Putting the Jigsaw Together

Practical strategies for assisting apprentices with numeracy issues

Trainer’s guide
A resource for vocational trainers

Manufacturing a skilled Australia
## Contents

Acknowledgements.................................................................................................................. 1

Introduction ........................................................................................................................................ 4

What are language, literacy and numeracy? ............................................................................. 5

  *Language is a system of communication using voice, sound, gestures and written symbols* ................................................................. 5

  *Literacy is the ability to read and use written information as well as to write appropriately, at home, at work and in the community* ......................................................................... 5

  *Numeracy is the ability to use mathematical concepts to function effectively in work and social contexts* ...................................................... 6

What are foundation skills? ........................................................................................................ 7

What are the core skills? .............................................................................................................. 8

Overview of the Australian Core Skills Framework ..................................................................... 9

  *Key features of the ACSF* ........................................................................................................... 9

  *Mapping and levels* ..................................................................................................................... 11

  *Trigger words to identify core skills in units of competency* .................................................... 13

Using the ACSF to determine the numerical concepts in a unit of competency ..................... 16

  *Numerical concepts at ACSF level 4* .......................................................................................... 16

  *Numeracy indicators* .................................................................................................................. 17

The ACSF in use .......................................................................................................................... 18

  *Mathematical knowledge and skills* .......................................................................................... 18

  *Scenario I* .................................................................................................................................. 19

  *Domains of communication* .................................................................................................... 19

How to use the tool kit .................................................................................................................. 20

  *Pre-training indicator tools* ........................................................................................................ 21

  *Using the indicator tools to guide support* ................................................................................. 21

  *How to use the numeracy tools* ................................................................................................ 23

  *Functions are indicated by the following icons* ....................................................................... 24

Related resources ....................................................................................................................... 25
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Introduction

Welcome to Putting the Jigsaw Together – Practical strategies for assisting apprentices to develop their numeracy skills.

This resource builds on the skills and knowledge gained from the MSA professional development resource Making the Connections – Using the Foundation Skills Training Package to integrate language, literacy and numeracy into training.

If you haven’t yet had the opportunity to undertake the professional development, this guide will provide you with an understanding of the issues confronting vocational trainers working with apprentices with language, literacy and numeracy (LLN) needs. It will also provide you with an introduction to strategies that can be used to support apprentices within your learning environment who are experiencing LLN needs.

The focus of this resource is on numeracy. Numeracy issues were identified through consultations with employers and trainers as the major issue faced when working with trade apprentices.

This resource has been developed using a problem-solving approach to skills learning. It consists of a series of tool kits that target identified numeracy skill areas based around solving a workplace numeracy problem. Each tool kit has been designed to support the numeracy skills required to solve a particular workplace problem.

Each tool has been created as a stand-alone resource for the trainer so the trainer is able to use the tool that is specific to the apprentice’s needs. This enables the delivery of targeted support that builds the apprentice’s skills as well as their confidence. They are aimed to reduce ‘math’s anxiety’ by progressively developing the apprentice’s numeracy skills.

To support the trainer in identifying and planning for individual needs, literacy and numeracy indicator tools, contextualised to engineering have been developed. It is important to note that these tools are indicators only of an individual's literacy and numeracy levels. They should not, indeed MSA would say MUST NOT, be used to prevent learners from entering an apprenticeship if one is on offer.

As the trainer, you will be in the best position to identify the level of assistance the apprentice will require. For example, they may have difficulty with metric conversions, so you could use the Performing metric conversions tool to provide assistance.
What are language, literacy and numeracy?

More than just Mathematics and English learned at school - LLN skills are a part of the way we all communicate and use numbers in our everyday lives.

In everyday workplace tasks, it is common for a person to use and respond to spoken and written language and to use numeracy skills at the same time. When designing training and assessment tasks, the trainer should be aware of this interlinking of LLN. However, there will also be situations in which only one of these skills is the focus of the training, for example, performing engineering calculations relating to developing and manufacturing precision models.

Although you will often find the terms ‘language, literacy and numeracy’ used together; they are not interchangeable or always linked.

