# Numeracy learning progression and Design and Technologies

## Purpose of the literacy and numeracy progressions

The purpose and intent of the progressions are to provide a tool to:

- locate the literacy and numeracy development of students
- plan for student progress in literacy and numeracy
- facilitate shared professional understanding of literacy and numeracy development
- support a whole school approach to literacy and numeracy development.

### Literacy and numeracy in the learning areas

The learning areas provide rich opportunities for extending and enriching literacy and numeracy. To effectively plan for differentiated teaching of literacy and numeracy in the learning areas, teachers draw on their knowledge of the Australian Curriculum and their knowledge of their students. Recognising that students learn at different rates, the progressions provide a continuum for teachers to identify and build on students' literacy and numeracy skills. The intention is that students will develop their literacy and numeracy expertise purposefully, in meaningful contexts.

### Using this advice and the progressions to plan for student progress in literacy and numeracy

This advice illustrates how the progressions can be used in Design and Technologies to support student progress in literacy and numeracy. This advice:

- identifies the sub-elements of the progressions that are most relevant to studying Design and Technologies
- identifies some aspects of an achievement standard that include literacy or numeracy demands
- lists some relevant indicators at one or more levels of the progressions to illustrate how the progressions might be unpacked to support student progress in literacy and numeracy in the study of Design and Technologies.

Figure 1 illustrates how the progressions are to be used by teachers to identify where students are at on the literacy and numeracy continuum and plan for their ongoing development within the learning areas. Therefore, this advice can support use of the progressions in developing explicit and targeted programs to ensure students are able to access discipline-specific knowledge, concepts, understanding and skills. While advice is provided on the most relevant sub-elements of each progression for the discipline of Design and Technologies, whole school planning may address other sub-elements to progress students' literacy and numeracy.

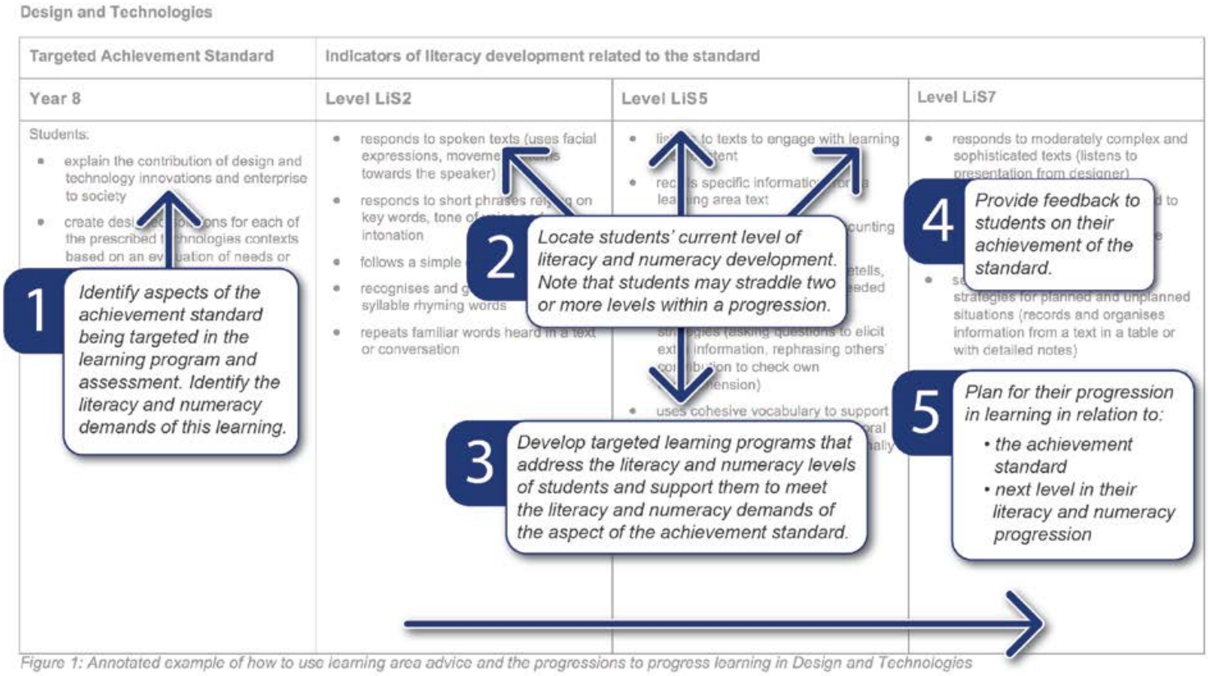

*Figure 1: Annotated example of how to use learning area advice and the progressions to progress learning in Design and Technologies*

## Numeracy in Design and Technologies

Students need to be numerate as they develop the knowledge and skills to use mathematics effectively in all learning areas of the Australian Curriculum and in their lives more broadly. Supporting students' numeracy in learning areas will enhance and supplement the content learning by ensuring they have the numeracy skills which allow them to access and understand the content area and demonstrate their knowledge and understanding. Learning in Design and Technologies requires students to recognise and understand the role of mathematics in the world and have the dispositions and capacities to use mathematical knowledge and skills purposefully across a range of technologies contexts. Students need to interpret and use mathematical knowledge and skills in a range of real-life situations. They will use number to calculate, measure and estimate; interpret and draw conclusions from statistics; measure and record throughout the process of generating ideas; developing, refining and testing concepts; and costing and sequencing when making products and managing projects. In using software, materials, tools and equipment, students will work with the concepts of number, geometry, scale, proportion, measurement and volume. They need to develop three-dimensional models, create accurate technical drawings, work with digital models and use computational thinking in decision-making processes when designing and creating best-fit solutions.

