

NATIONAL VOCATIONAL EDUCATION
AND TRAINING RESEARCH PROGRAM

RESEARCH REPORT

Seeking the N in LLN

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VICTORIA



Australian Government

Department of Industry, Innovation,
Climate Change, Science, Research
and Tertiary Education



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About the research

Seeking the N in LLN

Tina Berghella, Oggi Consulting, and John Molenaar, Manufacturing Learning Victoria

The importance of numeracy skills in particular in the workplace is widely recognised, with both national and international research demonstrating the impact that low numeracy skills have on workplace productivity and an individual's labour market outcomes. And yet very little is known in Australia about the extent of numeracy training required in a workplace, how best to deliver the training and, indeed, whether trainers are sufficiently skilled to deliver numeracy training in a workplace.

This study begins to redress this gap. Focusing on the process manufacturing industries, the qualifications, experience and numeracy skills of 20 language, literacy and numeracy (LLN) specialists and 24 vocational specialists – collectively referred to as VET practitioners – were investigated to determine the capacity of the vocational education and training (VET) workforce to address workplace numeracy needs.

Key messages

- VET practitioners appreciate the importance of numeracy in the workplace. However, a mismatch exists between what is required to address numeracy skills and the current capacity of VET practitioners, in terms of their understanding of numeracy requirements and their qualifications, skills and experience.
- The discrepancy between the perceived and actual numeracy skills, is a clear indicator of this mismatch and demonstrates the importance of both assessing the numeracy skills of those required to deliver numeracy training and knowing the context in which the training is being delivered.

This study was modest in scale and it is possible that it does not represent the skills of VET practitioners more generally. Nonetheless, the weakness of vocational specialists and LLN specialists in the area of numeracy is an issue which the Australian Government's National Foundation Skills Strategy for Adults needs to address.

Tom Karmel
Managing Director, NCVET

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Executive summary

Numeracy skills are a key driver of economic growth and yet, according to the Australian Bureau of Statistics (ABS 2008) nearly eight million Australian adults lack the numeracy skills to cope with everyday life and work. The vocational education and training (VET) sector is one part of the solution; however the VET workforce may be limited by its own skills needs. There is no research available to indicate what the implications are for the delivery of adult numeracy skills training in the workplace and for building the skills capacity of workers to effectively and adequately meet business needs.

This study begins to redress this gap by examining the capacity of the VET workforce to address workplace numeracy skills needs, particularly in the process manufacturing industries, industries that rely greatly on the numeracy skills of its semi-skilled workers. While this study is small, it does raise questions about the capacity of the current VET workforce to address the numeracy skills gaps of existing workers.

The research questions examined were as follows. The term ‘VET practitioner’ is used to refer to language, literacy and numeracy (LLN) specialists and vocational specialists collectively.

- What numeracy teaching qualifications and experience do VET practitioners have?
- To what extent do VET practitioners understand the importance of the numeracy skills of working-aged Australians generally and, specifically, of existing workers in the process manufacturing industries?
- What are the perceived and actual numeracy skills levels of VET practitioners?
- What numeracy skills gaps are preventing VET practitioners from effectively addressing the numeracy skills needs of existing workers in the process manufacturing industries?
- What is the capacity of Australian VET practitioners to address the numeracy skills needs of working-aged Australians?

Both qualitative (self-assessments, focus group discussions, interviews) and quantitative (numeracy assessments) approaches were used. The numeracy assessments comprised an assessment tool developed specifically for the research project. The assessment questions were contextualised to the process manufacturing industries and mapped to the Australian Core Skills Framework (ACSF), with a focus on numeracy levels 3 and 4¹. All data-collection tools are included in the support document.

The sample included 44 VET practitioners from Melbourne and Sydney who deliver workplace-based training. Of these, 20 self-identified as LLN specialists and 24 self-identified as vocational specialists. Participants were approached on the basis of their attendance at state-based Australian WELL² Practitioner Network meetings or as vocational trainers working at registered training organisations active in the delivery of process manufacturing qualifications. Minor differences in skills, qualifications and experiences relevant to adult numeracy training were found between the two groups.

¹ The Australian Core Skills Framework describes performance in five core skills: learning, reading, writing, oral communication and numeracy. Within each core skill there are five performance levels ranging from 1 (low level) through to 5 (high level performance).

² Workplace English Language and Literacy Program.

The research found that participants tended to have a limited understanding of the importance of numeracy in general but demonstrated an interest and a willingness to reflect on it and adapt their thinking. It was further found that participants had a limited focus on workplace numeracy. This was confirmed by participant accounts of their experience in delivering workplace numeracy skills. The numeracy skills delivery that was identified was described by participants as at a 'basic' level. Most LLN specialists reported rare and only incidental delivery of workplace numeracy skills training, while most vocational specialists reported delivering workplace numeracy skills training more often, as specified in the unit requirements within qualifications.

None of the participants had a specialist adult numeracy training qualification, not surprising given that only one qualification, the Graduate Certificate in Adult Numeracy Teaching, was found to be available. Six participants were identified as having an adult training specialisation that included a numeracy component, including one participant with the Vocational Graduate Certificate in Adult Language, Literacy and Numeracy Practice, one with the Advanced Diploma of Language, Literacy and Numeracy Practice in VET and four with an adult basic education qualification. Adult numeracy specialist qualifications are discussed in relation to the United Kingdom's Skills for Life Program, where there is a separate diploma-level qualification for each specialty area, and VET practitioners seeking to qualify as an adult numeracy specialist in the United Kingdom must undertake a numeracy proficiency entry test.

The research draws attention to the unreliability of numeracy self-assessment and consequently the importance of the numeracy testing of trainers, with participants generally overestimating their numeracy skills. Best practice numeracy assessment scoring methods used for this research is questioned with respect to its suitability for determining VET practitioner preparedness in the workplace context.

The analysis of the numeracy assessment data showed that most participants had numeracy proficiency skills levels below the current benchmark in the Vocational Graduate Certificate in Adult Language, Literacy and Numeracy Practice, the nationally recognised qualification applicable to those with responsibility for adult literacy and numeracy training. The benchmark is questioned by the researchers as being too low by comparison with the standard suggested by international research and adopted by the United Kingdom's Skills for Life Program.

The report also explores the differences between numeracy and mathematics, the characteristics of numeracy in the workplace context and the implications for pedagogy and numeracy assessment.

Based on the findings, it appears there is a mismatch between what is required to address numeracy skills needs in the process manufacturing industries and the current capacity of VET practitioners, in terms of their understanding of numeracy requirements, and their qualifications, skills and experience.

Introduction

The correlation between adult language, literacy and numeracy (LLN) skills and economic wellbeing and social inclusion is widely recognised (Green & Riddell 2001; Perkins 2009; Whatman et al. 2009; Carpentieri, Litster & Frumkin 2010). However, the particular importance of numeracy is often underestimated and overlooked (Coben 2004; Ginsburg 2011). Compared with low literacy, low numeracy skills have more impact on labour force productivity and on an individual's working life (Bynner & Parsons 1997; McIntosh & Vignoles 2000; Department for Education and Skills [UK] 2003; Gleeson 2005; Parsons & Bynner 2005; Marr & Hagston 2007; Tout 2008; Shomos 2010). This is a concern, given that nearly eight million Australian adults lack the minimum numeracy skills needed for daily living (ABS 2008; McHugh 2008).

Literacy and numeracy are described as the 'odd couple' (Coben 2004, p.6), with numeracy as the 'poor cousin' (Carpentieri 2008, p.2) or 'poor relation' (Coben 1992, cited in Coben 2004, p.6). The ubiquitous use of the terms 'literacy' and 'LLN' often masks a lack of adult numeracy focus and it is questionable whether adult LLN policy, practice and research include considerations of numeracy (Cummings 1996 cited in Coben 2003). This is not unique to the Australian experience and is reflected in the limited research available on the topic of adult numeracy (Coben 2003; Tout & Schmitt 2003; Carpentieri, Litster & Frumkin 2010).

Mathematics, numeracy and workplace numeracy

There is no single, accepted definition of numeracy (Coben 2003; Gal et al. 2003; Tout & Schmitt 2003; Benseman, Sutton & Lander 2005; American Institutes for Research 2006) but definitions of numeracy commonly include the use of mathematical skills in real life, the use of mathematical skills towards achieving a goal and the ability to communicate about mathematical ideas (Tout & Schmitt 2003).

