	✓	✓	✓
Expressing conclusions	✓	✓	✓	
Expressing requirements	✓	✓	✓	✓
Predicting	✓	✓	✓	
Hypothesising	✓	✓	✓	

TABLE 1
Language functions as required in the achievement objectives within and across the applied subject areas.

The curriculum statements require students to be able to understand and produce oral and written texts such as: descriptions; explanations; reports e.g., of field trips, experiments, investigations or research summaries; recipes; design briefs; instructions; arguments.

The production of these texts requires students to be able to use one or a number of language functions as outlined in the table above. For example, to produce an explanation of a process such as photosynthesis, students will need to be able to use language to define, express cause and effect, describe change and classify.

All students must develop the language associated with learning in Design and Technology. Teachers in all subject areas are teachers of language. In practice it requires Design and Technology classroom programmes to have specific language objectives. The language that students will need in order to understand and talk about content and to participate effectively in learning activities in Design and Technology should be identified and taught together with the appropriate content. In this way, language is developed in relevant and meaningful contexts.

Communication Skills

Communication skills are essential for all students to develop. Students need to be able to interpret and critically evaluate information that is received either by listening, reading or viewing. They also need to be able to communicate clearly, confidently and appropriately through speaking and writing and through other forms of communication and technologies. The development of these skills needs to be supported in all areas of the curriculum. Like language skills, communication skills required in the achievement objectives need to be identified and taught together with the appropriate content.

Learning Programs in Design Technology

Projects

Technology is about generating ideas to solve problems that results in a product. The product may be new or the product may be in need of repair.

To develop skills in making or repairing products teachers will be required to design teaching programmes that will give students an opportunity to be trained in the required skills. The skills that need to be developed relate to the design process. These are:

- Skills of investigation;
- Skills of designing solutions to problems;
- Skills of producing (or repairing) products;
- Skills in evaluating products (their own or of others).

The skills can be seen firstly as Technical Skills relating to the materials, tools to be used and the associated processes or procedures. These skills relate to the Producing (or Making) stage. This could be called the applied learning stage.

Secondly the skills associated with the designing process need to be developed - Design Skills relating to Investigating, Designing and Evaluating, the thinking stage.

Completed projects designed and specified by the teacher (or the student) are the main tangible outcomes for the students and the projects also provide the planning structure for teachers.

In years 9 and 10, the projects are mainly developed and designed by the teachers. In years 11 and 12 the students have an increasing role in their development. The projects then become the framework for the construction of the annual teaching program. The projects need to meet several important teaching requirements:

- the projects connect the intended learning to a real context or problem to be solved;
- the projects enable particular skills to be developed in a deliberate and planned way;
- the projects integrate the Design and Technology Strands;
- students can readily communicate their ‘project’ learning in oral and written form;
- teachers can conduct skills training les-

sons that are required for the students to complete the project. Such training will also include skills of investigating, devising and evaluating as well as technical or making skills.

At the centre of this course is the Design Brief which brings together the skills and the learning from all the strands. The Design Brief is a short paragraph describing the problem to be solved and establishing the need for the product and then setting out the specifications within which the product is to be developed.

The specifications will challenge the student's skills of: Investigation, Devising, Production (or making), and Evaluation. Therefore, in planning an annual teaching programme, the projects will be carefully selected by the teacher across the 4 terms to develop skills in a progressive and planned way integrating the strands. Sometimes two strands will be used, sometimes three, but eventually all strands and achievement objectives will be covered over the annual programme.

As students reach higher grade levels there will be increasing opportunity to undertake more complex projects and to design their own. In many cases they will work collaboratively in 'industry teams' mirroring what might happen in the work place. As projects become more complex, cost may become a factor and students may develop models or prototypes and only develop certain components of the final product to full size to demonstrate their making skills and keep costs to a minimum.

The programme-planning task for the teacher is to design interesting projects, analyse the skills required to complete the project and specify what achievement objectives will be covered. This can be an interesting and challenging course developed by creative teachers using available resources.

There will never be sufficient time to teach all the technical skills required for every possible trade or occupation that might be needed in a lifetime. But this course can teach students a Design Process that will enable them to think through problems. This skill will last a lifetime.