**Language is a system of communication using voice, sound, gestures and written symbols**

When we talk about language we are talking about speaking, listening, reading, writing and visual communication. Language involves using words and grammatical structures and other meaning support systems (e.g. gestures when speaking and listening, punctuation and formatting when reading and writing) to make meaning.

Language is more than a matter of knowing words and using correct grammar. Knowing the way language is used in different circumstances and for different purposes – at work or in the general community – gives us access to ‘the way things work’ and thereby enables us to achieve our personal, work and social goals.

Language changes over time and context. Industries have their own vocabulary, including jargon, technical terms and acronyms that workers must understand. This can be very challenging for some people, particularly those for whom English is not their first language. A worker can hold technical skills for example without yet having English language competency.

Effective cross-cultural communication requires a range of skills, including the ability to appreciate that there may be variations in the value placed on the communication forms of language. For example, while written language is highly regarded in the English language, Indigenous languages place higher value on verbal and visual communication forms.

**Literacy is the ability to read and use written information as well as to write appropriately, at home, at work and in the community**

Literacy is the ability to read and use written information as well as to write appropriately, in a range of contexts. Literacy involves the integration of speaking, listening, and critical thinking with reading and writing.
Literacy is purposeful and changes constantly along with changing social and cultural contexts. Our literacy skills enable us to interact with one another to achieve particular purposes: to explain, debate, retrieve and provide information, explore issues, entertain and create.

Literacy is more than basic reading and writing (sometimes called functional literacy), it also includes following instructions, filling in forms, reading bus timetables, writing a note to a household member, and so on. It is also a process of using higher order reading and thinking skills to question what we see in written texts (sometimes called critical literacy).

Literacy is also about our social application of language, for example, in our homes, communities and workplaces. Like language, literacy practices change over time and context. We have seen this over the last decade with emerging multimedia and information technologies and our multicultural society.

The literacy demands placed on individuals also change throughout their lifetimes. As we experience new situations we need to continually adapt and extend our literacy skills.

**Numeracy is the ability to use mathematical concepts to function effectively in work and social contexts**

Numeracy involves the practical application of mathematical skills to absorb, use and critically evaluate information in numerical or graphical form.

Depending on the context, this can include:

- number skills (e.g. calculating metal thicknesses using appropriate mathematical techniques)
- interpreting drawings, spatial and graphical concepts
- the use of measurement
- problem solving
- statistics.

Numeracy may also involve literacy, for example, interpreting and extracting mathematical information from drawings, instructions and specifications. In the workplace, the methods used to achieve certain numeracy tasks will differ according to the workplace requirements, technology and culture.

Numeracy does not seem to be an automatic outcome for many people after years of schooling, so it often needs to be explicitly taught in workplace contexts.

What are foundation skills?

Foundation skills are the skills essential for meeting the demands of everyday life, work, participation in the community and successfully achieving vocational qualifications or entering into the workforce.

Foundation skills encompass:

<table>
<thead>
<tr>
<th>Australian Core Skills Framework (ACSF)</th>
<th>Employability Skills</th>
<th>Digital literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning</td>
<td>Communication</td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>Teamwork</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>Problem solving</td>
<td></td>
</tr>
<tr>
<td>Oral Communication</td>
<td>Initiative and enterprise</td>
<td></td>
</tr>
<tr>
<td>Numeracy</td>
<td>Planning and organising</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Learning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Technology</td>
<td></td>
</tr>
</tbody>
</table>
What are the core skills?

The Australian Core Skills Framework (ACSF) identifies 'core skills' essential for learners to work, learn and communicate in diverse personal, community, work, and education and training contexts. Core skills include:

- **Learning**, the process of gaining understanding and developing skills by drawing on prior knowledge and experience.
- **Reading**, the process of making meaning from different types of documents – being aware of an author's purpose and intended audiences, of own purposes for reading, and of the role learners play in the construction of meaning.
- **Writing**, the process of employing prior knowledge and strategies to convey a message, taking into account the purpose of writing, audience and context.
- **Oral communication**, the process of speaking and listening, which is shaped by the purpose and context of communication. It involves transactional and interpersonal exchanges.
- **Numeracy**, the process of using and applying mathematics to make sense of the world.