There is also no common understanding of the relationship between mathematics and numeracy (Coben 2003; Coben 2004), although it is generally accepted that numeracy has context and purpose, and mathematics does not (Ginsburg 2011). The distinction is important (O'Donoghue 2003) because it means they must be taught differently (Tout & Schmitt 2003).

In the workplace an increasing demand for numeracy skills is occurring at all job levels, driven by globalisation, growing competition, changing technologies and increasing industry requirements (Hoyles et al. 2002; Schick 2005). Workplace numeracy involves the application of a range of numeracy skills and incorporates critical thinking and analysis (Marr & Hagston 2007). Numerical tasks considered basic in another context are not necessarily so in the workplace, where, for example, people must work cooperatively to meet budgets, satisfy customers or achieve schedules while meeting compliance requirements (Hoyles et al. 2002; FitzSimons 2005; FitzSimons et al. 2005; Ginsburg 2011). The transfer of numeracy skills between different contexts cannot however be assumed (Coben 2003; Williams & Wake 2007; Wake 2010). Workplace numeracy can also be so highly embedded that it is not recognised, but is simply 'part of the job' (Hoyles et al. 2002; FitzSimons et al. 2005), even when the skills are used frequently. Further, it has sometimes been described as being hidden within workplace systems and tools, only noticed when something goes wrong (Williams & Wake 2007; Wake 2010).

Process manufacturing industries focus

The Australian manufacturing industries are the fourth largest employer in the Australian economy. They employ just fewer than one million people, representing 8.4% of the total Australian workforce (ABS 2012). Just over half (52%) of the existing workers in the Australian manufacturing industry are unable to cope with the numeracy demands of everyday life and work, compared with 44% for the total Australian workforce (ABS 2008).

Process manufacturing is a subset of the manufacturing industry. It employs 13% of Australian manufacturing workers and includes chemical and chemical product manufacturing, polymer product and rubber product manufacturing, and non-metallic mineral product manufacturing (ABS 2012). Typical occupations include machine operators, plant operators and process workers. These occupations have significant numeracy demands, such as the analysis of numerical data to make decisions to meet business-related goals, including, for example, maintaining operations and achieving productivity improvements (Hoyles et al. 2002; Human Resources and Skills Development Canada website 2011).

The Australian Industry Group's National Workforce Literacy Project (Australian Industry Group 2010) found that 45% of employers identified labourers and process workers as those most affected by low-level literacy and numeracy and that the low skills were affecting their businesses.

The national response

The Australian Government has been criticised for not making LLN a priority (Tout & Schmitt 2003; Perkins 2009) and a broad range of stakeholders have called for a national approach (Australian Industry Group 2008; Australian Council for Adult Literacy 2009; Perkins 2009; Australian Industry Group 2010; Hicks 2010; Skills Australia 2010a; Industry Skills Councils 2011; Manufacturing Skills Australia 2011; Skills Australia 2011).

In a political climate of skills crisis discourse, the Australian Government is introducing a range of responses with long-term foundation skills³ targets that encompass adult numeracy, backed by an investment of \$119.2 million over four years (Gillard & Albanese 2010). For example, the 2008 National Agreement on Skills and Workforce Development (Council of Australian Governments 2008a) aims to reduce foundation skills gaps (Steering Committee for the Review of Government Service Provision 2011), while the National Foundation Skills Strategy for Adults, a ten-year national framework, aims for two-thirds of working-age Australians to have literacy and numeracy skills at level 3 or above by 2022⁴ (Council of Australian Governments Standing Council on Tertiary Education Skills and Employment 2012).

VET provision and workplace numeracy

The VET sector offers two main programs to address adult numeracy skills in the workplace.⁵ The most commonly accessed is the Australian Apprenticeships Incentives Program, funded through the Building

³ Foundation skills include the five core language, literacy and numeracy skills (reading, writing, oral communication, learning and numeracy), the eight employability skills (communication, teamwork, problem-solving, initiative and enterprise, planning and organising, self-management, learning and technology) and digital literacy (National Quality Council 2009).

⁴ Refers to the levels in the Adult Literacy and Life Skills Survey (ALLS), undertaken in 2006 by the ABS.

⁵ A significant amount of workplace training is delivered informally within the workplace (Richardson 2004; Australian Industry Group 2008). It is not known how much informal training supports the development of adult numeracy skills.

Australia's Future Workforce Package.⁶ This training is delivered by vocational specialists who, in accordance with National Skills Standards Council (NSSC) policy, must hold a Certificate IV in Training and Assessment or equivalent, relevant vocational competency and undertake continued professional development (National Skills Standards Council 2012). Vocational specialists deliver vocational training while identifying and supporting LLN and employability skills needs. Less commonly accessed is the Workplace English Language and Literacy (WELL) Program,⁷ delivered by LLN specialists who must also meet the National Skills Standards Council policy (Department of Industry, Innovation, Science, Research and Tertiary Education 2012, p.12). LLN specialists provide LLN support integrated with vocational training.

Even though such programs are available, in practice there may not be a significant focus on effectively developing workplace numeracy skills. VET products⁸ are one possible limitation. Numeracy in training packages has been so well integrated that it can be easily overlooked (National Quality Council 2009). This has been described as 'not built in or bolted on, but buried' (Perkins 2008, cited in Roberts & Wignall 2010, p.6). Training package policy is changing to address this issue, but there may also be a need to address VET workforce capacity (Perkins 2009).

What do adult workplace numeracy specialists need?

Ginsburg (2011) argues that the most important contributor to adult numeracy learner progress is a deep level of teacher numeracy knowledge, more so than the level of teaching experience and teaching qualifications. This is supported by international research (Cara & de Coulon 2009) involving 84 numeracy teachers and 237 of their learners, which found that the learners whose teachers possess strong mathematical skills, as evidenced by the possession of a mathematics degree, demonstrate greater progress.

Important in adult numeracy teaching is mathematics anxiety - a condition which makes it difficult for a person to access their working memory and think logically and adversely affects their feelings towards mathematics, affective performance and skill development (Coben 2000; Ashcraft & Kirk 2001; Ashcraft 2002; Ministry of Education, New Zealand Government 2009; Carpentieri, Litster & Frumkin 2010). It is possibly caused by negative learning experiences (Dingwall 2000; Ashcraft 2002; Marr & Hagston 2007).

The reality of mathematics anxiety has implications for pedagogy. Effective adult numeracy delivery requires a facilitating and questioning approach that challenges and engages learners, focuses on meaning, context and real-world examples (Dingwall 2000; FitzSimons et al. 2005; Swain et al. 2005; Tout & Motteram 2006; Ministry of Education, New Zealand Government 2009; MPR Associates & US Department of Education, Office of Vocational and Adult Education 2011), employs adult learning principles (Tout & Schmitt 2003) and promotes a positive attitude towards numeracy (Ministry of Education, New Zealand Government 2009). Unfortunately, without training in adult numeracy pedagogies, teachers tend to teach the way they were taught mathematics at school, in a procedural manner lacking underpinning concepts and using mathematics text books, rote-based rule learning, mathematics tests and minimal contextualisation (Tout & Schmitt 2003; Marr & Hagston 2007; Carpentieri, Litster & Frumkin 2010).

⁶ The Building Australia's Future Workforce Package has allocated \$3 billion over six years to skills and training initiatives to support workforce participation and the development of a skilled workforce (Gillard & Albanese 2010).

⁷ In 2009–10 the WELL Program serviced approximately 16 500 employees, a figure representing less than 1% of Australia's four million working population (Skills Australia 2010a).

⁸ VET products include both training packages and accredited courses.

In the workplace numeracy has a specific purpose, complexity, level of accuracy, importance of context, complementary skills demands and skills and knowledge transfer demands (Hoyles et al. 2002; FitzSimons et al. 2005; Marr & Hagston 2007; Council of Australian Governments 2008b). Townsend and Waterhouse (2008) observe that it would be incorrect to assume that VET practitioners know how to deliver training integrated into workplaces, while industry skills councils note that there are many LLN specialists with classroom-based context experience but no workplace context experience (Industry Skills Councils 2011, p.20).

