

Numeracy By Measure

Building the Workplace Measurement Skills
of VET Practitioners



Health Monitoring

BODY MEASURES

Many jobs require workers to work with measurements. Measurement underpins the success and welfare of a modern workplace and touches almost every part of working life. To develop and sell products and services, to manage quality and safety, and to enhance productivity workplaces need to measure processes, products and performance.

The example used in this Snapshot is a job task performed by personal care workers in residential aged care facilities. The job task involves taking measurements to monitor the health of residents. It includes understanding and working with a range of measures, including blood pressure, pulse rate, respiration rate, time and temperature.

The numeracy skills required include the ability to read, interpret and understand the mathematical information in written instructions and specifications (and/or oral if instructions are also given verbally) – the

application of ACSF numeracy indicator .09, *identifying mathematical information and meaning in activities and texts*.

The numeracy skills also include the ability to use and apply a range of mathematical skills to undertake the task, including using tools to measure and then compare the results with specified tolerances – the application of ACSF numeracy indicator .10, *using and applying mathematical knowledge and problem solving processes*.

The numeracy skills also include the ability to record measurements and communicate orally with supervisors and residents – the application of ACSF numeracy indicator .11, *communicating and representing mathematics*.

Workers responsible for undertaking such measurement tasks must also have a range of other complementary skills, such as the skills to work safely (follow safety procedures and identify and report hazards)

and the skills to follow workplace procedures (identify what must be measured and what tools to use, how often and when, where and how it needs to be recorded, identify the need to take action

and take appropriate action). Other skills may include those needed to explain measurement information to other workers, supervisors or residents.

THE CONTEXT

A personal care worker needs to be able to monitor the health of residents and record and report the results. A screen shot of an application used by workers to enter digital data is shown on the next page. It illustrates the types of measurement information involved.

The ability to use and interpret measurements using the following tools is needed to complete this task:

- A blood pressure monitor for measuring blood pressure and pulse.
- A watch or clock for measuring respiration rate.
- A thermometer for measuring body temperature.

The image shows a mobile application interface for a 'New Entry' form. The form is titled 'New Entry' and has a 'Save' button. It contains several input fields for patient data, each with a corresponding label and a value. The labels and values are as follows:

Label	Value
Date	20 May 2013 11:30
BP (mmHg)	135 / 70
Pulse (bpm)	49
Resp	30
Temp	36.7
Notes	

Annotations with arrows pointing to the form fields:

- Time** (orange box) points to the Date field.
- Pulse** (green box) points to the Pulse (bpm) field.
- Respiratory rate** (purple box) points to the Resp field.
- Blood pressure** (blue box) points to the BP (mmHg) field.
- Temperature** (red box) points to the Temp field.

Image used with permission of Management Advantage.

ACSF NUMERACY MAPPING

The process of mapping the numeracy skills demands of a job task to the ACSF is imprecise. That is, there is no absolute right or wrong. Professional judgement is needed. Consult the ACSF as you reflect on the numeracy skills mapping presented in this Snapshot. Do you follow and agree with the logic? What is your reasoning?

This task maps to **ACSF numeracy level 3**, with the mathematical content mainly related to the focus area *Mathematical knowledge and skills: measurement and geometry*. Knowledge of rates (pulse and respiration) is also required and they are described in the focus area *Mathematical knowledge and skills: number and algebra*, at ACSF numeracy level 3. A worker needs to be at **exit** numeracy level 3 to successfully and competently undertake a task such as this – that is, they need to be working at ACSF numeracy level 4.

At level 3, the first indicator specifies that tasks at this level require the interpretation of mathematical information that ‘may be partly embedded in a range of familiar, and some less familiar, tasks and texts’. This is true in this case as a worker working in the aged care industry will find these measurements familiar. However, the skills are applied across a range of different contexts and measures. Similarly, the second indicator describes the mathematical application aspects as using ‘a variety of developing mathematical and problem solving strategies’ while the third indicator describes the use of ‘a combination of both informal and formal oral and written mathematical language and representation’.

To undertake the whole task requires the understanding and application of a range of measures and measurement activities focused on health monitoring. Individually some of the components of the tasks are at level 2, for example reading the values of measurements such as blood pressure, pulse and respiration rates which are only represented as whole numbers into the hundreds. However, as the job task demands the combination of a range of measurement and mathematical skills and their application across a number of different but related processes, it requires using higher level skills aligned to level 3. In particular this applies to the second indicator and the application of a range of mathematical and problem solving strategies. These are summarised in the table on the next page.