*Source: Australian Core Skills Framework 2012*

The ACSF provides a framework that enables consistent descriptions of the five core skills (learning, reading, writing, oral communication and numeracy) in training programs tailored to workplace performance. For each core skill, there are five levels of performance with 1 being a learner who is working alongside an expert/mentor through to 5 which describes the skills of an autonomous learner.

Overview of the Australian Core Skills Framework

Key features of the ACSF

The ACSF describes the levels of each of the five core skills and the variables that influence these levels.

Five core skills – learning, reading, writing, oral communication and numeracy.

Five levels of performance ranging from 1 (low level performance) to 5 (high level performance).

Four performance variables that may influence a person’s performance at any time:

- support
- context
- text complexity
- task complexity.

The table on the following page describes these variables at each level.

Note:
The levels of the AQF do not match the performance levels of the ACSF.

The Australian Qualifications Framework (AQF) is the framework for qualifications in Australia and consists of 10 levels. (Certificate 1 up to Doctoral Degree)

Effective performance in different industries requires different core skills. Two qualifications at the same AQF level can have different core skill requirements. For example, MEM30205 Certificate III in Engineering – Mechanical trade has higher numeracy requirements than CHC30212 Certificate III in Aged Care.
## ACSF Performance Variables Grid

<table>
<thead>
<tr>
<th>FIVE LEVELS OF PERFORMANCE</th>
<th>SUPPORT</th>
<th>CONTEXT</th>
<th>TEXT COMPLEXITY</th>
<th>TASK COMPLEXITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Work alongside an expert/mentor where prompting and advice can be provided</td>
<td>Works alongside an expert/mentor where prompting and advice can be provided</td>
<td>Highly familiar contexts</td>
<td>Short and simple</td>
<td>Concrete tasks of 1 or 2 steps Processes include locating, recognising</td>
</tr>
<tr>
<td>2 May work with an expert/mentor where support is available if requested</td>
<td>May work with an expert/mentor where support is available if requested</td>
<td>Familiar and predictable contexts</td>
<td>Simple familiar texts with clear purpose</td>
<td>Explicit tasks involving a limited number of familiar steps Processes include identifying, simple interpreting, simple sequencing</td>
</tr>
<tr>
<td>3 Works independently and uses own familiar support resources</td>
<td>Works independently and uses own familiar support resources</td>
<td>Range of familiar contexts</td>
<td>Routine texts</td>
<td>Tasks involving a number of steps Processes include sequencing, integrating, interpreting, simple extrapolating, simple inferencing, simple abstracting</td>
</tr>
<tr>
<td>4 Works independently and initiates and uses support from a range of established resources</td>
<td>Works independently and initiates and uses support from a range of established resources</td>
<td>Range of contexts, including some that are unfamiliar and/or unpredictable</td>
<td>Complex texts</td>
<td>Complex task organisation and analysis involving application of a number of steps Processes include extracting, extrapolating, inferencing, reflecting, abstracting</td>
</tr>
<tr>
<td>5 Autonomous learner who accesses and evaluates support from a broad range of sources</td>
<td>Autonomous learner who accesses and evaluates support from a broad range of sources</td>
<td>Broad range of contexts</td>
<td>Highly complex texts</td>
<td>Sophisticated task conceptualisation, organisation and analysis Processes include synthesising, critically reflecting, evaluating, recommending</td>
</tr>
</tbody>
</table>

- **SUPPORT**
  - Highly familiar contexts
  - Concrete and immediate
  - Very restricted range of contexts

- **CONTEXT**
  - Familiar and predictable contexts
  - Limited range of contexts

- **TEXT COMPLEXITY**
  - Short and simple
  - Highly explicit purpose
  - Limited, *highly familiar* vocabulary

- **TASK COMPLEXITY**
  - Concrete tasks of 1 or 2 steps
  - Processes include locating, recognising

  - Simple familiar texts with clear purpose
  - Familiar vocabulary

  - Routine texts
  - May include some unfamiliar elements, embedded information and abstraction
  - Includes some specialised vocabulary

  - Complex texts
  - Embedded information
  - Includes specialised vocabulary
  - Includes abstraction and symbolism

  - Highly complex texts
  - Highly embedded information
  - Includes highly specialised language and symbolism

  - Sophisticated task conceptualisation, organisation and analysis
  - Processes include synthesising, critically reflecting, evaluating, recommending
Mapping and levels

Both the MEM30205 Certificate III in Engineering – Mechanical Trade and MEM30305 Certificate III in Engineering – Fabrication Trade qualifications content has been mapped against the ACSF’s five core skills. For both qualifications, findings for the numeracy skills identified the following outcomes:

- The numeracy skills in the units of competency of these qualifications cross ACSF levels. Some have been mapped at an ACSF level 3, while most are at an ACSF level 4.