VET workforce capability

Research into broader VET workforce capabilities (Perkins 2009; Skills Australia 2010b; Wheelahan & Moodie 2010; Industry Skills Councils 2011) and LLN specialist workforce capabilities (Berghella, Molenaar & Wyse 2006a; Mackay et al. 2006) identifies increasing skills needs. A recent Productivity Commission research report found that ‘the VET workforce will increasingly need to assist a significant proportion of VET learners who have poor foundation skills, but many trainers and assessors might be found wanting in delivering to these groups’ (Productivity Commission 2011, p.xliii). Specific to numeracy, the Mathematical Association of Victoria believes that the VET workforce does not have adequate numeracy skills and knowledge (Tout 2010).

The title of LLN specialist brings with it an implicit assumption that he or she is skilled and experienced in adult numeracy delivery. However, Innovation and Business Skills Australia (IBSA) found that LLN specialists often lack the capacity to contribute to the development of numeracy skills (Innovation and Business Skills Australia 2010c). A 2006 study of WELL practitioners found they were recruited for their language and literacy specialisations, not numeracy (Berghella, Molenaar & Wyse 2006a) and very few WELL practitioners are adult numeracy specialists (Berghella, Molenaar & Wyse 2006b). International studies also raise concerns about a lack of adult numeracy specialists with content and pedagogical skills and knowledge (Dingwall 2000; Hinds 2009; Bickerton 2011; Ginsburg 2011; MPR Associates & US Department of Education, Office of Vocational and Adult Education 2011; Southwood 2011).

The assumption that LLN specialists are adult numeracy specialists underpins LLN initiatives. For example, Perkins suggests the recruitment of experienced LLN specialists to coach inexperienced LLN specialists (Perkins 2009). There are also moves to raise the LLN awareness of non-LLN specialists with referral to LLN specialists for support (Skills Australia 2010a; Industry Skills Councils 2011; Council of Australian Governments Standing Council on Tertiary Education Skills and Employment 2012). In addition, there is increasing support for team-teaching approaches, whereby a vocational specialist is paired with an LLN specialist, who provides numeracy pedagogical and content advice (Casey et al. 2006; Whatman et al. 2009).

Australia can learn from other countries that have attempted to recognise and address adult numeracy skills needs. The United Kingdom’s Skills for Life Strategy, launched in 2001 and updated in 2009, is an all-of-government strategic framework and major investment in adult LLN skills development supported by research, policy and practice⁹ (Department for Innovation, Universities and Skills [UK] 2009). Skills for Life numeracy teachers hold an adult teaching qualification and a

⁹ The United Kingdom invested £5.0 billion in the Skills for Life Strategy between 2001 and 2010 (National Audit Office 2008). Skills for Life activities include national standards and curriculum for LLN, service delivery across a range of settings, investment in resources and teacher training and the National Research and Development Centre for Adult Literacy and Numeracy (NRDC), which conducts research and development projects to improve LLN and related skills and knowledge.

numeracy subject specialisation diploma (Lifelong Learning UK 2007b). Course entry is subject to a numeracy proficiency entry test (Lifelong Learning UK 2007a) and the course only teaches numeracy pedagogies. An approximate mapping¹⁰ of an exemplar entry test (QIA Skills for Life Improvement Programme 2008) indicates that it incorporates tasks at Australian Core Skills Framework levels 4 and 5¹¹ (Tout, pers. comm., 12 December 2011). An inability to meet the entry requirement is the main reason for prospective and current adult numeracy teachers being refused a place on the course, with the United Kingdom since implementing numeracy proficiency bridging courses to assist prospective course participants to build their numeracy proficiency skills (Cara, Casey & Mallows 2010). Reviews of the Skills for Life Program report that skills improvement targets were achieved ahead of time but identify significant challenges in relation to numeracy provision, in particular a shortage of adult numeracy specialists with strong numeracy proficiency skills and pedagogical training to meet current and future demands (Department for Innovation, Universities and Skills [UK] 2009; Hinds 2009; National Audit Office 2008; National Institute of Adult Continuing Education 2011; Southwood 2011).

Building capability

In Australia the number of courses available to support the development of LLN practitioners has diminished (Roberts & Wignall 2010). Opportunities for the development of adult numeracy practitioner skills have always been limited (Tout 2010) and currently there is only one numeracy-specific qualification available, the Graduate Certificate in Adult Numeracy Teaching of the University of Technology, Sydney (C11210v1). This specialist qualification comprises four core subjects covering numeracy proficiency and numeracy pedagogy and has a take-up of fewer than six students per year. It has no numeracy proficiency entry or completion requirements and no numeracy proficiency skills testing.

Also available, but not specific to numeracy, is the Vocational Graduate Certificate in Adult Language, Literacy and Numeracy Practice (TAE70110), which was developed in response to an identified need for more LLN specialists. It is the nationally recognised but not mandated credential for LLN specialists in the VET sector (Innovation and Business Skills Australia 2010b, 2011) and is supported by the federal government's funded scholarship program to increase the number of LLN specialists (Department of Education, Employment and Workplace Relations 2010). The Vocational Graduate Certificate contains one adult numeracy-specific unit: TAELLN702A Analyse and apply adult numeracy teaching practices. Contained in this unit, in the 'required knowledge' section, is the specification that in order to train up Australian Core Skills Framework level 3 numeracy, VET practitioners need to have personal numeracy skills at minimum exit level 3, which means that they are operating at level 4. In addition, VET practitioners also need to be able to analyse and articulate a problem at levels 4 and 5 without necessarily being able to solve the problem (Innovation and Business Skills Australia 2010a).

An understanding of how the numeracy proficiency level of the Vocational Graduate Certificate in Adult Language, Literacy and Numeracy Practice was determined is gained by examining the key considerations that emerged in the consultative process led by Innovation and Business Skills Australia, the industry skills council responsible for the qualification's development. On one hand there was the view of numeracy as a core skill spanning all levels of the Australian Core Skills Framework and the recognition that, while most funded LLN programs target Australian Core Skills Framework levels 1 to 3, in the workplace and in the community, individuals often also require

¹⁰ No formal mapping of Australian and English frameworks is currently available.

¹¹ The Australian Core Skills Framework describes levels of performance across five core skills areas: reading, writing, oral communication, numeracy and learning.

higher-level skills. This view supports a higher-level numeracy skills requirement, consistent with international research and adopted by the United Kingdom's Skills for Life Program. On the other hand there was the view of numeracy as only related to lower-level skills, a view that suggests a lower-level numeracy skills requirement. Finally, there was a concern that a level 5 requirement may limit take-up, as well as limit and compromise completion based on the history of its predecessor, the 40499SA Advanced Diploma of Language, Literacy and Numeracy Practice in VET, which included a core level 5 numeracy unit. The final decision was a compromise between these views (Innovation and Business Skills Australia 2009), a decision that has been argued by some to be a major concern:

There is a MAJOR issue in the teaching and training of numeracy (apart from the skills of the learners) – which people seem to avoid recognising or acting on.

(Tout, pers. comm., 12 December 2011)

Research questions

This report investigates VET workforce capacity to meet the numeracy skills needs of working-aged Australians, with a focus on the Australian process manufacturing industries. The context provided in this introduction suggests that effective workplace numeracy training requires the VET practitioner to hold higher-level numeracy proficiency levels relevant to the workplace context and adult numeracy pedagogical content skills and knowledge relevant to workplace numeracy delivery. From this the following research questions emerge:

- What numeracy teaching qualifications and experience do VET practitioners have?
- To what extent do VET practitioners understand the importance of the numeracy skills of working-aged Australians generally and, specifically, of existing workers in the process manufacturing industries?
- What are the perceived and actual numeracy skills levels of VET practitioners?
- What numeracy skills gaps are preventing VET practitioners from effectively addressing the numeracy skills needs of existing workers in the process manufacturing industries?
- What is the capacity of Australian VET practitioners to address the numeracy skills needs of working-aged Australians?

Note that throughout the report the term 'VET practitioner' is used to refer to LLN specialists and vocational specialists collectively.