### Planning for student progress in numeracy in Year 8 Digital Technologies

*The highlighted text below indicates where there are numeracy demands in the Design and Technologies achievement standard.*

By the end of Year 8, students explain factors that influence the design of products, services and environments to meet present and future needs. They explain the contribution of design and technology innovations and enterprise to society. Students explain how the features of technologies impact on designed solutions and influence design decisions for each of the prescribed technologies contexts.

Students create designed solutions for each of the prescribed technologies contexts based on an evaluation of needs or opportunities. They develop criteria for success, including sustainability considerations, and use these to judge the suitability of their ideas and designed solutions and processes. They create and adapt design ideas, make considered decisions and communicate to different audiences using appropriate technical terms and a range of technologies and graphical representation techniques. Students apply project management skills to document and use project plans to manage production processes. They independently and safely produce effective designed solutions for the intended purpose.

### Using the numeracy progression to support students in Design and Technologies

The most relevant sub-elements of the numeracy progression for Design and Technologies are within:

- Number sense and algebra
- Measurement and geometry
- Statistics and probability

These elements are essential for students to develop discipline-specific knowledge, understanding and skills and to demonstrate the learning described in the Design and Technologies achievement standard. Specific examples are shown in brackets (example). A number of numeracy sub-elements could be relevant to Design and Technologies but are dependent on the selected context for creating solutions. For example, position and location may be very relevant when working with online maps. The indicators identified below are only some examples.

Tables 2 to 4 focus on Year 8 but also reflect where similar or more sophisticated demands may be required in Year 10.

## Numeracy

Table 2: Numeracy indicators for *Number sense and algebra* related to the achievement standard

| **Targeted Achievement Standard** | **Examples of how indicators relate to the AC standard.** *Individual student numeracy may be at different levels of the progression as indicated in Figure 1.* | | | | |
|---|---|---|---|---|---|
| **Year 8** | **Number sense and algebra** | | | | |
| | **Additive strategies** | **Multiplicative strategies** | **Operating with decimals** | **Operating with percentages** | **Comparing units** |
| create and adapt design ideas, make considered decisions and communicate to different audiences using appropriate technical terms and a range of technologies and graphical representation techniques | **AdS8**<br>• chooses and uses multiple strategies for solving everyday problems involving addition and subtraction (compares prices of different materials) | | | | **CoU2**<br>• interprets ratios as a comparison between the same units of measure (draws engineering drawing to scale)<br>• expresses a ratio as equivalent fractions or percentages (ratio 1:1, each part represents ½ or 50% of the whole) (creates mixtures eg adhesives, finishes, salad dressings)<br>• uses a ratio to increase or decrease quantities to maintain a given consistency (doubling a recipe) |

| | | | | | |
|---|---|---|---|---|---|
| apply project management skills to document and use project plans to manage production processes | **AdS8**<br>• chooses and uses multiple strategies for solving everyday problems involving addition and subtraction (develops costings for ingredients) | | | **OwP4**<br>• identifies the whole for a range of multiplicative situations (percentages for calculating discounts and rates for best buys) | |
| produce effective designed solutions for the intended purpose. | **AdS8**<br>• chooses and uses multiple strategies for solving everyday problems involving addition and subtraction (measures marking of materials) | **MuS7**<br>• uses estimation and rounding to check the reasonableness of products and quotients | **OwD3**<br>• understands that multiplying and dividing decimals by 10, 100, 1000 changes the positional value of the numerals (converts cm to mm when planning, measuring and marking)<br>• connects and converts decimals to fractions to assist in mental computation involving multiplication<br>• recognises the equivalence of decimals to benchmark fractions ($\frac{1}{4}$ = 0.25, $\frac{1}{2}$ = 0.5, $\frac{3}{4}$ = 0.75, $\frac{1}{10}$ = 0.1, $\frac{1}{100}$ = 0.01) (converts cup measures to ml) | **OwP5**<br>• recognises that adding a percentage is equivalent to multiplication (adding 3% is multiplying by 1.03) (plans for increased crop yield) | |

| | | | | | |
|---|---|---|---|---|---|
| | | | **OwD4**<br>• uses knowledge of approximate answers to check accuracy of solutions when using a variety of strategies (checks measurements in advance of cutting materials) | | |