- Many of the technical units require numeracy skills, such as interpretation of engineering drawings, specifications and circuit diagrams. Others require measurement of fine tolerances, and the application of formulae, volumes and ratios. Some units require the use of technological devices to measure and record data and some interpretation of results to make adjustments to processes.
## Trigger words to identify core skills in units of competency

### CLI & CIII Manufacturing Skills Australia (MSA) qualifications

<table>
<thead>
<tr>
<th>Learning</th>
<th>Reading</th>
<th>Writing</th>
<th>Oral communication</th>
<th>Numeracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>analyse</td>
<td>access information</td>
<td>complete workplace reports/forms</td>
<td>ask and respond to questions</td>
<td>calculate</td>
</tr>
<tr>
<td>apply</td>
<td>check invoices, job sheets, job cards</td>
<td>document faults</td>
<td>check and clarify instructions</td>
<td>calibrate</td>
</tr>
<tr>
<td>new and different situations and contexts</td>
<td>comply with standard operating procedures (SOPs)</td>
<td>enter information on forms</td>
<td>clarify job requirements</td>
<td>check/read gauges</td>
</tr>
<tr>
<td>assess and respond</td>
<td>categorise</td>
<td>follow reporting procedures</td>
<td>fill in forms</td>
<td>communicate clearly</td>
</tr>
<tr>
<td>assess and implement</td>
<td>contribute to planning</td>
<td>gather information</td>
<td>label or mark products</td>
<td>confirm accuracy</td>
</tr>
<tr>
<td>coordinate</td>
<td>identify and follow guidelines</td>
<td>log problems</td>
<td>consult personnel</td>
<td>estimate</td>
</tr>
<tr>
<td>demonstrate understanding</td>
<td>interpret procedures</td>
<td>maintain accurate work records</td>
<td>contribute to meeting</td>
<td>extract information from graphs</td>
</tr>
<tr>
<td>determine required action</td>
<td>relevant job specs obtained</td>
<td>modify plan</td>
<td>describe cause of fault</td>
<td>identify costs</td>
</tr>
<tr>
<td>identify nature and scope of task</td>
<td>obtain data</td>
<td>prepare report</td>
<td>explain procedures</td>
<td>interpret data/drawings</td>
</tr>
<tr>
<td>identify a problem</td>
<td>read procedures</td>
<td>record information</td>
<td>following verbal instructions</td>
<td>maintain records of test results</td>
</tr>
<tr>
<td>interpret and apply</td>
<td>read and interpret specifications, SOPs</td>
<td>report</td>
<td>give and receive feedback</td>
<td>measure for conformance to specs</td>
</tr>
<tr>
<td>monitor</td>
<td>select appropriate forms</td>
<td>write workplace forms</td>
<td>give clear instructions</td>
<td>measure components</td>
</tr>
<tr>
<td>organise information</td>
<td>signs and symbols understood</td>
<td>inform team leader</td>
<td>mix chemicals</td>
<td></td>
</tr>
<tr>
<td>plan and sequence operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>problem solve</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>predict consequences</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>prioritise tasks</td>
<td></td>
<td></td>
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<tr>
<td>recognise and adapt</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>respond to</td>
<td></td>
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<tr>
<td>review and modify</td>
<td></td>
<td></td>
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<tr>
<td>select the appropriate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>show initiative</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>take corrective action</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>take appropriate steps</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>take responsibility for own work</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>transfer skills and knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>undertake work autonomously</td>
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</tr>
</tbody>
</table>

**Numeric/mathematical terms may include:**

- angles
- area
- charts
- coordinates
- dials
- dimensions
- drawings
- equipment
- formulae
- geometry
- graphs
- measuring instrument
- mass
- parameters
- pressure
- specifications
- speeds
- temperature
- tolerances
- voltage
- volume
Examples of trigger words identifying core skills in units of competency