Methodology

This report uses a mixed-method design combining quantitative and qualitative data collection to explore the numeracy-related qualifications, skills and experience of VET practitioners delivering training in Australian workplaces. Quantitative data are collected through individual numeracy assessments using a custom-designed numeracy assessment tool contextualised to the process manufacturing industries. Qualitative data collected through focus groups, self-assessment, interviews and researcher observation add richness to the quantitative data, while addressing broader questions.

Participants

Forty-four VET practitioners from Melbourne and Sydney agreed to participate in the study, including 20 LLN specialists and 24 vocational specialists. The inclusion criteria required participants to identify themselves as either an LLN specialist delivering WELL-funded training or a vocational trainer delivering vocational training through programs such as the Australian Apprenticeship Incentives Program or fee-for-service programs. All participants were directly involved in the delivery of workplace training to existing workers in industry.

The sample was a convenience sample. LLN specialists were accessed through existing formal professional development meetings organised by the Australian WELL Practitioners Network. An invitation to participate in the research was sent to 221 potential participants through the Australian WELL Practitioners Network database.

No equivalent mode of access was available for vocational specialists. Instead, invitations to participate in the research were sent to the managers of five training providers known by the researchers to be active in training delivery in the process manufacturing industries. The managers of the four training providers that had agreed to participate made their own arrangements for their staff to attend meetings specially organised to conduct the research.

The participants included novices with less than one year’s experience, through to experienced practitioners with up to 30 years experience. The average length of experience was eight years and the median six years. This is skewed towards lesser experience when compared with the broader population of trainers and assessors identified in the Productivity Commission’s research into the characteristics of the Australian VET workforce (Productivity Commission 2011) shown in table 1.

Table 1 Years of experience in VET training delivery: research sample compared with the broader population of VET trainers and assessors

Years of experience in VET training delivery	Percentage of VET practitioners	
	‘Seeking the N in LLN’ sample	VET trainers and assessors
Fewer than 2 years	25	14
2–5 years	23	22
5–10 years	23	21
More than 10 years	29	43
Total	100	100

Note: The term ‘VET practitioner’ is used to refer to participants who were LLN specialists or vocational specialists collectively.

Source: VET trainers and assessors column is based on Productivity Commission (2011).

The training experience of LLN specialists ranged from less than one year to 18 years, with an average of seven years and a median of two years. The training experience of vocational specialists ranged from less than one year to 30 years, with an average of ten years and a median of seven years.

Sixty per cent of LLN specialists and 79% of vocational specialists had experience in delivering training in the process manufacturing industries.

Research methods

The following is a description of each of the data-gathering methods as they relate to the research questions. Copies of the instruments used are available in the support document.

What numeracy teaching qualifications and experience do VET practitioners have?

All 44 participants completed an individual survey that asked them to self-identify as either an LLN specialist or a vocational specialist and to list their qualifications.

Follow-up one-on-one interviews were conducted with 20 VET practitioners (eight LLN specialists and 12 vocational specialists) who had participated in the assessments to probe further into VET practitioner adult numeracy qualifications and training experiences.

To what extent do VET practitioners understand the importance of the numeracy skills of working-aged Australians generally and, specifically, of existing workers in the process manufacturing industries?

Groups of three to five participants were invited to respond to key research statements about increasing numeracy demands, the relative importance of numeracy compared with literacy to a person's life and livelihood, and the implications for workers in the process manufacturing industries.

Follow-up one-on-one interviews were conducted with 20 VET practitioners (eight LLN specialists and 12 vocational specialists) who had participated in the assessments, to collect individual feedback about VET practitioner awareness of the importance of numeracy in industry.

What are the perceived and actual numeracy skills levels of VET practitioners?

Participants were asked to complete a numeracy self-assessment against the sample numeracy activities from the Australian Core Skills Framework.

Participants were asked to complete a written numeracy assessment containing 24 questions, ranging from Australian Core Skills Framework numeracy levels 1 to 5 and contextualised to the process manufacturing industries. The questions covered topics including graphs and tables, percentages, formulas, calculation, ratio and proportion, measurement, problem-solving and decision-making, data interpretation, patterns and anomalies, and plans and diagrams. For example, there were questions asking participants to record the read-out of a temperature dial, construct a bar chart and calculate mixing ratios. The questions were validated by industry representatives and mapped to the Australian Core Skills Framework. The mapping was verified with the help of a recognised numeracy assessment specialist. The bulk of the questions represented numeracy skills at Australian Core Skills Framework levels 2 through to 4 (see table A1). A copy of the tool is provided in the support document.

A key feature of the Australian Core Skills Framework is that it recognises the nature and degree of support available and it is not until level 3 that an individual is expected to be able to work independently. Support was not provided during the implementation of the numeracy assessment and

therefore it is not a fair assessment of levels 1 and 2. Note also that the numeracy assessment contains only one question at level 5 and the focus of the assessment was levels 3 and 4.

Responses were scored by the researchers and moderated by a recognised numeracy assessment specialist, as well as an Australian Core Skills Framework developer. Responses were assigned one of three possible outcomes: credit, insufficient evidence or not attempted.

Consistent with numeracy assessment best practice a technically correct answer was not required to achieve a credit using the following principles:

- Participants were given the benefit of the doubt. For example, if a participant used the correct procedure but arrived at an incorrect answer, a credit was given.
- The highest Australian Core Skills Framework numeracy level was given priority. For example, if a participant calculated a ratio correctly but did not calculate the metric conversion correctly, a credit was given.
- Incorrect data from previous questions were overlooked. For example, if a participant carried through an incorrect response from an earlier part of a question to arrive at an incorrect answer to a later question but the mathematical procedure was correct, a credit was given.
- More right than wrong was credited. For example, if a participant plotted three out of four data points correctly, a credit was given.

'Insufficient evidence' was assigned where the participant had attempted the question but had not provided sufficient evidence for a credit to be applied. For example, if the answer was incorrect and either there was no evidence of the procedure used, or there was evidence that the procedure used was incorrect.

'Not attempted' was assigned where there was no evidence of an attempt to answer the question.

The results were also scored against the three Australian Core Skills Framework numeracy indicators, where indicator 09 is the ability to identify and extract the mathematical information, indicator 10 is the ability to do the mathematical task and indicator 11 is the ability to represent the mathematical information. For example, one question asked participants to calculate a ratio and give the answer in millilitres. If a participant calculated the answer correctly but provided the answer in litres they were given a credit for indicators 09 and 10 but not 11 as they had not represented the information as required. In the scoring it was assumed that if a participant could select the correct mathematical procedures (10), then they must be able to understand the question (09). Therefore indicator 09 and 10 were scored together.

Details of how the assessment instrument was developed and administered are provided in the support document.

What numeracy skills gaps are preventing VET practitioners from effectively addressing the numeracy skills needs of existing workers in the process manufacturing industries?

Follow-up one-on-one interviews were conducted with 20 VET practitioners (eight LLN specialists and 12 vocational specialists), in which they were informed of their numeracy assessment result and asked questions about their perceived skills and confidence in teaching numeracy in the process manufacturing industries.

What is the capacity of the Australian VET practitioners to address the numeracy skills needs of working-aged Australians?

Focus groups of VET practitioners were conducted in Melbourne, Sydney and Adelaide to review and discuss the findings and implications. A total of 74 individuals participated, including 57 LLN specialists and 17 vocational specialists. The discussions inform this report.

Limitations

This is a small study and therefore caution must be taken when drawing inferences from the findings.

