

# Design & Technology Syllabus

Lower Secondary  
Normal (Technical)



Ministry of Education  
SINGAPORE

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## **INTRODUCTION**

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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.

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## **AIMS**

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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.

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## SYLLABUS FRAMEWORK

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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.

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## SUBJECT CONTENT

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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

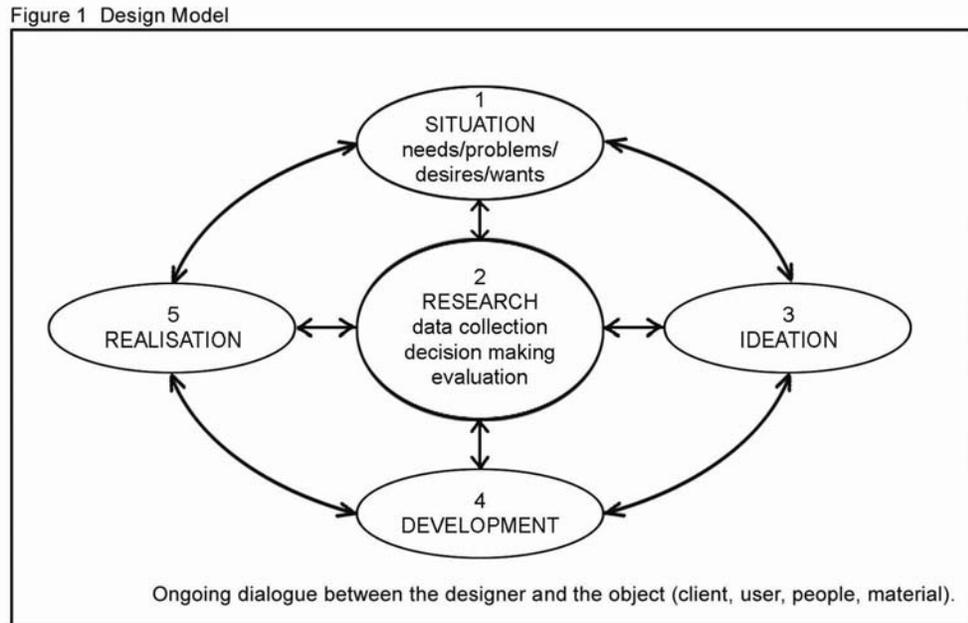
Design Appreciation	Designing	Making
1 Aesthetics	5 Design Method	11 Planning
2 Design in Society	6 Need Definition	12 Materials
3 Sustainability	7 Research	13 Practical Processes
4 Basic Technology	8 Idea Generation and Development	
	9 Communication	
	10 Evaluation	

## Domain 1 Design Appreciation

Topic	Pupils should be able to:
<b>1 Aesthetics</b>	<ul style="list-style-type: none"><li>▪ appreciate the role of line, shape &amp; form, colour, texture, proportion and ergonomics in relation to design needs</li><li>▪ understand the link between ergonomics, function and aesthetics</li></ul>
<b>2 Design in Society</b>	<ul style="list-style-type: none"><li>▪ show an awareness of societal and cultural influences on design</li></ul>
<b>3 Sustainability</b>	<ul style="list-style-type: none"><li>▪ demonstrate awareness of environmental considerations related to materials usage, production methods and after-use disposal</li></ul>
<b>4 Basic Technology</b> <ul style="list-style-type: none"><li>▪ Electronics</li><li>▪ Mechanisms</li><li>▪ Structures</li></ul>	<ul style="list-style-type: none"><li>▪ appreciate how technology is applied to enhance product functionality</li><li>▪ understand the roles electronics play in everyday life</li><li>▪ demonstrate awareness in circuit connection and the use of common electronic components</li><li>▪ show awareness of the working principles of simple machines and mechanisms in familiar products</li><li>▪ describe the use of mechanisms in conversion and transmission of motion</li><li>▪ appreciate how structures contribute to strength and aesthetic appeal</li><li>▪ understand what a structure is and the need for structures</li><li>▪ recognise the use of different methods of reinforcing structures</li></ul>