Inclusive Education

Inclusive education is a process whereby the school systems, strategic plans and policies adapt and change to include teaching strategies for a wider, more diverse range of children and their families. Inclusive education means to identify a child's learning style and adapt the classroom and teaching strategies to ensure high-quality learning outcomes for all members of the class. Everyone is important, unique and valued for their contribution to the school.

Students who are gifted in one or more areas also have educational needs. For these students, it is important that programmes are provided that extend their abilities and assist them to develop their intellectual, artistic or other talents to their fullest potential.

Gender

The Sämoa Secondary School Curriculum Overview Document requires education to be gender-inclusive. This means students should notbe excluded from developing good self-esteem or from participating fully and successfully in learning because of narrow gender stereotypes.

Materials used with this curriculum must give learners the opportunities to understand how men and women and girls and boys can have a wide range of occupations, tasks and responsibilities. Materials must also use gender- neutral language where possible.

School programmes and classroom learning tasks should reflect the diversity of roles available to women and men and girls and boys.Teachers need to ensure that gender is not an obstacle to learning, success, or individual value. To ensure this, Design and Technology programmes will:

- include the interests, perspectives and contributions of both females and males in

programme content, resources and methods of teaching;

- ensure both females and males use Design and Technology equipment and take part in investigations and practical work;
- ensure both females and males take active and valued leadership roles in activities;
- ensure females and males have equitable access to resources (including teachers' time), learning assistance and technological equipment.

Time Allocation

The following time allocation should only be taken as a guide. It is based on the assumption that a school year consists of 40 teaching weeks.

Strands	Recommended Time Allocation (40 Weeks)
Design	6 weeks
Drawing	5 weeks
Tools	5 weeks
Materials	5 weeks
Process	6 weeks
Technology	3 weeks
Oral Communication	5 weeks
Written Communication	5 weeks

Strands, Aims and Learning Outcomes by Levels

for Years 9 - 12

STRAND 1: DESIGN

AIM: The Design Process - learning how designers and technologists work.

MAJOR LEARNING OUTCOME: from the study and practice of DESIGN students will learn and use the design process.

NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

YEAR 9	YEAR 10	YEAR 11	YEAR 12
Students will be able to:			
• Explain the process of design. • Identify the parts which make up a design brief and work through the design. • Use open and closed design specifications. • Develop sound investigation skills.	• Explain the importance and role of specifications in the development of products. • Use specifications in the development of a design brief. • Interpret problems and understand specifications developed from a problem. • Develop a range of design skills that demonstrates appropriate use of available materials and equipment. • Develop a design brief from client or customer. • Develop an understanding of the constraints (closed specifications) placed upon designers by the client or customers.	• Write a statement from a perceived need or situation. • Resolve competing choices of materials, processes and equipment. • Effectively communicate their design thinking and product proposals. • Competently explain the purpose and construction of design briefs.	• Specify criteria for plans and purposes relating to problems or tasks. • Identify criteria for evaluation of product outcomes. • Undertake research and communicate ideas. • Prepare sketches/working drawings/action plans. • Test, modify and confirm ideas. • Select an appropriate solution.

STRAND 1: DESIGN

AIM: Design Evaluation - the thinking part of Design Technology.

MAJOR LEARNING OUTCOME: from the study and practice of DESIGN students will analyse and explain the design decisions in products developed by themselves and others.

NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

Students will be able to:

YEAR 9	YEAR 10	YEAR 11	YEAR 12
• Compare their own design. • Defend the choices made of equipment, materials and processes.	• Reflect on each stage of the design process. • Develop and use a range of perspectives from which to critique products, processes and systems. • Investigate the problems in depth giving consideration to the elements of design, including form, function and fitness purpose. • Explain the decisions and choices made in the design and manufacture of products made by themselves and others.	• Confidently evaluate a product outcome in relation to the design specifications. • Evaluate the strengths and weaknesses of products from different perspectives including safety, health, aesthetics, environment, cost and appropriate use of resources.	• Review criteria and standards - reliability; safety; quality; cost effectiveness. • Suggest improvements to the outcome by analysing: » plans designed; » option chosen; » procedures used; » use of materials; » cost effectiveness; • Prepare reports on the analysis - oral and written.

STRAND 1: DESIGN

AIM: Applying the mind - using skills and imagination to solve problems leading to solutions.

MAJOR LEARNING OUTCOME: from the study and practice of DESIGN students will apply imagination and creativity to solve practical problems.

NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

Students will be able to:

YEAR 9	YEAR 10	YEAR 11	YEAR 12
• Develop thorough planning and good management skills. • Apply the design process to the solving of practical problems. • Explain the need to adapt to changing situations or changes in materials or equipment.	• Adopt a safe and responsible working practice toward themselves and others in the manufacture and development of their product. • Identify personal weaknesses in skills acquisition and knowledge and seek to address those weaknesses. • Creatively interpret a design brief and work confidently through the design process. • Accept a need to be flexible and change ideas and approaches in response to changing situations. • Work cooperatively in teams to resolve problems in the development or evaluation of products. • Work independently from a design brief. • Test products using prototypes and models. • Recognise there are many solutions to any design brief.	• Explain and accept the need to work within required rules and procedures in the work place. • Initiate a design brief from a perceived need or situation. • Investigate a range of solutions thoroughly. • Defend their own products or solution to a problem by reference to their decisions and constraints.	• Manage and control quality, reliability, safety and cost. • Undertake appropriate maintenance of equipment. • Apply principles and concepts in new situations. • Work alone and collaboratively. • Implement solutions or plans. • Use resources, equipment and materials appropriately.

STRAND 2: DRAWING

MAJOR LEARNING OUTCOME

From the study and practice of DRAWING students will develop the ability to communicate in graphic and verbal forms.
NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

YEAR 9	YEAR 10	YEAR 11	YEAR 12
Students will be able to:			
• Develop the ability to sketch as a basic communication tool. • Demonstrate a knowledge of basic technical drawing techniques *e.g., orthographic 3rd angle projection, isometric projection, oblique projection.* • Apply standard practice when using lines, lettering and scales.	• Produce a range of concept sketches that record their thinking in a pictorial form. • Draw formal instrumental drawings and dimension them correctly. • Demonstrate knowledge and understanding of the construction of regular polygons, similar figures and figures of equal area. • Complete full working drawings including construction details of their finished design solution. • Read and interpret plans and working drawings. • Apply standard practice when using of geometrical construction, divisions of lines, arcs and bisecting.	• Compile a set of sketches which record the "working-up" of their design solution to the problem. • Produce full working drawings of their design solution and a rendered (coloured) pictorial sketch if required. • Apply the principles of intersection to solve problems involving simple geometrical solids with axis lying on one plane - prisms; cylinders. • Understand procedures for solving problems on intersecting solids: axis inclined to each other and axis offset. • Name parts and constructs from given information the following geometrical solids: cube, regular prisms, regular pyramids, cylinders, cones, spheres. • Determine magnitude of forces and their point of application graphically.	• Apply principles of technical graphics to the solution. • Identify types and determine the magnitude forces acting on a beam. • Construct and produce a helix as a focus on a right cylinder. • Produce orthographic views of engineering components working from: pictorial drawing/ orthographic drawing. • Apply procedures of projecting: true length of lines, true angle of inclination to principal planes, traces of lines and planes, true shape of planes. • Apply isometric drawing, cabinet oblique, perspective two-point. • Apply helix curve to the projection of screw threads and helical springs: threads single, two and three start, springs - round, square, pitch and lead. • Produce accurate assembly of orthographic drawings of simple engineering parts and components. • Produce general assembly orthographic drawings of simple engineering products from detail drawings. • Demonstrate the use of radial and triangulation techniques of development.

STRAND 3: TOOLS

MAJOR LEARNING OUTCOME

From the study and use of TOOLS students will gain knowledge of the safe use and care of tools used in the workshop.
NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

YEAR 9	YEAR 10	YEAR 11	YEAR 12
Students will be able to:			
• Identify and use the basic hand tools in the school workshop. Name their parts and understand their functions. • Adjust the setting of the blades, stops and guides and replace blades on bench tools as required.	• Recognize the need for and function of specialist hand tools and use them appropriately *e.g., bench shears, pop riveters, shoulder plane.* • Maintain hand tools in a safe working condition. • Utilize power and battery-operated tools in a safe and appropriate manner. • Maintain and sharpen edge tools and be able to change belts, blades and bits when required.	• Use approved wood-working and metal-working machinery confidently under teacher supervision. • Maintain machine tools in a safe and responsible way and keep safety guards operational.	• Explain why proper storage of tools and equipment is important, *e.g., secure storage for dangerous materials, appropriate waste disposal and appropriate storage of raw materials.* • Identify, use, storage and maintenance of hand tools, portable power tools. • Demonstrate correct procedures when using tools.