Findings

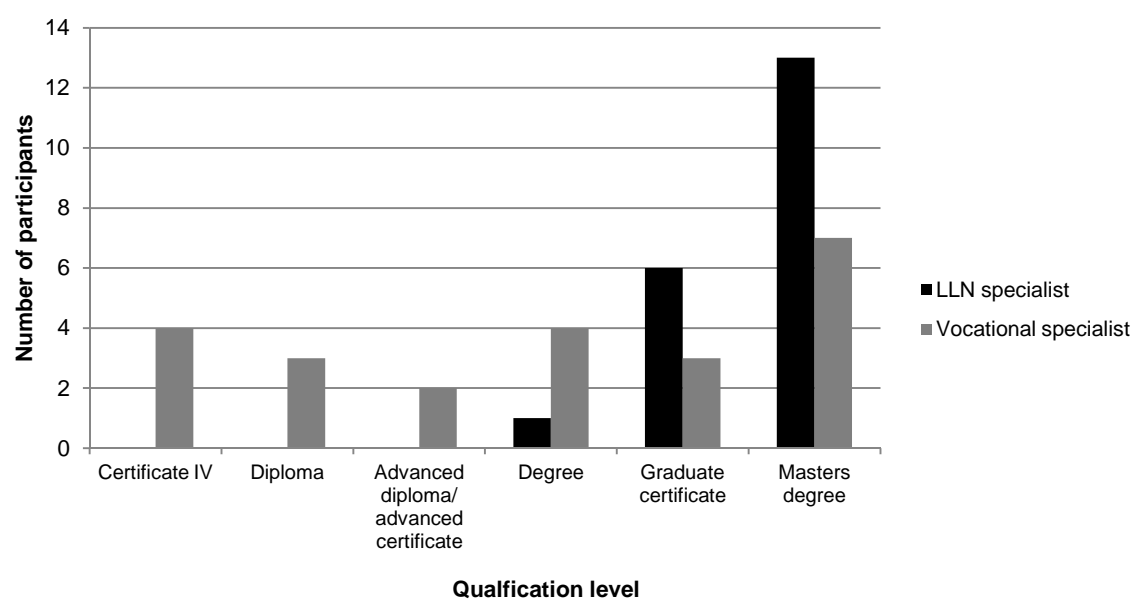
The following findings are presented as they relate to each of the research questions.

VET practitioner numeracy teaching qualifications and experience

Qualifications

As shown in figure 1, almost 80% (34) of all participants reported a degree-level qualification or higher, with 45% (20) holding a qualification at master's level.

Figure 1 Numbers of participants by highest qualification level achieved



Notes: This includes all qualifications that participants held, regardless of area of study.

Half of the participants (18 LLN specialists and four vocational specialists) held an LLN specialist training qualification in addition to the Certificate IV in Training and Assessment or its equivalent, the mandatory minimum requirement in the VET sector (see tables A2 and A3). The most common specialisations held were an adult English language specialist qualification and/or an adult literacy specialist qualification, for example, a Graduate Diploma in Teaching English to Speakers of Other Languages (TESOL).

No participants held an adult numeracy specialist training qualification. However 14% (6) of participants held a specialist training qualification that included adult numeracy, as shown in table 2.

Table 2 Participant qualifications containing adult numeracy content by qualification level and numeracy proficiency level

Qualification level	Qualification	Numeracy level
Graduate diploma/ graduate certificate	Vocational Graduate Certificate Adult LLN Practice	ACSF level 3/4
	Graduate Diploma ABE	Unknown
	Graduate Diploma Adult Education	Unknown
	Graduate Diploma TESOL/ALBE	Unknown
Degree	Bachelor Adult Learning and Development	Unknown
Advanced diploma	Advanced Diploma of Language, Literacy and Numeracy Practice in VET	ACSF level 5

Notes: ABE = Adult Basic Education; ALBE = Adult Literacy and Basic Education.

The participants were asked to identify and describe any relevant qualifications or professional development activities they had undertaken to develop their own numeracy skills or their numeracy training skills. Seven participants (one LLN specialist and six vocational specialists) identified non-training qualifications relevant to developing their own numeracy skills, including a commerce degree, postgraduate engineering qualifications and trade qualifications. One participant (LLN specialist) reported a personal interest in numeracy skills development through self-directed research. No other instances of professional development in numeracy were reported.

Groups of participants were asked to reflect on the credentials needed to be an adult English language specialist, an adult literacy specialist or an adult numeracy specialist and suggested a range of qualifications, ranging from certificate IV through to master's degree. The Vocational Graduate Certificate in Adult Language, Literacy and Numeracy Practice and the non-current Certificate IV in LLN Assessment and Training were suggested as appropriate for LLN specialists across all three LLN domains.

In relation to the qualifications needed to be an adult English language specialist or an adult literacy specialist, the VET practitioners identified a number of specialist qualifications; for example, Graduate Diploma in Adult Literacy, Bachelor of Education with literacy major, and Certificate IV in TESOL. No clear view was expressed about the qualification level. Some VET practitioners held the strong opinion that an English language specialist must hold a postgraduate-level qualification such as a Graduate Diploma in TESOL, while other VET practitioners believed that a specialist can hold a certificate-level qualification such as a Certificate IV in TESOL.

In relation to adult numeracy, most participants could not think of a qualification. Two qualifications suggested were a Bachelor of Education with a numeracy teaching specialty and a Bachelor of Education with a mathematics teaching specialty. When asked to reflect on the level of numeracy proficiency needed by a numeracy specialist, the responses were not conclusive and included Australian Core Skills Framework numeracy levels 3, 4 and 5.

Training experience

In the interviews the participants were asked to describe their experience in delivering numeracy skills training to adults generally and, specifically, in the process manufacturing industries. Most VET practitioners reported some numeracy training experience, which they described as basic and incidental:

Numeracy delivered as part of unit and job requirements. Limited, usually incidentally.

(Vocational specialist)

None specific. In the WELL Program with production workers, but incidental.

(LLN specialist)

Participants reported a range of contexts in which they had gained their adult numeracy training experience. Typically LLN specialists reported gaining their experience in migrant English, adult education and employment preparation programs, and delivering courses such as the Certificate in General Education for Adults. Examples of numeracy skills areas delivered included measurement, counting and reading time. Typically, vocational specialists reported gaining their experience while delivering vocational qualifications in areas such as food processing, competitive manufacturing and engineering. Examples of numeracy skills areas delivered included measurement, formulas, planning, calculations and recording.

Understanding of the importance of numeracy skills

Participants were asked to reflect on the importance of numeracy skills and what they mean for VET practitioners, industry and existing workers in the process manufacturing industries. There was general agreement that numeracy skills are important and that there is a lack of focus, which is of great concern. While vocational specialists provided more concrete industry examples in their responses, no marked difference in opinion between the two groups was observed.

Participants were generally unfamiliar with statements taken from the latest research findings on the importance of numeracy. There was general agreement with the statement ‘there is an increasing demand for numeracy skills at all job levels in the workplace’. The statement ‘numeracy potentially has a greater influence on an individual’s access to employment, higher wage levels and productivity than literacy’ generated more detailed discussion. For example, some participants made a distinction between seeking employment and maintaining employment.

You need LL skills to get a job, but you need N skills to stay there. (Vocational specialist)

Some participants thought that there was a stronger focus on literacy than numeracy in employment.

The first thing that an employer focuses on is literacy skills, not numeracy skills. (Vocational specialist)

The statement ‘poor numeracy skills have more impact on an individual’s life than poor literacy skills’ caused the most surprise, but on reflection was generally accepted by participants.

We thought ‘communication skills’ would be more important – but it does make sense. Numeracy impacts on many things – petrol station, supermarket, change, banking etc. (LLN specialist)

Practitioners were asked to reflect on how the statements were relevant to them as VET practitioners.

We all think that these findings are relevant to our work as trainers, in assisting people to develop the skills to do their job. (Vocational specialist)

Numeracy skills development for process workers is often embedded within the process/technical training, for example, complete a control process chart. (Vocational specialist)

There was general agreement that there was a need for a greater focus on numeracy skills in training.

We need to ensure that people have an understanding of how to do their job. We rarely consider numeracy skills, as it is assumed that [they are] embedded in the technical skills we teach them. It is taken for granted, and therefore we don’t evaluate people’s numeracy skills, however, there are probably many workers whose productivity would increase significantly if they had the appropriate numeracy skills. (Vocational specialist)

We pay little attention to numeracy skills in the workplace. We should but we don't.

(Vocational specialist)

Participants recognised that numeracy skills are embedded and hidden in job tasks, in VET products and in training delivery and how, as VET practitioners, they are often unaware of the numeracy demands of the job. Some suggested that this could be due to VET practitioner skills gaps.

It is not until we start thinking about it that it becomes apparent to us – the numeracy skills that need to be applied in manufacturing processes and how these are largely ignored.

(Vocational specialist)

Numeracy skills require a greater emphasis and we should all focus on the assessment of learners' numeracy skills, in addition to technical and LL skills.

