Design & Technology Syllabus

Lower Secondary
Special/Express/Normal (Academic)

CONTENTS

INTRODUCTION

Design & Technology (D&T) is part of a holistic broad-based education. It is a compulsory project-based subject in the lower secondary school curriculum. D&T anchors on design action and the application of knowledge and process skills.

AIMS

The lower secondary D&T syllabus aims to enable pupils to:

- develop an awareness of design in the made-world;

- develop an appreciation of function, aesthetics and technology in design;

- develop basic design thinking and communication skills;

- experience the process of realising design through making; and

- think and intervene creatively to become autonomous decision makers.

Pupils are to engage in design-and-make activities and experience a basic process of design adapted to their abilities, interest and design context.

SYLLABUS FRAMEWORK

The D&T syllabus comprises **three learning domains** broadly classified as **Design Appreciation**, **Designing** and **Making**. Pupils will learn to apply knowledge and skills through design-and-make activities.

Design Appreciation
Design appreciation exposes pupils to product awareness, product functions, aesthetics, design in society, and cultural and technological influences on design.

Designing
Through the design process, pupils learn and practise basic strategies and skills in research, analysis, ideation and development, evaluation and design communication.

Making
Pupils acquire basic making skills and related knowledge through the manipulation of resistant materials, simple modelling materials and basic technology; and the execution of appropriate techniques and processes in a workshop environment. Through making, pupils also learn to use materials prudently and develop the habit of effective and efficient work processes in a safe manner.

SUBJECT CONTENT

The topics for each of the learning domains are listed in Table 1. These topics are suggested content to be taught in the context of the design-and-make activities. Teaching of the topics should take an integrative approach to help pupils appreciate the application of related knowledge and skills. Pupils are encouraged to draw on knowledge and understanding from other subject areas like Science, Mathematics and Art.

Table 1 Summary of Topics

Design Appreciation	Designing	Making
1 Aesthetics 2 Design in Society 3 Sustainability 4 Basic Technology	5 Design Method 6 Need Definition 7 Research 8 Idea Generation and Development 9 Communication 10 Evaluation	11 Planning 12 Materials 13 Practical Processes

Domain 1   Design Appreciation

Topic	Pupils should be able to:
1 Aesthetics	▪ appreciate the role of line, shape & form, colour, texture, proportion and ergonomics in relation to design needs ▪ understand the link between ergonomics, function and aesthetics
2 Design in Society	▪ show an awareness of societal and cultural influences on design
3 Sustainability	▪ demonstrate awareness of environmental considerations related to materials usage, production methods and after-use disposal

4   Basic Technology
  ▪ Electronics
  ▪ Mechanisms
  ▪ Structures
	▪ appreciate how technology is applied to enhance product functionality
	▪ understand the roles electronics play in everyday life
	▪ demonstrate awareness in circuit connection and the use of common electronic components
	▪ show awareness of the working principles of simple machines and mechanisms in familiar products
	▪ describe the use of mechanisms in conversion and transmission of motion
	▪ appreciate how structures contribute to strength and aesthetic appeal
	▪ understand what a structure is and the need for structures
	▪ recognise the use of different methods of reinforcing structures

5   Design Method

A convenient model to help pupils engage in design activity is shown in Figure 1.

Figure 1 Design Model

Figure 1 Design Model
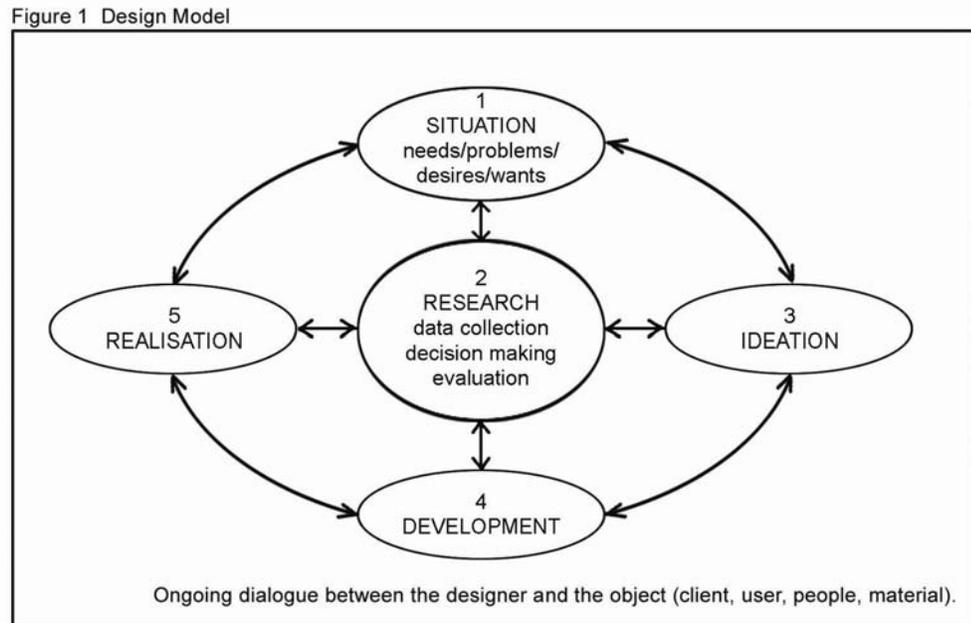
Note: The numbering of the design stages is meant as a guide.