ACSF numeracy indicator .10, *using and applying mathematical knowledge and problem solving processes*

At ACSF numeracy level 2 this includes:

- Selects and uses appropriate familiar mathematical problem solving strategies to solve problems in familiar contexts

Relies substantially on hands-on (concrete) and real life materials, personal experience and prior knowledge to:

- make estimations and check reasonableness of processes and outcomes in relation to the context

At ACSF numeracy level 3 this includes:

- Selects from and uses a variety of developing mathematical and problem solving strategies in a range of familiar and some less familiar contexts

Draws on a combination of hands-on, in-context materials, personal experience, mathematical and other prior knowledge to:

- use developing estimation, and other assessment skills, to check and reflect on the outcome and its appropriateness to the context and task

At level 2 the specification of skills is limited. At level 3, however, there is the need to be able to select from and use a 'variety of developing mathematical and problem solving strategies' and 'to check and reflect on the outcome and its appropriateness to the context and task'. This job task requires mathematical knowledge and understanding to assist problem solving and reflection abilities in order to read and interpret the health data correctly and accurately – a resident's health and well-being is dependent on this. Therefore, although there are some elements that map to level 2, collectively the requirements align to ACSF numeracy level 3.

The following pages illustrate and explain the unpacking and mapping of four of the measurement skills required in this task (blood pressure, pulse rate and respiration rate, time, and temperature) to the relevant ACSF numeracy indicators, focus areas and performance features.

BLOOD PRESSURE

Blood pressure is the pressure of the blood in the arteries as it is pumped around the body by the heart. Blood pressure is usually measured by wrapping an inflatable pressure cuff around the upper arm. The measuring instrument is called a blood pressure monitor or a *sphygmomanometer*.



Blood pressure is recorded as two numbers, such as 147/96 as shown above on the blood pressure monitor readout or 135/70 as shown below.



The larger number indicates the pressure in the arteries as the heart pumps out blood during each heartbeat. This is called the systolic blood pressure. The lower number indicates the pressure as the heart relaxes before the next heartbeat. This is called the diastolic blood pressure. A person's blood pressure is usually expressed in terms of the systolic pressure over diastolic pressure and is measured in millimetres of mercury (mm Hg).

This is seemingly a straightforward job task as the numbers used in the measurement are whole numbers up into the hundreds. However, the understanding of blood pressure, the units and measurement used and the accurate interpretation of the pressure measurements are crucial. This job task is therefore ACSF numeracy level 3.

The information in the following table shows how the measurement of blood pressure applies to this job task and aligns to ACSF numeracy level 3.

ACSF numeracy indicator 3.09	
Focus areas and performance features	Comment
<p>Explicitness of mathematical information</p> <ul style="list-style-type: none"> Interprets and comprehends a range of everyday mathematical information that is embedded in familiar and routine texts <p>Complexity of mathematical information</p> <ul style="list-style-type: none"> Interprets and comprehends familiar and routine measures <p>ACSF performance variables for level 3 state:</p> <ul style="list-style-type: none"> Includes some specialised vocabulary Some specialisation in familiar/known contexts 	<p>The worker needs to be able to read and understand blood pressure measurements and the terminology used. They must also interpret the permissible safe ranges for blood pressure – which is based on a pair of values, not just a single value, making it more complicated than a standard, common measure.</p> <p>The units of millimetres of mercury (mm Hg) are themselves not familiar and simple as described at level 2, but are also not quite as complex as described at level 4: ‘extracts, interprets and comprehends a range of mathematical information that is embedded in relevant but possibly unfamiliar or non-routine texts’. Although the measure and its units are not standard or common units, they are routine and familiar to workers who use them on a daily basis.</p> <p>Similarly, the performance variables at level 3 specify that the context and materials encountered include some level of specialisation and the units for blood pressure fall into this category.</p>

ACSF numeracy indicator 3.10	
Focus areas and performance features	Comment
<p>Problem solving processes including estimating and reflecting</p> <ul style="list-style-type: none"> Select appropriate methods of solution from a limited range of mathematical processes Use developing estimation, and other assessment skills, to check and reflect on the outcome and its 	<p>The task includes both use of appropriate tools and accurate measurement of blood pressure.</p> <p>The worker needs to clearly understand blood pressure and the units of measurement used, and also accurately interpret the readings taken. A crucial part of the job task is to check and reflect on the result and act in one way or another depending on whether the values taken meet expected safe</p>

ACSF numeracy indicator 3.10	
Focus areas and performance features	Comment
<p>appropriateness to the context and task</p> <p>Mathematical methods and use of tools</p> <ul style="list-style-type: none"> Selects and uses appropriate tools, hand held devices, computers and technological processes <p>Mathematical knowledge and skills: measurement and geometry</p> <ul style="list-style-type: none"> Measures, estimates and calculates 	<p>values for each resident. This is described at level 3 in the expression 'to check and reflect on the outcome ...'</p>