(LLN specialist)

We don't focus on our learner's numeracy skills because of our own lack of confidence in delivering numeracy skills programs.

(LLN specialist)

Participants were also asked to reflect on the importance of the statements to industry and generally agreed that numeracy skills are important and are needed to meet job demands and contribute to productivity, quality and waste reduction.

Improved workplace confidence, function in daily work more effectively, improved efficiency and productivity, accurate report writing using numbers, accurate measurement for producing final products →customer satisfaction →career progression.

(LLN specialist)

Specific numeracy skills considered important included measurement, costings, calculations and estimation.

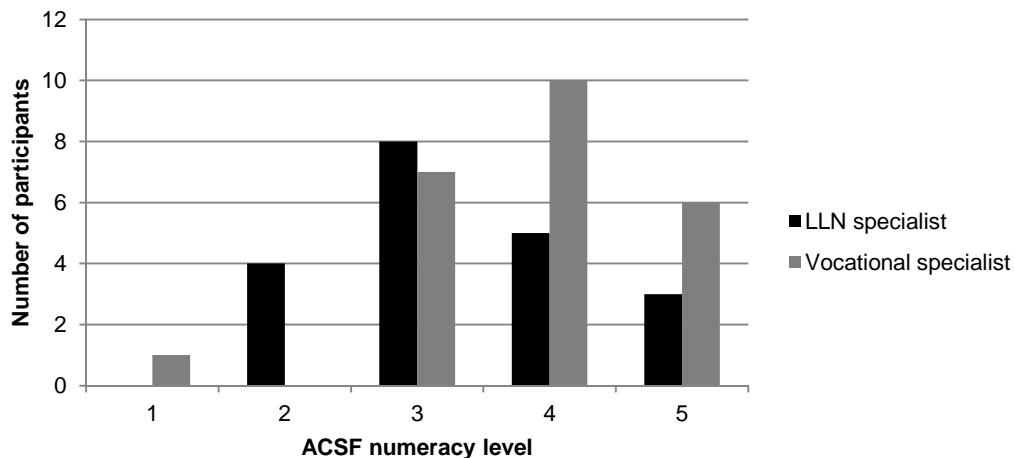
Numeracy skills levels of VET practitioners

Numeracy self-assessment results

Figure 2 presents the self-assessment results. Overall, almost 90% (34) of participants assessed themselves as at Australian Core Skills Framework numeracy level 3 or higher. Generally, vocational specialists assessed themselves higher than LLN specialists.

Evidence cited for the self-assessments included general life skills, financial skills, school mathematics grades, school mathematics teaching experience, LLN provider experience, industry employment history, technical qualifications and own home renovation experience.

Figure 2 Participant self-assessment results against Australian Core Skills Framework numeracy levels 1 to 5



Numeracy assessment results

As shown in table 3, 36% (16) of all participants achieved at least 80% credits at level 3 and 10 of the 16 participants achieved at least 80% credits at level 4. The remaining of participants (28) did not achieve at least 80% proficiency at level 3 or higher.

Table 3 Participants who achieved 80% proficiency at Australian Core Skills Framework numeracy levels 3 and 4 in the numeracy assessment

ACSF numeracy level	VET practitioners		
	LLN specialists	Vocational specialists	All
3	6	10	16
4	4	6	10

Notes: The term 'VET practitioner' is used to refer to participants who were LLN specialists or vocational specialists collectively. 80% proficiency was achieved when a credit was assigned for 80% of the questions. Credit was assigned where an answer was correct or where the answer was incorrect but the correct procedure was followed, there was evidence that the highest numeracy skill requirement of the question was demonstrated or the answer was more right than wrong.

Participants provided feedback immediately following the assessment. Some participants indicated that they could demonstrate higher numeracy skills in a more familiar context.

I prepare complex training budgets and use spreadsheets, but I am not comfortable with this assessment due to the context. (LLN specialist)

Some participants thought the trade rulers used in the measurement question were inappropriate, commenting that the graduations were too small and it was too hard to see the numbers to make an accurate reading.

VET practitioners expressed various levels of confidence and comfort.

It is the exam conditions and perception that made it difficult to think. (LLN specialist)

I have had no specialist training but I could do this. (Vocational specialist)

At first it all seemed difficult until I got stuck into answering examples. (LLN specialist)

It took a while to get going, but once I settled down, it all came back to me. (Vocational specialist)

It makes no sense to me, created a significant amount of stress to complete the assessment. (LLN specialist)

There was general agreement that the assessment questions were realistic and representative of a process manufacturing workplace environment.

When provided with their individual numeracy assessment results and invited to comment, most participants across all levels of performance reported that their results were what they expected.

Realistic representation of own skills. (Vocational specialist)

Many participants believed their assessment results confirmed their self-assessment, although there were also some disappointments.

A bit disappointed. I thought my numeracy skills were higher as I have applied them to my trade. (Vocational specialist)

The results were also accepted as an accurate reflection of VET practitioners in the validation meetings, although there were concerns about the sample size.

The research outcomes are relatively accurate, we can relate to the results. (Mixed group)

The data is not accurate, there are some skilled numeracy WELL practitioners, there may not be many but there are some and the research does not identify this. (LLN specialist)

Effectively addressing numeracy skills

The results shown in table 3 indicate that about two-thirds of participants performed below level 3 and that there may be numeracy skills gaps at levels 3 and 4.

Table 4 shows the results of the numeracy assessment by credits received by Australian Core Skills Framework numeracy level and indicator, with indicators 09 and 10 combined. The results suggest that there may be a larger skills gap at indicator 11 than at indicators 09 and 10.

Table 4 Total number of credits achieved by all participants (44) per Australian Core Skills Framework numeracy level and indicator

Level	Indicators 09 and 10	Indicator 11
1	39	39
2	168	149
3	253	233
4	212	175
5	31	5
Total	703	601

Notes: Indicator 09 is the ability to identify and extract the mathematical information; indicator 10 is the ability to do the mathematics task and indicator 11 is the ability to represent the mathematical information. Indicators 09 and 10 were scored together. Credit was assigned where an answer was correct or where the answer was incorrect but the correct procedure was followed, there was evidence that the highest numeracy skill requirement of the question was demonstrated or the answer was more right than wrong.

Individual participants were asked to comment on whether they thought they had the necessary numeracy skills and knowledge to address existing worker numeracy needs in the process manufacturing industries. Of the 20 participants interviewed, all thought that they did.

Some VET practitioners were confident that they could address all needs.

Yes, I think that I have the skills to support workers at all levels. (LLN specialist)

Most VET practitioners identified limits and qualified their response.

Yes, up to level 3, but not beyond. (LLN specialist)

Yes. OK for workers on the shop floor. Not sure about higher levels. (Vocational specialist)

VET practitioner capacity to address numeracy skills needs

Groups of LLN specialists and vocational specialists were asked to reflect on what the numeracy assessment results might mean for VET capacity in relation to the different stakeholders. The following is a summary of the participants' views.

- Employers may not be having their numeracy skills demands met through current training delivery because the VET practitioners may not possess the necessary skills. Employers need to be more proactive about having their needs met and should question training providers about the numeracy capacity of their VET practitioners.

- More VET practitioners with greater numeracy skills are needed. Suggested strategies include identifying and addressing numeracy skills gaps through professional development and encouraging more collaboration between LLN specialists and vocational specialists.
- Training providers need to be more aware of the numeracy capacity of their staff, actively recruit staff with numeracy skills, support professional development that assists staff to build their numeracy skills, better match VET practitioners to the training need and explore different approaches, such as team teaching and access to a numeracy specialist.
- Learners have a range of needs that are not being identified or supported. There could be improved identification of the numeracy needs of their job role and of learner numeracy skills gaps, better understanding of the impact of mathematics anxiety, and more effectively targeted numeracy support.
- The government needs to support an increased focus on numeracy. Suggestions include introducing a WELL numeracy quota (for example, 25% of WELL training projects must be numeracy projects) and the development of numeracy champions. There was also a suggestion to rethink the qualifications for LLN specialists in the WELL and LLN programs and to introduce a numeracy requirement.