The arrows show that design is not always a linear process but is dynamic in nature, requiring looping back to other stages of the design model. For example, in the process of realisation, there may be further development to the design solution. The numbered steps serve as a guide on the sequence of design activities pupils would generally undertake in a design-and-make project.

Domain 2   Designing (cont'd)

Topic	**Pupils should be able to:**

6 Need Definition
- Analysing
- Image Board
- Design Factors

- define a need by considering
  - the needs and values of intended users
  - factors that affect design e.g. function, aesthetics
- write a design brief
- write specifications

7 Research
- Product Analysis

- appreciate the need for relevant information to make sound design decisions
- gather relevant information that will help in their designing
- investigate and evaluate a range of relevant consumer products in terms of meeting needs and fitness for purpose

8 Idea Generation and Development

- use SCAMPER or other ideation techniques to generate ideas
- develop ideas by considering design factors
- use models or mock-ups to test ideas

9 Communication
- Freehand Sketching
- Working Drawings
- Design Modelling

- express design ideas using
  - freehand sketching techniques with meaningful annotations
  - models and mock-ups
- prepare working drawings

10 Evaluation

- reflect on the progress of their work as they design and make
- evaluate their artefact against design specifications
- identify ways they could improve their artefact

Domain 3   Making

Topic	**Pupils should be able to:**

11 Planning
- prepare an outline plan of the steps in making, including the materials to be used

12 Materials
- Resistant Materials (wood, metal & plastics)
- Modelling Materials

- understand the basic properties of common materials in relation to their use
- manipulate a range of materials using suitable practical processes to model and realise design ideas

13 Practical Processes
- Measuring and Marking Out
- Holding, Cutting and Shaping
- Bending and Forming
- Joining and Assembling
- Finishing

- demonstrate the correct use of tools and machines
- measure, mark out, cut and shape a range of materials using appropriate techniques
- use jigs and formers to bend or form materials
- use appropriate methods to join parts of a job to form the desired structure or give the required movement
- use finishes to enhance the artefact function and appearance

ASSESSMENT GUIDELINES

Assessment Objectives

The following assessment objectives for each learning domain are designed to reflect the intent of the syllabus.

Pupils should be able to:

Design Appreciation

1 demonstrate awareness of societal and technological influences in design;

2 demonstrate the ability to apply knowledge in design, materials, processes and basic technology;

Designing

3 define a need by considering appropriate human, functional and aesthetic factors;

4 gather and use relevant information for design decision making;

5 generate and develop ideas using appropriate methods;

6 test and evaluate their design ideas, making appropriate modifications;

7 apply appropriate communication techniques to inform and defend ideas;

Making

8 plan the steps in making their artefact;

9 realise their artefact in appropriate material(s) using suitable techniques; and

10 make appropriate modifications to enhance the artefact.

Assessment Mode

Pupils will be assessed through purposefully designed projects which require demonstration of learning outcomes across the three learning domains. All projects shall include evidence of pupils' learning in the form of documentation of the design process and artefacts/models/mock-ups. Schools may include presentation boards for assessment.

Pupils may also be assessed through written examination. Schools have the autonomy on the design of the written paper format.

The weighting of the two assessment modes is as follows:

Assessment Mode	Weighting
Project	80% (minimum)
Written Examination	20% (maximum)

Assessment Grid

Table 2 lists the criteria for each learning domain upon which a design-and-make project is assessed.

The three learning domains are weighted to give an indication of their relative importance. They are not intended to provide a precise statement of the number of marks allocated to particular assessment objectives or criteria.

The suggested maximum mark provides a guide on the relative emphasis given to each assessment criterion.

Table 2 Assessment Grid

Learning Domain	Assessment Criteria	Suggested Maximum Mark	Weighting
Design Appreciation	Design Awareness	20	30%
	Knowledge Application	40	
Designing	Needs Analysis	10	40%
	Research	15	
	Idea Generation and Development	25	
	Communication	20	
	Evaluation	10	
Making	Planning	10	30%
	Making	50	
	Total		100%

Table 3 (from Pages 10 and 11) shows the assessment rubric for each criterion. Not every criterion may be assessed in a single design-and-make project. Any adjustments made to the suggested maximum mark shall maintain the relative emphasis of the criteria within each domain, and the weighting of the three domains. An example to illustrate the assessment of a design-and-make project is given in Table 4 on page 12.

To cover all criteria, pupils are to be given a range of projects with emphasis on different aspects of the learning domains. The marks given to each project would be added to give the total marks for the programme. Schools may decide on the weighting of each project depending on the extent of the project. An example to illustrate the computation of the total marks is given in Table 5 on page 13.