MAJOR LEARNING OUTCOME

From the study and use of TOOLS students will set a good personal example in safe practice and attitudes.
NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

• Explain the need for safety in the workshop and the value of a clean working environment. • Move safely around the workshop and show concern for the safety of others in the work place. • Describe the need for safe practice and procedures in the workshop.	• Demonstrate a safety consciousness and concern for others in the work place. • Dress and work safely and adopt safe practices without direction. • Conform to safety standards at all times. Use guards and dress appropriately for the workshop. • Act responsibly and never alone. Check electrical leads for wear and avoid using power tools in wet areas.	• Avoid using machines in a dangerous and unsafe way and understand the limitations of each. • Act responsibly and avoid taking risks while operating machine tools.	• Safely use and maintain common wood-working machinery: Table saw; Thicknesser/planer; Morticer; Drill press; Grinder; Lathe. • Demonstrate: » safe handling of power and hand tools; » general workshop safety; » care and maintenance of tools and equipment.

STRAND 4: MATERIALS

MAJOR LEARNING OUTCOME

From the study and use of MATERIALS students will study and use a variety of materials that can be safely used in a school workshop with an emphasis on wood and metal.
NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

Students will be able to:

YEAR 9	YEAR 10	YEAR 11	YEAR 12
• Identify a range of materials commonly used in the school workshop and be able to evaluate the properties of each *e.g., hardness, texture, grain.* • Explain the growth process of a tree and classify timbers into hardwoods and softwoods.	• Explain the nature of materials, their characteristics and suitability for the task in hand. • Identify common species of trees both growing and, when milled, explore the conversion process and use the correct terms associated with the grading of timber products. • Investigate the properties of hardwoods and softwoods, solid timber, wood products and make informed decisions about the material best suited for their project. • Describe the need for timber treatment and the treatment process and be familiar with the technical terms associated with the grading of treated timber products.	• Consider the merits of using alternative materials when working up a design solution. • Select and apply the finish best suited to preserve or enhance the finished product.	• Identify and use fasteners such as: » glue, nails, screws, staples; » bolts and nuts; » dowels, sinnets; » traditional local types of fastenings; » cabinet fittings; » types of hinges; • Determine the cost and quantity of materials. • Explain the processes of construction of types of manufactured materials *e.g., veneers, particle board, chip board, plywood, pinboard, weatherboard.*

STRAND 4: MATERIALS

MAJOR LEARNING OUTCOME

From the study and use of MATERIALS students will understand the working qualities of materials, their sources and production.

NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

Students will be able to:

YEAR 9	YEAR 10	YEAR 11	YEAR 12
• Describe the basic properties of metals and be able to classify ferrous and nonferrous metals.	• Identify the most common metals in use and understand the production process of each. • Explain what factors determine the nature of metals, and be familiar with the technical term associated with the processes and working properties of metals.	• Shape, form, cast, mould, temper and anneal metal components required in the manufacture of their projects. • Choose and apply the right surface finish or protective coating to enhance and protect the finished metal work products.	• Explain: » the nature, quality and use of materials; » the characteristics of hardwood, softwood; » moisture content; » seasoning of timber; » preservation and timber treatment. • Identify and explain properties of materials including: » stress and strain; » fatigue; » durability and strength.

STRAND 5: PROCESSES

MAJOR LEARNING OUTCOME

From the study and use of PROCESSES students will gain knowledge and understanding of the processes used when working with materials and tools in the workshop.

NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

Students will be able to:

YEAR 9	YEAR 10	YEAR 11	YEAR 12
• Prepare material, measure accurately and set out work. • Cut material accurately to size and or shape.	• Demonstrate the correct construction or fabrication techniques and use the appropriate technical terms. • Select and dress material, check measurements and cut accurately to size. • Set out and check all measurements, cut and prepare the material competently so as to reduce waste and conserve resources. • Select the appropriate method for joining or fabricating the work in progress and prepare accordingly.	• Match material for joinery and prepare it for size; set out and cut joints ready for assembling. • Check all components for accuracy and fit before assembling the work.	• Read and interpret engineering drawings, standards and conventional representations of engineering components and fastenings. • Apply and understand the use of appropriate development practices such as layout development and roll out development. • Solve simple problems on the intersection of common geometrical solids such as pyramids, cones, fillet curves. • Demonstrate the application of the principles of intersection to solve related problems. • Apply principles for solving area reduction and enlargement problems. • Solve problems on the intersection of geometric solids to include cones, spheres and axis in various arrangements. • Construct solutions to problems involving plane figures reduced or enlarged to specified area ratios. • Apply the use of appropriate wood finishes such as sanding; wood filling; edging; painting; varnishing; oiling. • Identify the types of joints to use and be aware of steps in making the joints. • Apply appropriate methods: planing, cutting, testing for squareness, levelling (square and flat). • Plan the order and execution of a project. Describe procedures and systems for construction and use of standard procedures. • Describe procedures and systems for construction and use of standard procedures.

STRAND 5: PROCESSES

MAJOR LEARNING OUTCOME

From the study and use of PROCESSES students will understand and demonstrate good trade practice and take a pride in work well done.
NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

Students will be able to:

YEAR 9	YEAR 10	YEAR 11	YEAR 12
• Dress or finish material and assemble using the correct glue or other accepted techniques. • Clean up and prepare work for applying surface finishes.	• Set out work using the conventional methods such as facemasks and centre lines. • Prepare and cut joints or set out and drill tap for fastenings with accuracy. • Demonstrate the practical skills of craftsmanship. • Appreciate the need for care and attention to detail in the making and finishing of craft work. • Complete a compulsory (8 week) Study Unit in Building Construction.	• Avoid surface damage check work for squareness and brace accordingly. • Appreciate good craft skills and display a thorough understanding of good trade practice. • Demonstrate a knowledge of alternative finishes or coatings and be able to apply them successfully. • Complete a compulsory (8 week) Unit Study – topic optional.	• Apply skills appropriately to new situations: » Manage and control quality, reliability, safety and cost; » Undertake appropriate maintenance of equipment; » Apply principles and concepts in new situations; » Work alone and collaboratively; » Implement solutions or plans; » Use resources, equipment and or materials appropriately; • Explain: » Properties of materials; » Principles of assembly; » Basic industry standards; » Basic wood procedures; • Construct accurately to stated proportions and dimensions - woodworking joints used in stool and carcase constructions.

STRAND 6: TECHNOLOGY

MAJOR LEARNING OUTCOME

From the study and use of TECHNOLOGY students will understand the nature of Technology and its effects on the lives of people.

NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

YEAR 9	YEAR 10	YEAR 11	YEAR 12
Students will be able to:			
• Explain the place of technology and the part it plays in our everyday lives. • Describe the helpful and harmful effects of technology.	• Investigate the changes that technology brings to Samoan culture.	• Actively participate in a study on the effects of technology in the workplace. • Identify the place that both design and technology play in the development of crafts and in industry.	• Recognise environmental concerns and forest management issues such as: felling, re-afforestation, advantages/disadvantages of certain types of timber. • Consider the implications and consequences of the solution at a personal, local and global level. • Reflect on personal achievement. • Seek other evaluative feedback in relation to expectations of the design brief.

ORAL COMMUNICATION

MAJOR LEARNING OUTCOME

In their study of DESIGN AND TECHNOLOGY students will be able to participate effectively through developing oral communication skills.
NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

YEAR 9	YEAR 10	YEAR 11	YEAR 12
Students will be able to:			
• Express ideas appropriately in various group activities *e.g., discussions, planning.* • Use language to ask and respond to questions, instruction. • Give brief explanations, descriptions and comparisons. • Give a brief oral report of their findings during an investigation; state and give reasons for their opinions. • Give an oral summary of the key points from an oral or written source. • Review the first 2000 words, use the technical vocabulary of each topic. • Locate, extract and interpret information from appropriate materials such as signs, maps, charts, graphs, special publications, advertisements and newspapers. • Recognise the language structures that signal the logical organisation of information in: » definitions; » classifications; » chronological sequence; » cause and effect; » instructions.	• Speak effectively from notes in a short presentation. • Take notes from short presentations. • Discuss ideas and responses in small groups. • Ask detailed questions to gain information. • Give extended explanations, descriptions, reports or instructions. • Paraphrase. • Participate in various speaking activities such as seminars, group presentations, oral reports, debates and interviews. • Conduct an interview or survey to get specific information and report the results. • Describe procedures. • Give an oral evaluation and extended reasons for their points of view. • Listen to a variety of real unedited material (live or recorded), obtain facts and make inferences from the information presented.	• Participate in various speaking activities such as seminars, group presentations, oral reports and debates. • Use language appropriate to a given situation or purpose. • Take notes from extended presentations. • Make critical evaluations. • Defend a point of view applying analysis and principles.	