The LLN specialists were asked to reflect on the labels ‘LLN specialist’ and ‘LLN expert’ and the expectations that employers might have about their capacity to deliver numeracy training based on these labels. There were mixed responses. Some said they felt comfortable, others less comfortable.

Sounds reasonable.	(LLN specialist)
Feel like a fraud.	(LLN specialist)
Should a WELL practitioner be an all rounder?	(LLN specialist)

Many thought the labels were inaccurate but inconsequential, as it is the training provider’s responsibility to know the skills of their VET practitioners and allocate the best VET practitioner to the needs of the workplace.

This is not an accurate assumption; there are LL specialists and N specialists. Horses for courses.	
The appropriately skilled practitioner will be allocated to a project. We cannot assume that a WELL practitioner has both an LL and an N specialisation.	(LLN specialist)

There were concerns that numeracy demands not identified at the start of a project may arise during its implementation, and that an employer may have an expectation that the LLN specialist had the skills to address them.

There was a general willingness among all of the participants to undertake professional development, provided it was relevant to their work. A range of activities was suggested with the most popular option being short, focused online courses with some group work.

Discussion and implications

In this section the implications for VET sector capacity for addressing workplace numeracy skills are discussed in the context of the research questions.

VET practitioner numeracy teaching qualifications and experience

Adult numeracy training qualifications held

No participants were identified as holding an adult numeracy specialist training qualification, a not-so-surprising finding, given that there is only one qualification available, the Graduate Certificate in Adult Numeracy Teaching. However, six participants were identified as having an adult training specialisation that includes an adult numeracy component.

Some participants suggested that the low number of participants identified with an adult numeracy training specialisation could be a reflection of the sampling strategy, and that the researchers could have targeted departments within training organisations where numeracy skills training is delivered. This strategy was not used because the focus was on VET practitioners who deliver training to existing workers in the workplace. A different sampling strategy, which samples VET practitioners who deliver numeracy skills training on campus in, for example, the Language, Literacy and Numeracy Program and adult basic education courses, could be the focus of another study.

It is also possible, as suggested by some participants and acknowledged as a limitation of this research, that the sample size was too small. This could be addressed through further research utilising a larger sample size.

Despite these concerns, the research finding was generally accepted by the VET practitioners in the validation meetings as being an accurate reflection of VET practitioners. The finding is also consistent with an earlier study in 2006 (Berghella, Molenaar & Wyse 2006a), which reviewed the qualifications of 45 LLN specialists delivering workplace training in the WELL Program. This study also identified effective numeracy practice as one of the priority areas for LLN specialist professional development.

Interestingly, four of the vocational specialists were found to hold higher-level LLN specialist training qualifications. Perhaps a further area of study could challenge the idea that vocational specialists lack LLN awareness and explore the incidence of LLN specialist qualifications and experience among vocational specialists.

Suggested adult numeracy training qualifications

The federal government funds the Language, Literacy and Numeracy Practitioner Scholarship Program, which is designed to address the shortage of LLN specialists. If the initiative is to effectively support the development of workplace numeracy specialists, an appropriate qualification is needed.

Participants identified a plethora of qualifications they consider to be appropriate credentials for an adult English language or an adult literacy specialist. There was no clear view on the qualifications needed for an adult numeracy specialist, with significantly fewer suggestions made by the participants, and with less confidence. The two specialty qualifications suggested, a Bachelor of Education with either a numeracy teaching specialty or a mathematics teaching specialty, are questionable as being suitable for VET practitioners: while they may support higher-level practitioner numeracy proficiency skills, they are not focused on adult numeracy pedagogies or the workplace context.

For effective workplace numeracy training, VET practitioners need higher-level numeracy proficiency levels relevant to the workplace context and adult numeracy pedagogical content skills and knowledge relevant to workplace delivery. None of the qualifications identified meets these requirements. Instead they reflect the range of courses that are available and familiar to participants, rather than what is needed for effective workplace numeracy training. For example, in relation to numeracy proficiency skills, the Graduate Certificate in Adult Numeracy Teaching does not include a numeracy proficiency requirement and the Vocational Graduate Certificate in Adult Language, Literacy and Numeracy Practice contains a numeracy proficiency requirement that may be lower than that needed to facilitate the greatest learner outcomes. This highlights a need for further research to review what VET practitioners really need to support workplace numeracy skills development.

While not asked of participants, an issue that became obvious is whether LLN specialists should be required to hold a qualification that embraces all three LLN domains or should they specialise in one of these domains? The idea that one qualification can adequately address all three specialty areas is not consistent with the United Kingdom's Skills for Life Program, where VET practitioners must complete a diploma-level qualification in each specialty area. With the introduction of foundation skills in Australia the issue is further complicated, as this encompasses not just English language, literacy and numeracy but employability skills and digital literacy. Should LLN specialists then be required to hold a qualification that embraces all three LLN domains across the five Australian Core Skills Framework core skills from pre-level 1 through to level 5, plus employability skills and digital literacies?

Numeracy training experience

The level of VET practitioner experience in workplace numeracy training in this study appears limited. Where participants reported numeracy training experience, it was incidental to other training and focused on what participants described as 'basic' numeracy skills training. This is consistent with a lack of numeracy focus as described earlier and may possibly reflect the VET practitioners' confidence in their own numeracy skills.

Understanding of the importance of numeracy skills

Many research participants considered numeracy skills important, but they were not aware of the extent of the impact of low numeracy skills on a person's work and life, particularly when compared with literacy skills. However, most participants demonstrated an interest and a willingness to reflect on the importance of numeracy and adapt their thinking. This suggests that, while there may be a significant need to raise VET practitioner awareness of the importance of numeracy, it may simply be a matter of disseminating up-to-date information, rather than the potentially more difficult task of shifting entrenched attitudes.

Numeracy skills levels of VET practitioners

While most participants assessed their numeracy skills at Australian Core Skills Framework levels 3 or 4, the numeracy assessment results tell a different story, suggesting that almost two-thirds of participants performed below level 3. This is inconsistent with the current level 3 and 4 numeracy proficiency requirement in the Vocational Graduate Certificate in Adult English Language, Literacy and Numeracy Practice and may be too low for effective numeracy training.

The vocational specialists performed slightly better than the LLN specialists on the numeracy assessment; however, no conclusions can be drawn from this, as the sample size was too small. It is also

worthwhile remembering the importance of context. The data show that the vocational specialists typically came from an industry background, while LLN specialists typically came from an educational background. The highly contextualised nature of the numeracy assessment tool means that it was possibly more suited to the vocational specialists, who routinely work in the process manufacturing industries, than the LLN specialists, who work across a range of industries. Indeed, some of the LLN specialists commented that in a more familiar context, they would expect to score better.

The findings suggest that the skills gap may be greater for Australian Core Skills Framework numeracy indicator 11 than indicators 09 and 10. This means some participants could read and understand the mathematical information and solve the problem more successfully than they could represent the results. For example, they represented a result differently from that required, such as in litres instead of millilitres, or plotted a line graph instead of a bar chart. In a real workplace, where results matter, such errors or misrepresentations can compromise productivity. For example, the next worker may use equipment that measures in millilitres not litres and lack the skills needed for metric conversion, resulting in costly errors. VET practitioners need to understand this, demonstrate numeracy proficiency skills across all three Australian Core Skills Framework numeracy indicators and to be able to effectively deliver numeracy training across all three indicators in the workplace context.

The difference between the self-assessment results and the numeracy assessment results is not surprising, as self-assessment is known to be an unreliable measure of numeracy skills (Bynner & Parsons 2006). Adults often have a low self-awareness of their own numeracy skills and those with low numeracy skills tend to use effective survival strategies and live a productive life. People may only become aware that they lack numeracy skills when their skills are tested; for example, when they undertake an assessment or they need to help their child with homework. On the other hand, many adults are often not aware of the numeracy skills they possess. This is because people often see the numeracy skills they possess as unremarkable and just common sense and the numeracy problems they cannot solve as mathematics (Coben 2003). This reinforces the importance of assessing VET practitioner numeracy skills, a practice adopted by the United Kingdom's Skills for Life Program, rather than relying on self-assessments.