## 5 Design Method

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



*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:
<b>6 Need Definition</b> <ul style="list-style-type: none"><li>▪ Analysing</li><li>▪ Image Board</li><li>▪ Design Factors</li></ul>	<ul style="list-style-type: none"><li>▪ define a need by considering<ul style="list-style-type: none"><li>- the needs and values of intended users</li><li>- factors that affect design e.g. function, aesthetics</li></ul></li><li>▪ write a design brief</li><li>▪ write specifications</li></ul>
<b>7 Research</b> <ul style="list-style-type: none"><li>▪ Product Analysis</li></ul>	<ul style="list-style-type: none"><li>▪ appreciate the need for relevant information to make sound design decisions</li><li>▪ gather relevant information that will help in their designing</li><li>▪ investigate and evaluate a range of relevant consumer products in terms of meeting needs and fitness for purpose</li></ul>
<b>8 Idea Generation and Development</b>	<ul style="list-style-type: none"><li>▪ use SCAMPER or other ideation techniques to generate ideas</li><li>▪ develop ideas by considering design factors</li><li>▪ use models or mock-ups to test ideas</li></ul>
<b>9 Communication</b> <ul style="list-style-type: none"><li>▪ Freehand Sketching</li><li>▪ Working Drawings</li><li>▪ Design Modelling</li></ul>	<ul style="list-style-type: none"><li>▪ express design ideas using<ul style="list-style-type: none"><li>- freehand sketching techniques with meaningful annotations</li><li>- models and mock-ups</li></ul></li><li>▪ prepare working drawings</li></ul>
<b>10 Evaluation</b>	<ul style="list-style-type: none"><li>▪ reflect on the progress of their work as they design and make</li><li>▪ evaluate their artefact against design specifications</li><li>▪ identify ways they could improve their artefact</li></ul>

## 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

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## ASSESSMENT GUIDELINES

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### 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:

<b>Assessment Mode</b>	<b>Weighting</b>
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**

<b>Criteria</b>	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Level 4</b>
<b>DESIGN APPRECIATION</b>				
<b>Design Awareness</b>	Demonstrates minimal awareness of aesthetics and technology	Recognises aesthetic appeal of familiar products	Recognises cultural and technological influences on designed products	Demonstrates some judgement on design aesthetics and functionality
<b>Knowledge Application</b>	Demonstrates limited ability to apply knowledge	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
<b>DESIGNING</b>				
<b>Needs Analysis</b>	Need stated but unclear	Need stated with little awareness of main requirements	Need stated with some relevant design requirements identified	Need defined with relevant design requirements identified
<b>Research</b>	Little evidence of information gathered	Some information gathered from research	Some research with relevant information identified	Some research with use of information gathered for decision making
<b>Idea Generation and Development</b>	Demonstrates limited ability to generate meaningful ideas	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
<b>Evaluation</b>	Comments on artefact in simple terms	Recognises how well the artefact serves its function	Recognises strengths and areas of improvement of the artefact	Modifies artefact towards improvement during making
<b>Communication</b>	Demonstrates limited ability to communicate ideas or intent	Describes ideas using pictures and words	Describes information in some detail with sketches and notes	Communicates clearly with annotated sketches and/or models

**Table 3 Assessment Rubric (cont'd)**

<b>MAKING</b>				
<b>Planning</b>	Demonstrates minimal awareness of steps in planning, needs ongoing guidance	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
<b>Making</b>	Poor quality product	Some competency demonstrated	Fairly well managed artefact	Fairly well managed artefact; effective solution

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

Criteria	Level 1	Level 2	Level 3	Level 4	Mark Awarded	Subtotal × Weighting	Weighted Mark
<b>DESIGN APPRECIATION</b>							
<b>Design Awareness</b>	1 – 3 Demonstrates minimal awareness of aesthetics and technology	4 – 6 Recognises aesthetic appeal of familiar products	7 – 8 Recognises cultural and technological influences on designed products	9 – 10 Demonstrates some judgement on design aesthetics and functionality	7	7/10 × 30%	21
<b>DESIGNING</b>							
<b>Needs Analysis</b>	1 – 3 Need stated but unclear	4 – 6 Need stated with little awareness of main requirements	7 – 8 Need stated with some relevant design requirements identified	9 – 10 Need defined with relevant design requirements identified	6	21/35 × 40%	24
<b>Idea Generation and Development</b>	1 – 7 Demonstrates limited ability to generate meaningful ideas	8 – 15 Generates ideas by drawing on own experience of familiar products	16 – 20 Generates own ideas with some evidence of refinement	21 – 25 Generates and develops ideas, recognising the basic needs of the design	15		
<b>MAKING</b>							
<b>Planning</b>	1 Demonstrates minimal awareness of steps in planning; needs ongoing guidance	2 – 3 Needs some guidance to plan steps in making	4 Able to plan main steps in making with minimal guidance	5 Able to plan main steps in making, showing some awareness of processes	3	25/30 × 30%	25
<b>Making</b>	1 – 7 Poor quality product	8 – 15 Some competency demonstrated	16 – 20 Fairly well managed artefact	21 – 25 Fairly well managed artefact; effective solution	22		
<b>Total</b>							<b>70</b>

**Table 5 Example of Computation of Total Marks for Programme 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	✓		✓		✓			✓	✓	70	30	21.0
2		✓	✓		✓	✓	✓		✓	65	50	32.5
3	✓			✓	✓				✓	83	20	16.6
Total Mark for Programme											100	70.1