<table>
<thead>
<tr>
<th></th>
<th>Elements and PCs</th>
<th>Required skills &amp; knowledge</th>
<th>Evidence Guide</th>
<th>Range Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan and sequence operations</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Express reasons for selecting a particular type of equipment</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apply the competency in new and different situations and contexts</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Select and use problem solving strategies</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review effectiveness of plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify sequence of activities</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take appropriate corrective action</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Reading</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read, interpret and follow information on written job instructions and specifications</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Determine outcomes from the interpretation of job instructions</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Interpret technical drawings <em>(also numeracy)</em></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Check components for conformance to specification <em>(also numeracy)</em></td>
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</tr>
<tr>
<td>Use standard operating procedures (SOPs)</td>
<td></td>
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<tr>
<td>Interpret and understand engineering drawings <em>(also numeracy)</em></td>
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<td></td>
</tr>
<tr>
<td>Follow materials preparation instructions <em>(also oral communication)</em></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Writing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enter routine and familiar information onto proformas</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Record production data</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Maintain operating log</td>
<td></td>
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<td>X</td>
<td></td>
</tr>
<tr>
<td>Report changes and adjustments in accordance with SOPs</td>
<td></td>
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<td>X</td>
<td></td>
</tr>
<tr>
<td>Complete all reports and documentation correctly to required specifications</td>
<td></td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Oral communication</strong></td>
<td></td>
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<td></td>
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<tr>
<td>Check and clarify task-related information</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Obtain and clarify specifications and procedures</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Instruct machine operators</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Follow oral instructions</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Report machine malfunctions <em>(also writing)</em></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Numeracy</strong></td>
<td></td>
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<td></td>
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<tr>
<td>Obtain measurements accurately</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimate expected results, including rounding off</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use instruments, such as dial test indicators and read-out equipment</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Check components for conformance to specification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use precision measurement equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculate coordinates for machining functions</td>
<td></td>
<td></td>
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<td>X</td>
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<td>Check dimensions and tolerances; geometry and tolerances</td>
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<td>Calculate spinning speeds</td>
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Using the ACSF to determine the numerical concepts in a unit of competency

In reading this section, it is recommended that you refer to the ACSF available from the Department of Innovation, Industry, Science, Research and Tertiary Education (SIISRTE) website:


The ACSF contains information that as a trainer, you can use to assist in supporting apprentices with numeracy issues. By referring to the different levels, you are able to gain an understanding of what an apprentice at that level should be able to do and the mathematical concepts that they should be able to use.

**Numerical concepts at ACSF level 4**

For example, at numeracy level 4, an apprentice should be able to:

- extract and evaluate the mathematical information embedded in a range of tasks and texts
- select from, and apply, an expanding range of mathematical and problem-solving strategies in a range of contexts
- use a range of informal and formal oral and written mathematical language and symbols to communicate mathematically.

Among the concepts that an apprentice should be able to use are:

- fractions, decimals and percentages, including their equivalent values
- ratio, rates and proportions
- positive and negative numbers
- numbers expressed as powers (e.g. \(2^3\) or \(3.6 \times 10^3\))
- routine formulae and algebraic representations and conventions
- 2-D and 3-D shapes, including compound shapes
- detailed maps and plans
- statistical data in complex tables and spreadsheets, graphs, measures of central tendency, simple measures of spread and common chance events.

The apprentice should be able to:

- use and apply relevant ratio, rates and proportions (e.g. scales on maps and plans) in the mixing of chemicals or ingredients, or calculating magnification factors
- calculate with fractions, decimals and percentages and flexibly use equivalent forms; calculate with relevant positive and negative numbers; and use numbers expressed as roots and powers (e.g. \(2^3 = 8\), \(\sqrt{4} = 2\) or \(3.6 \times 10^3 = 3,600\))
• develop, interpret and use routine formulae and algebraic representations and conventions that describe relationships between variables in relevant contexts (e.g. in sport, when considering the cost of repairs, in calculating routine area and volume) using Pythagoras’s theorem or in using workplace formulae.