ACSF numeracy indicator 3.11	
Focus areas and performance features	Comment
<p>Written mathematical language</p> <ul style="list-style-type: none"> Uses a combination of both informal and formal written mathematical language and symbols and general language to document and report on the mathematical and problem solving process and results <p>Oral mathematical language</p> <ul style="list-style-type: none"> Uses a combination of both informal and formal oral mathematical and general language to present and discuss the mathematical and problem solving process and result <p>Complexity of mathematical symbolism, representation and conventions</p> <ul style="list-style-type: none"> Uses a combination of both formal and informal symbolism, diagrams, graphs and conventions relevant to the mathematical knowledge of the level 	<p>The worker needs to be able to record blood pressure information and also discuss the results and how they were obtained with supervisors and residents using some specialised terminology expected at level 3.</p>

PULSE RATE AND RESPIRATION RATE

Pulse rate or heart rate is the number of times a person's heart beats per minute (bpm). Pulse is sometimes measured using a device like the above *sphygmomanometer* and the values taken from the device readout. However, pulse can also be measured manually.

Manual pulse rate measurement involves two procedures both requiring mathematical calculations. If a patient has a regular pulse, the worker needs to count the number of heartbeats in 15 seconds and multiply that number by four to get the number of heartbeats per minute. If the patient has an irregular pulse, then the heartbeats need to be counted for a full minute to get the number of heartbeats per minute. In either case, the use of a digital or analogue timer is required.

Respiration rate is measured as the number of breaths taken in one minute. It is measured when a resident is at rest and involves counting the number of times their chest rises and falls in one minute. The number of breaths in 15 seconds is usually counted and multiplied by four to get the number of breaths per minute.

Measuring both these rates requires the use of a timer such as a clock or watch. The worker needs to be able to read the appropriate measure of time accurately, calculate the pulse and respiratory rates and record them correctly. In this example the results are recorded as shown below.

Pulse (bpm)	49
Resp	30

The information in the following table shows how pulse rate and respiration rate measurement in this context align to ACSF numeracy level 3. The requirements regarding time measurement are outlined in a following section.

ACSF numeracy indicator 3.09	
Focus areas and performance features	Comment
<p>Explicitness of mathematical information</p> <ul style="list-style-type: none"> Interprets and comprehends a range of everyday mathematical information that is embedded in familiar and routine texts <p>Complexity of mathematical information</p> <ul style="list-style-type: none"> Interprets and comprehends familiar and routine measures 	<p>The worker needs to be able to read and understand the meaning and measurement of the two rates. Rates are described at level 3. For workers working in aged care this mathematical information is everyday, familiar and routine, even if it is not necessarily so for others outside the industry.</p>

ACSF numeracy indicator 3.10	
Focus areas and performance features	Comment
<p>Problem solving processes including estimating and reflecting</p> <ul style="list-style-type: none"> Select appropriate methods of solution from a limited range of mathematical processes Use developing estimation, and other assessment skills, to check and reflect on the outcome and its appropriateness to the context and task <p>Mathematical methods and use of tools</p> <ul style="list-style-type: none"> Selects and uses appropriate tools, hand held devices, computers and technological processes <p>Mathematics knowledge and skills: measurement and geometry</p> <ul style="list-style-type: none"> Measures, estimates and calculates time <p>Mathematical knowledge and skills: number and algebra</p> <ul style="list-style-type: none"> Uses and applies rates in familiar or routine situations 	<p>The worker needs to be able to measure, calculate, check and reflect on the rates measured and act in one way or another depending on whether the values taken meet expected values for each individual resident. This is described at level 3 in the expression 'to check and reflect on the outcome ...' with level 2.</p> <p>The worker needs to be able to ascertain whether the pulse rate is regular or irregular and select the most appropriate procedure to use.</p> <p>The calculation and application of the two rates also aligns with level 3.</p>

ACSF numeracy indicator 3.11

Performance features	Comment
<p>Written mathematical language</p> <ul style="list-style-type: none"> • Uses a combination of both informal and formal written mathematical language and symbols and general language to document and report on the mathematical and problem solving process and results <p>Oral mathematical language</p> <ul style="list-style-type: none"> • Uses a combination of both informal and formal oral mathematical and general language to present and discuss the mathematical and problem solving process and result <p>Complexity of mathematical symbolism, representation and conventions</p> <ul style="list-style-type: none"> • Uses a combination of both formal and informal symbolism, diagrams, graphs and conventions relevant to the mathematical knowledge of the level 	<p>The worker needs to record the two rates and discuss the results and how they were obtained with supervisors and residents using some specialised terminology expected at level 3.</p>

TIME

There is a range of numeracy skills requirements expected of the personal care workers that involve the measurement of time. Workers need to be able to read and enter the date and time regularly onto a hand held device. They also need to be able to calculate with time to comply with designated time intervals required between resident monitoring. This includes the ability to read both digital and analogue times and the ability to count forward in time to calculate when next health checks are needed. It includes understanding both AM/PM and 24 hour times. In this example the results are recorded as shown below.