Table 3: Numeracy indicators for *Measurement and geometry* related to the achievement standard

<table>
<tr><td>Targeted Achievement Standard</td><td colspan="4">Examples of how indicators relate to the AC standard.<br>Individual student numeracy may be at different levels of the progression as indicated in Figure 1.</td></tr>
<tr><td rowspan="2">Year 8</td><td colspan="4">Measurement and geometry</td></tr>
<tr><td>Understanding units of measurement</td><td>Understanding geometric properties</td><td>Positioning and locating</td><td>Measuring time</td></tr>
<tr><td>create and adapt design ideas, make considered decisions and communicate to different audiences using appropriate technical terms and a range of technologies and graphical representation techniques</td><td>UuM9<br>• identifies appropriate levels of precision with measurement (creates working drawings)<br>• understands that the relationship between the circumference and the diameter of a circle is constant (pi)<br>• uses the constant pi to determine the circumference and the area of a circle</td><td>UGP5<br>• estimates and identifies measures of angles in degrees up to one revolution<br>• uses angle properties to identify perpendicular and parallel lines (develops a computer-aided design drawing)<br>UGP6 (Year10)<br>• uses relevant properties of geometrical figures to find unknown lengths and angles (interprets working and technical drawings)</td><td>PoL3<br>• draws an informal map or sketch to provide directions<br>• locates positions on an informal map<br>• orients an informal map using recognisable landmarks and current location<br>PoL4<br>• locates position on maps using grid references<br>• identifies features on maps and plans<br>• describes routes using landmarks and directional language<br>PoL5<br>• interprets the scale as a ratio used to create plans, drawings or maps</td><td></td></tr>
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| Targeted Achievement Standard | Examples of how indicators relate to the AC standard.<br>*Individual student numeracy may be at different levels of the progression as indicated in Figure 1.* | | | |
|---|---|---|---|---|
| **Year 8** | **Measurement and geometry** | | | |
| | **Understanding units of measurement** | **Understanding geometric properties** | **Positioning and locating** | **Measuring time** |
| | | | • interprets plans involving scale<br>• uses compass directions, latitude and longitude to locate position (identifies coordinates for GPS technologies) | |
| apply project management skills to document and use project plans to manage production processes | | | | **MeT4**<br>• determines elapsed time using different units (hours and minutes, days and weeks) (develops project plans and schedules) |
| produce effective designed solutions for the intended purpose. | **UuM8**<br>• converts between formal units of measurement (measures, estimates and calculates when working with materials)<br>• explains why having 100 cm in a metre results in 10 000 $cm^2$ in a square | | | |

| **Targeted Achievement Standard** | **Examples of how indicators relate to the AC standard.**<br>*Individual student numeracy may be at different levels of the progression as indicated in Figure 1.* | | | |
|---|---|---|---|---|
| **Year 8** | **Measurement and geometry** | | | |
| | **Understanding units of measurement** | **Understanding geometric properties** | **Positioning and locating** | **Measuring time** |
| | metre (interprets scale drawings) | | | |

Table 4: Numeracy indicators for Statistics and probability related to the achievement standard

| **Targeted Achievement Standard** | **Examples of how indicators relate to the AC standard.**<br>*Individual student numeracy may be at different levels of the progression as indicated in Figure 1.* |
|---|---|
| **Year 8** | **Statistics and probability** |
| | **Interpreting and representing data** |
| Students:<br>explain how the features of technologies impact on designed solutions and influence design decisions for each of the prescribed technologies contexts | **IRD5**<br>• recognises that continuous variables depicting growth or change often vary over time (presents charts to illustrate features)<br>• interprets graphs depicting motion such as distance–time graphs<br>• interprets and describes patterns in graphical representations in real-life situations<br>• interprets the impact of outliers in data |
| create designed solutions for each of the prescribed technologies contexts based on an | **IRD5**<br>• determines whether to use data from a sample or a population (conducts target market research)<br>• determines what type of sample to use from a population<br>• makes reasonable statements about a population based on evidence from samples |

| | |
|---|---|
| evaluation of needs or opportunities | • interprets the impact of outliers in data |
| develop criteria for success, including sustainability considerations, and use these to judge the suitability of their ideas and designed solutions and processes | **IRD6**<br>• applies an understanding of distributions to evaluate claims based on data (the larger the sample taken, the more accurate the prediction of the population value is likely to be) |
| create and adapt design ideas, make considered decisions and communicate to different audiences using appropriate technical terms and a range of technologies and graphical representation techniques | **IRD5**<br>• uses graphical representations relevant to the purpose of the collection of the data<br>• uses features of graphical representations to make predictions<br>• recognises that continuous variables depicting growth or change often vary over time (creates growth charts to illustrate impacts of design decisions) |
| apply project management skills to document and use project plans to manage production processes | **IRD5**<br>• uses graphical representations relevant to the purpose of the collection of the data (creates project management plans)<br>• uses features of graphical representations to make predictions |