As previously mentioned, the ACSF describes five core skills, each with five levels of performance. The level of performance describes what a person should be able to do at that level.

Numeracy involves understanding and applying mathematical skills. It also involves drawing on knowledge of the context in deciding when to use mathematics, extracting the mathematical information from the context and choosing the appropriate mathematics to use. Numeracy requires reflecting on and evaluating the use of the mathematics, and being able to represent and communicate the mathematical results.

**Numeracy indicators**

An adult's numeracy performance is described against three performance indicators.

- The first numeracy indicator addresses the identification of mathematical information and meaning in activities and texts.
- The second numeracy indicator addresses the use and application of mathematical knowledge and problem-solving processes across a range of mathematical skill areas.
- The third numeracy indicator addresses the way informal and formal language, symbolic and diagrammatic representations and conventions of mathematics are used to communicate.

(ACSF 2012 p. 125)

At each level, there are specific Indicator statements. It is important to remember that these statements describe the skills and knowledge that the apprentice should have at the completion of training at that level. This concept is similar to the underpinning concepts of competency-based training which is that the Elements and Performance Criteria in a unit of competency describe what the apprentice needs to be able to do once they have been assessed as ‘competent’.
The ACSF in use

Each numeracy tool in the tool kit is organised with activities that move sequentially from ACSF level 1 to level 3 (or level 4 in some tools). As the trainer you are able to guide the apprentice’s skill development according to their individual needs.

Example

If you look at the focus area ‘Complexity of mathematical information’ at ACSF level 1 – the apprentice needs to be able to:

- Locate and recognise:
  - whole numbers and money into the 100, and halves
  - digital time, including am/pm and familiar dates
  - familiar 2-D shapes and objects, such as triangles, squares and circles
  - basic and familiar metric measurements and quantities
  - simple and familiar oral directions
  - simple data in highly familiar, simple graphs and tables.

The tool ‘Working with shapes’ is designed so that you are able to step the apprentice through the development of complex mathematical concepts by moving from familiar 2-D shapes, such as triangles, squares and circles to more complex shapes, such as compound shapes. This will enable you to build the apprentice’s ability to break down compound shapes into their component shapes.

Mathematical knowledge and skills

The ACSF also provides guidance in that it specifies the skills and knowledge that an apprentice at each level should have.

At level 1, for example, an apprentice should have the following skills and knowledge in relation to measurement and geometry:

- recognise and compare familiar shapes and objects in relation to size and shape
- recognise and compare familiar basic metric measurements and quantities, such as length, mass, capacity/volume, time and temperature (e.g. personal height and weight, a litre of milk or vehicle height clearances)
- give and follow simple and familiar oral directions, including using highly familiar maps/diagrams.
At level 4, an apprentice should have the following skills and knowledge in relation to measurement and geometry:

- use knowledge about space and shape, including angle properties, symmetry and similarity to describe, draw or construct relevant common 2-D and 3-D shapes, such as compound shapes
- estimate, accurately measure and calculate quantities, including areas and volumes, using relevant routine formulae
- convert within the metric system and between metric and non-metric units
- use, calculate and interpret information based on maps and plans, including scales, bearings, travel distances, speeds and times, and time zones.

Scenario I

If the apprentice is working at ACSF level 1 for numeracy, there is quite a skill gap that needs to be bridged.

The ACSF also provides you with guidance on how best to approach support for the apprentice at this level.

The information that provides guidance around how the apprentice learns at each level can be found in the Indicator 10: Using and applying mathematical knowledge and problem solving processes.

For example, at ACSF level 1, the apprentice relies heavily on hands-on (concrete) and real-life materials, personal experience and prior knowledge to make sense of the numerical concepts and activities presented.

By using practical activities which involve identifying and comparing basic shapes in the apprentice’s workplace, the apprentice will become familiar with terms, such as square, triangle and circle, and also will know that the size of or the material that the object is made of makes no difference to the properties of the 2-D object.

Domains of communication

Another area that can provide you as the trainer with guidance in providing assistance to an apprentice to progress their numeracy skills is in the domains of communication section. This section contains sample activities. Due to the broad nature of the ACSF, the sample activities are generic and not contextualised to the metal and engineering workplace. As a guide to the type of activities that could be undertaken, they can be adapted easily to provide industry-specific examples.