Measuring pulse rates and respiration rates also requires the use of a clock or watch. The worker needs to be able to read off the appropriate measure of time accurately and do the calculations with time to convert the measurements into the appropriate rate representations. There are elements of both level 2 and level 3 in these time measurements and calculations. The following table is a comparison of the levels for time related performance features.

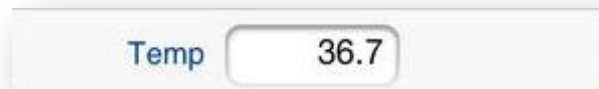
ACSF performance features relating to time	
<p>At ACSF numeracy level 2 this includes the following descriptions about time.</p> <p>Identifies and interprets:</p> <ul style="list-style-type: none"> analogue and digital times and dates <p>Measures and estimates time</p>	<p>At ACSF numeracy level 3 this includes the following descriptions about time.</p> <p>Interprets and comprehends:</p> <ul style="list-style-type: none"> dates and time, including 24 hour times <p>Measures, estimates and calculates time</p>

The comparison shows that the numeracy skill demands relating to time measurement incorporate demands at level 2 but also cross over into level 3 because of the need to be able to calculate with time.

Working through this PD resource will support you to confirm and strengthen your measurement teaching skills.

TEMPERATURE

The understanding and use of temperature measurement is also an important part of health monitoring tasks performed by a worker in aged care. This involves taking temperatures using a thermometer and recording and reporting the results correctly. In this example the results are recorded as shown below.



Again, there are numeracy skill demands across both level 2 and level 3. The information in the table on the next page compares how the measurement of temperature is described in the ACSF at both these levels.

ACSF performance features relating to temperature	
<p>At ACSF numeracy level 2 this includes the following descriptions about temperature.</p> <p>Identifies and interprets:</p> <ul style="list-style-type: none"> familiar and simple temperature measures <p>Measures and estimates temperature</p> <p>Uses a combination of mainly informal and some formal symbolism, diagrams, graphs and conventions relevant to the mathematical knowledge of the level, e.g. °C</p>	<p>At ACSF numeracy level 3 this includes the following descriptions about temperature.</p> <p>Interprets and comprehends:</p> <ul style="list-style-type: none"> familiar and routine temperature measures <p>Measures, estimates and calculates temperature</p> <p>Uses a combination of both formal and informal symbolism, diagrams, graphs and conventions relevant to the mathematical knowledge of the level</p>

Given that body temperature is a relatively common and everyday temperature measurement, the comparison indicates that most of the descriptions for level 2 align closely with the requirements of health monitoring in relation to body temperature measurements. Therefore, the demands of this element of the job task align to ACSF numeracy level 2 and are not as high in relation to ACSF numeracy levels as the other job task elements.

Working through this PD resource places you in the role of the learner.

ABOUT THIS RESOURCE

Numeracy by Measure: Building the Workplace Measurement Skills of VET Practitioners is a professional development resource to support the development of VET practitioner numeracy proficiency skills and numeracy training skills. It has been developed in response to a National Centre for Vocational Education and Research (NCVER) report titled *Seeking the N in LLN*. This report found that there may be a need to increase the capacity of the vocational education and training (VET) workforce to meet the numeracy skills needs of existing workers in Australia. A copy of the full report is available for download at www.ncver.edu.au.

Numeracy by Measure: Building the Workplace Measurement Skills of VET Practitioners includes a [Guide](#) with professional development activities and six Snapshots exploring different workplace numeracy skills based on measurement. This is one of the Snapshots.

Measurement topics covered in the Snapshots include:

- [Bicycle Fitting](#)
- [Cabinet Fitting](#)
- [Health Monitoring](#)
- [Shoe Fitting](#)
- [Smallgoods Packing](#)
- [Tyre Wall Markings](#)

VET practitioners interested in increasing their awareness of numeracy skills in the workplace may also like to access the companion resources [Numeracy in Focus: Building VET Practitioner Awareness of Numeracy in the Workplace](#) and [Numeracy in Practice: Building Workplace Numeracy Proficiency and Training Skills of VET Practitioners](#).

[Numeracy by Measure](#), [Numeracy in Practice](#) and [Numeracy in Focus](#) are available for download from www.oggiconsulting.com/resources/.

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