As a guide, 5 - 8 projects may be planned for the lower secondary programme (Sec 1 and 2). Each project may take 4 - 6 weeks.

Table 3 Assessment Rubric

Criteria	Level 1	Level 2	Level 3	Level 4	Level 5
DESIGN APPRECIATION					
Design Awareness	Recognises aesthetic appeal of familiar products	Recognises cultural and technological influences on designed products	Demonstrates some judgement on design aesthetics and functionality	Demonstrates ability to evaluate quality of designed products	Demonstrates ability to evaluate impact of designed products on society and environment
Knowledge Application	Recognises characteristics of familiar products	Generates ideas based on own experience of working with materials	Uses information gathered from research and knowledge of familiar products	Uses relevant information gathered, showing understanding of form and function of familiar products when developing ideas	Makes connections with other subject areas, considering cultural and environmental issues when developing ideas
DESIGNING					
Needs Analysis	Need stated with little awareness of main requirements	Need stated with some relevant design requirements identified	Need defined with relevant design requirements identified	Need clearly defined with some investigation into design requirements	Need well analysed with considerations on user, function and aesthetics
Research	Some information gathered from research	Some research with relevant information identified	Some research with use of information gathered for decision making	Adequate research with relevant information gathered and used for decision making	Thorough research with analysis of relevant information for decision making
Idea Generation and Development	Generates ideas by drawing on own experience of familiar products	Generates own ideas with some evidence of refinement	Generates and develops ideas, recognising the basic needs of the design	Generates and develops ideas with considerations on some requirements key to the needs identified	Generates imaginative ideas; develops ideas in detail with considerations on user needs, function and appearance

Table 3 Assessment Rubric (cont'd)

Criteria	Level 1	Level 2	Level 3	Level 4	Level 5
DESIGNING (cont'd)					
Evaluation	Recognises how well the artefact serves its function	Recognises strengths and areas of improvement of the artefact	Modifies artefact towards improvement during making	Tests and modifies mock-up/artefact, showing understanding of design requirements	Makes modifications on design solution via on-going evaluation and testing against specifications
Communication	Describes ideas using pictures and words	Describes information in some detail with sketches and notes	Communicates clearly with annotated sketches and/or models	Communicates clearly with sufficient detail and appropriate use of graphics and models	Communicates effectively with detailed competent graphic presentation and models
MAKING					
Planning	Needs some guidance to plan steps in making	Able to plan main steps in making with minimal guidance	Able to plan main steps in making, showing some awareness of processes	Able to plan steps in making with some details on construction process	Able to monitor own progress with detailed planning of steps in making
Making	Some competency demonstrated	Fairly well managed artefact	Fairly well managed artefact; effective solution	Well managed artefact; effective solution	Well managed and well finished artefact; desirable solution

Table 4 Example of Assessment of a Design-and-Make Project

Criteria	Level 1	Level 2	Level 3	Level 4	Level 5	Mark Awarded	Subtotal x Weighting	Weighted Mark
DESIGN APPRECIATION								
Knowledge Application	1 - 8 Recognises characteristics of familiar products	9 - 16 Generates ideas based on own experience of working with materials	17 - 24 Uses information gathered from research and knowledge of familiar products	25 - 32 Uses relevant information gathered, showing understanding of form and function of familiar products when developing ideas	33 - 40 Makes connections with other subject areas, considering cultural and environmental issues when developing ideas	20	20/40 x 30%	15
DESIGNING								
Idea Generation and Development	1 - 5 Generates ideas by drawing on own experience of familiar products	6 - 10 Generates own ideas with some evidence of refinement	11 - 15 Generates and develops ideas, recognising the basic needs of the design	16 - 20 Generates and develops ideas with considerations on some requirements key to the needs identified	21 - 25 Generates imaginative ideas; develops ideas in detail with considerations on user needs, function and appearance	18	30/45 x 40%	27
Communication	1 - 4 Describes ideas using pictures and words	5 - 8 Describes information in some detail with sketches and notes	9 - 12 Communicates clearly with annotated sketches and/or models	13 - 16 Communicates clearly with sufficient detail and appropriate use of graphics and models	17 - 20 Communicates effectively with detailed competent graphic presentation and models	12		
MAKING								
Making	1 - 10 Some competency demonstrated	11 - 20 Fairly well managed artefact	21 - 30 Fairly well managed artefact; effective solution	31 - 40 Well managed artefact; effective solution	41 - 50 Well managed and well finished artefact; desirable solution	45	45/50 x 30%	27
					Total			69

Table 5 Example of Computation of Total Mark at the End of Secondary One

Criteria / Project No.	Design Awareness	Knowledge Application	Needs Analysis	Research	Idea Generation and Development	Evaluation	Communication	Planning	Making	Total Marks / 100	Weighting (%)	Weighted Total (Marks × Weighting)
1		✓			✓		✓		✓	69	10	6.9
2	✓			✓		✓	✓		✓	55	15	8.3
3		✓	✓	✓	✓			✓	✓	83	25	20.1
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	60	50	30.0
								Total Mark for Programme			100	65.3