For example, in Workplace and employment at ACSF numeracy level 2, the sample activity:

- measures familiar and predictable quantities using simple and routine measuring instruments and units
could be an activity where the apprentice has to measure and cut 10 pieces of steel rod 200 mm long from a steel rod that is 2.4 m in length.

**How to use the tool kit**

Each tool kit consists of a workplace scenario or task and tools that support the development of the underlying numeracy skills required to solve the problem contained in the scenario or task.

The trainer is guided through breaking down the scenario or task to identify the underlying numeracy skills. For each numeracy skill identified in the scenario or task, there is a corresponding tool to support the trainer who is working with an apprentice to improve their numeracy skills.

It is important to note that each apprentice is an individual and as such, there may be a range of numeracy skill needs that present within a group of apprentices.

Content in these tools has been developed to assist trainers to provide apprentices with background information for the task requiring numeracy knowledge, worked examples and practical activities to be able to carry out the task. The worked examples use very small steps to develop the apprentice’s understanding.

Depending upon the ability of the apprentice to learn independently, as the trainer you may want to use these tools as a self-paced set of materials.

Each tool can be used independently. However like the ACSF, the tools build on each other. It is recommended that the ‘*Working with decimals*’ be considered the ‘first’ tool in the kit. If the apprentice has a sound understanding and skill in working with decimals, the concepts in the other tools will be easier to master.
**Pre-training indicator tools**

Indicator tools have been developed to assist you to identify an apprentice’s literacy and numeracy strengths and gaps.

**NOTE:** The tools are indicators only. Formal assessments of an apprentice’s LLN needs should only be undertaken by qualified LLN assessors. In large registered training organisations (RTOs) such professionals may be found in the Learning Support Unit. If you are based in a smaller RTO without a Learning Support Unit, it may be necessary to refer the apprentice to a specialist service provider.

These tools are NOT tools that assess an apprentice’s LLN level. Rather they are guides for you to use to assist in identifying when an apprentice has a literacy and numeracy skills gap and to give some indication of where that gap is.

Once an apprentice’s strengths and gaps have been identified, you will be able to make informed decisions around program planning and assessment which will support course completions. If a large number of the cohort has significant gaps, it would be worth talking to a LLN specialist who can collaborate with you to work with your learners.

To successfully complete an apprenticeship, an apprentice needs to also be able to read and interpret documents such as job sheets, specifications and standard operating procedures. Even tasks that predominantly involve numeracy skills require some literacy skills. In some cases, an apprentice may appear to be having difficulties with numeracy when the underpinning issue may relate to literacy (or there may be a vision impairment). It is important that as a trainer, you approach providing support from a holistic perspective.

The literacy indicator tool has been included because in workplace practice, literacy and numeracy skills are often used in conjunction with one another.

**Using the indicator tools to guide support**

The indicator tools can be used as a guide to the amount of support that an apprentice might need.

The purpose of the indicator tool is to assist you to identify apprentice’s strengths and gaps so that you can plan and deliver training and assessment that explicitly addresses the literacy and numeracy skills gaps as part of the achievement of vocational competency.

If individual apprentices have significant gaps, you may need to provide additional support for them to develop the foundation skills required or involve a LLN specialist.

The indicator tools consist of two sections:

- Section A: For the trainer
- Section B: For the apprentice
Section A is a feedback sheet in which there are the answers to the activities in Section B, together with the steps that an apprentice should demonstrate to achieve the answer.

Section B contains several activities for the apprentice to complete. These activities have been contextualised to typical workplace tasks that the apprentice would undertake.

The process used to obtain the answer is as important as arriving at the correct answer. Therefore it is important that the apprentice also records how they arrived at the answer as well as the answer. This can assist you to identify where the apprentice has a skills gap.

Each activity has been mapped to the ASCF. By looking at the ACSF level of the activities that the apprentice has completed, you will have an indication of the level at which the apprentice is comfortable/able to work at.

Another indicator of skills gap can be gauged by looking at which activities the apprentice has completed. For example, in the Numeracy Indicator Tool for the Certificate III in Engineering – Fabrication Trade, the apprentice may have completed all the activities except the activities relating to calculations. This would indicate to you that the apprentice needs assistance in building their skills around doing calculations.