WRITTEN COMMUNICATION

MAJOR LEARNING OUTCOMES

In their study of DESIGN AND TECHNOLOGY students should be able to participate effectively through developing their written communication skills.
NOTE: All learning outcomes are to be read in the context of the practical task set (design brief).

Students will be able to:

YEAR 9	YEAR 10	YEAR 11	YEAR 12
• Use language to: » express cause and effect; » state research questions, or hypotheses; » give basic definitions. • Write to express ideas in simple paragraphs to describe things in terms of their features, their qualities, the substances they are made from, their component parts, functions, behaviours, or properties; • Explain: (i) how something works as in a mechanical process *e.g., how does a pump work, or* (ii) natural process e.g., how are mountains formed, or (iii) reasons for some phenomenon *e.g., why do living things need food?* • Write paragraph summaries. • Write a simple but complete report of an investigation.	• Establish the first 2000 words, use the technical vocabulary of each topic. • Extract key ideas from short passages and draw conclusions. • Recognise the language structures that signal the logical organisation of information: compare and contrast. • Write to compare, contrast; combine paragraphs to write increasingly detailed descriptions and explanations. • Explain processes, and how systems work. • Explain reasons for complex related phenomenon. • Write increasingly detailed reports of investigations. • Introduce academic word list, use the technical vocabulary of each topic. • Use reference materials: locating, evaluating, selecting information. • Use a variety of sentences: simple, compound, complex. • Recognise the language structures that signal the logical organisation of information: summary, conclusion; generalisation and examples; hypothesis; extended definitions. • Write curriculum vitae, covering letters and other business-related correspondence. • Write to express assumptions and conclusions. • Write descriptive, expository and persuasive passages of increasing complexity.	• Continue with academic word list. • Use the technical vocabulary of each topic. • Recognise the language structures that signal the logical organisation of information: » argument; » research reports. • Extract more detailed information and write coherent, longer texts integrating information from multiple sources. • Write argument texts: thesis statement, followed by argument, followed by conclusion. • Write research reports using illustrations, graphs or charts. • Write short essays using different methods of development: comparison, extended definition, cause and effect. • Follow the conventions of academic writing in their presentations *e.g., citing references in writing, quotations and presentations, bibliography.*	

Terms and Definitions

General Terms

Learning outcomes
This term refers to what students are expected to learn.

Aims
The General Aims are the broad goals of the subject, while Specific Aims are related to each strand of the curriculum.

Curriculum
The National Curriculum for Design and Technology is the approved statement of the required learning for students in all schools.

General aims
A statement of goals to provide purpose to the teaching and learning.

Level
Groupings of achievement objectives for each year e.g., year 9.

Programme
All the units of work that together make up a year's work.

Related studies
Collected information based on the practical work being done.

Strand
A broad grouping of related achievement objectives.

Unit of work
A part of the year's programme centred around a design brief or topic.

Terms Use in the Learning Outcomes

Apply their knowledge
To use their understanding in a new situation or for problem solving.

Investigate
To search for information.

Brainstorming
Group thinking, sharing everybody's ideas.

Concept drawings
Ideas recorded with sketches - "thinking with a pencil".

Classify
To sort, arrange or place things according to groups e.g., Cutting tools.

Describe
To record in some way, a process an idea or concept.

Design
The process of putting ideas together.

Designing
The process of developing an idea or solution.

Design Brief
A statement of the problem to be solved.

Elements of design
Proportion, balance, line, form, shape, harmony.

Explain
To make clear the cause or reason.

Function
How well a design works when used.

Gather information
Collecting facts related to the project or brief.

Graphics
The process or art of drawing and recording what you are thinking.

Identify
To recognise, establish or prove to be.