The tools have a recommended timeframe in which the apprentice should be able to complete the activities. The timeframe is based on the average time it would take an apprentice who is fluent with numeracy to complete the activities. An apprentice who takes longer than the average time may have the numeracy skills but lack fluency in the use of those skills.
How to use the numeracy tools

Each tool has been designed to support vocational trainers working with apprentices to develop their numeracy skills and focuses on a specific area of numeracy. Tools should be contextualised to match the workplace of the apprentice and the sample activities framed within a workplace context.

Apprentices may often question why they need to perform certain calculations manually rather than using a calculator. Some examples of times when it is useful to be able to perform manual calculations are:

- the battery in the calculator is flat
- the apprentice left the calculator at home
- the answer on the calculator looks ‘wrong’.

As a trainer, you will be able to provide other examples relevant to the apprentices’ workplace.

The numeracy examples for each task have been designed in small incremental steps to assist the apprentice to build up to the final answer. It is intended that there is no assumed knowledge. The tool may, where appropriate, point to foundation numeracy topics which can be found on the MSA website. The tools may also support numeracy units from the Foundation Skills Training Package.

Sample activities are provided as practice for the numeracy task. These can be completed by the apprentice either with support from the trainer or alone. Worked answers are provided for each activity at the rear of the tool to assist the trainer to monitor the apprentice’s understanding and progress.

A word list has been provided to support the pre-teaching and/or review of specific numeracy terms. As the trainer you may want to provide your own definition of these words and/or add other words as required. You may also use the word list to encourage the apprentice to develop their own definitions which will assist in demonstrating their understanding of the numerical concepts being developed.

You may use additional activities or replace the sample activities with activities relevant to the apprentice. In some instances, you may want to focus on a particular area in which the apprentice is experiencing difficulty.

For the more advanced apprentice, this tool could be provided as a self-paced learning resource.
**Functions are indicated by the following icons**

- **Information**
  - Information is provided that is relevant to the concepts, activities or workplace that the apprentice is engaged in.

- **Why we do this**
  - ‘Why we do this’ offers the apprentice an explanation regarding the relevance of the knowledge, skill or activity to the work they are engaged in.

- **Fact**
  - A true statement.

- **Example**
  - An example of a function or calculation. Worked examples are given to assist the trainer to break down the steps involved in an activity. Initially an apprentice whose numeracy skills are not fluent will need to be guided through each step. As the apprentice develops fluency in their numeracy skills, they will begin to skip steps.

- **Hint**
  - A hint that can make things easier. Hints are an important part of the learning process for apprentices as they usually are based on the trainer’s own experiences.

- **Proposed activity**
  - A proposed theoretical activity for apprentices. This activity is designed to embed the underpinning mathematical concepts needed to complete a task.

- **Use a calculator**

- **Do not use a calculator**

- **Hands-on activity**
  - Hands-on activity for apprentices. This activity is designed to engage the apprentice in a practical activity that consolidates conceptual learning.
The icons are designed to make navigating the tools easier for both yourself and the apprentice.

**Related resources**

The following related resources have been reviewed and are highly recommended for use by both the trainer and the learner.

**Product:** Starting Trade Maths  
**Product owner:** Australian Government – Department of Education, Employment and Workplace Relations  
**Developer:** Gipps TAFE  
**Where to purchase:** Central Gippsland Institute of TAFE  
Phone: +61 3 5127 0213  
Cost: $15.00 per CD plus delivery  
**Resource type:** Interactive CD

**Product:** 905 Fabrication – A flexible learning Toolbox  
**Product owner:** Australian Government – Department of Industry, Innovation, Science, Research and Tertiary Education  
**Developer:** TAFE SA Adelaide South, Adelaide City Campus  
**Where to purchase:** eWorks  
Tel: +61 3 9661 8700  
Fax: +61 3 9661 8799  
Email: enquiries@eworks.edu.au  
Web: www.eworks.edu.au  
Cost: $440 per Toolbox  
**Resource type:** Interactive web-based resource

**Note:** You will need to sign in to be able to access this toolbox.