Numeracy assessment limitations

Measuring numeracy skills levels can be difficult for the following reasons:

- the difficulties with the definition of numeracy, as discussed earlier
- the difficulties identifying what can be tested because 'numeracy itself cannot be tested: rather, "numerate behaviour" can be observed' (Gal et al. 2003; van Groenestijn 2003, p.230)
- the difficulties associated with the highly contextualised nature of numeracy. For example, studies of street vendors and shoppers found that they could calculate quickly and accurately in context but not in a test situation (as cited in Coben 2003)
- the literacy demands that are placed on adults when undertaking a numeracy assessment. Adults who possess numeracy skills may lack the literacy skills to perform well in an assessment (Swain 2008, as cited in Carpentieri, Lister & Frumkin 2010)
- the complication of mathematics anxiety, a common difficulty among adults that affects mental processing (Ministry of Education, New Zealand Government 2009) and can therefore affect numeracy assessment performance (Carpentieri, Lister & Frumkin 2010)

- the challenge of developing a numeracy assessment that accurately reflects numeracy in context (Coben 2003)
- the difficulties associated with making it real. While every attempt was made by the researchers to develop realistic numeracy assessment tasks based on the real-job tasks found in the process manufacturing industries, realistic is not the same as real, with implications for the validity of the assessment tool (Ginsburg, Manly & Schmitt 2006).

It is also acknowledged that the way in which the numeracy assessments were scored could be seen as a limitation. Consistent with best practice, a credit was often assigned to technically incorrect answers. This occurred where the correct mathematical procedure was followed, where there was evidence that the highest numeracy skill requirement of the question was demonstrated, or where the answer was more right than wrong. The researchers agree that this standard is not reflective of the demands of the workplace, where workers have to submit the right answer and there are few second chances, and VET practitioners must be able to operate at least at, or preferably above, the standard required. There is a strong possibility that the very generous scoring method used may have resulted in an overestimation of the numeracy skills of participants. This suggests that there is a need for further research to determine a more appropriate scoring method for assessing the capacity of VET practitioners to support numeracy development in the workplace. This also has implications for how workplace numeracy skills are developed and assessed, which VET practitioners may not be aware of without appropriate training.

Effectively addressing numeracy skills

Many participants said that they felt confident to deliver workplace numeracy skills training as required by their learners, despite low levels of numeracy proficiency and a lack of adult numeracy training qualifications or professional development. The availability of Australian Government-funded training with the capacity to support the development of workplace numeracy skills suggests that there should be a significant amount of numeracy skills training being delivered in the workplace. However, the findings suggest that in reality there is not. The level of VET practitioner focus on workplace numeracy skills development appears to be less than the focus on workplace literacy skills and technical skills and may be inconsistent with the importance of workplace numeracy skills. Any effort to identify and address workplace numeracy skills by the participants was at best incidental. LLN specialists focused largely on literacy and English language skills development, and VET specialists focused largely on meeting unit requirements within qualifications, which can include numeracy skills. Participants may feel confident about delivering numeracy skills because they are required to do so only rarely and only to a level at which they feel comfortable, rather than in the volume and at the level needed.

VET practitioner capacity to address numeracy skills needs

If the numeracy assessment results are an accurate reflection of VET practitioner numeracy proficiency, then VET practitioners may not have sufficient skills to support the development of workplace numeracy skills in the process manufacturing industries.

While the topic of VET practitioner capacity to address workplace numeracy skills requirements has not been studied in Australia previously, the findings from this research are consistent with international research, which highlights a lack of VET practitioner numeracy capacity and numeracy skills focus.

Conclusion

Without an appropriately skilled and experienced VET workforce – skilled in the identification and delivery of numeracy skills – the VET sector cannot respond effectively to the numeracy demands of the workplace.

If the importance of workplace numeracy skills continues to be under-represented, there will not only be a shortage of workplace numeracy specialists, but VET practitioners currently delivering in the workplace will continue to provide only nominal numeracy support.

Without serious consideration of the qualifications available and the VET practitioner skills and knowledge needed to adequately meet demand, VET practitioners will be unsupported and ill-equipped to deliver workplace numeracy skills. This has significant implications for VET sector capacity for meeting the current and future workplace numeracy skills needs of existing workers and workplaces in the process manufacturing industries.

Until now limited attention has been focused on the workplace numeracy training capabilities of the VET workforce and it has been assumed that LLN specialists are numeracy specialists. This has limited our understanding of VET capacity in this area, to the extent that we do not know what we do not know. Ensuring we have qualified and experienced adult numeracy specialists is just one small but critical step in what must be a fully considered approach encompassing policy, research and practice. To increase VET capacity we must seek the N in LLN at all levels.

References

- American Institutes for Research 2006, *A review of the literature in adult numeracy: research and conceptual issues*, American Institutes for Research, Washington, DC.
- Ashcraft, MH 2002, 'Math anxiety: personal, educational, and cognitive consequences', *Current Directions in Psychological Science*, vol.11, no.5, pp.181–5.
- Ashcraft, MH & Kirk, EP 2001, 'The relationships among working memory, math anxiety, and performance', *Journal of Experimental Psychology: General*, vol.130, no.2, pp.224–37.
- ABS (Australian Bureau of Statistics) 2008, *Adult Literacy and Life Skills Survey: summary results*, cat.no.4228.0, ABS, Canberra.
- 2012, *Labour force, Australia, detailed, quarterly, August 2012*, cat.no.6291.0.55.003, ABS, Canberra.
- Australian Council for Adult Literacy 2009, 'No national spotlight on adult literacy?', *Literacy Link*, vol.29, no.1, pp.1–2.
- Australian Industry Group 2008, *Skilling the existing workforce: final project report*, AiGroup, Sydney.
- 2010, *National Workforce Literacy Project: report on employer views on workplace literacy and numeracy skills*, AiGroup, Sydney.
- Benseman, J, Sutton, A & Lander, J 2005, *Working in the light of evidence, as well as aspiration: a literature review of the best available evidence about effective adult literacy, numeracy and language teaching*, The University of Auckland & UniServices Ltd, Auckland.
- Berghella, T, Molenaar, J & Wyse, L 2006a, *The professional development requirements of Workplace English Language and Literacy Programme practitioners*, NCVET, Adelaide.
- 2006b, *The professional development requirements of Workplace English Language and Literacy Programme practitioners: support document*, NCVET, Adelaide.
- Bickerton, B 2011, 'Policy to improve math teaching and learning in adult basic education: a perspective from Massachusetts', *Adult numeracy: a reader: four papers from CAAL's January 2011 Roundtable on Adult Numeracy*, Council for Advancement of Adult Literacy, New York, pp.29–37.
- Bynner, J & Parsons, S 1997, *Does numeracy matter?: evidence from the National Child Development Study on the impact of poor numeracy on adult life*, Basic Skills Agency, London.
- 2006, *New light on literacy and numeracy: summary report*, National Research and Development Centre, London.
- Cara, O, Casey, H & Mallows, D 2010, *Recent trends in the initial training of teachers of literacy, numeracy and ESOL for the further education sector in England*, National Research and Development Centre, London.
- Cara, O & de Coulon, A 2009, *Skills for Life teachers' qualifications and their learners' progress in adult numeracy*, National Research and Development Centre, London.
- Carpentieri, JD 2008, *Research briefing: numeracy*, National Research and Development Centre, London.
- Carpentieri, JD, Litster, J & Frumkin, L 2010, *Adult numeracy: a review of research: research report commissioned by BBC Learning and conducted by NRDC*, National Research and Development Centre, London.
- Casey, H, Cara, O, Eldred, J, Grief, S, Hodge, R, Ivanic, R, Jupp, T, Lopez, D & McNeil, B 2006, 'You wouldn't expect a maths teacher to teach plastering ...' *Embedding literacy, language and numeracy in post-16 vocational programmes – the impact on learning and achievement*, National Research and Development Centre, London.
- Coben, D 2000, 'Mathematics or common sense? Researching "invisible" mathematics through adults' mathematics life histories', in *Perspectives on adults learning mathematics: research and practice*, eds D Coben, J O'Donoghue and GE FitzSimons, Kluwer Academic Publishers, Dordrecht, pp.53–66.
- 2003, *Adult numeracy: review of research and related literature*, National Research and Development Centre, London.
- 2004, 'What is specific about research in adult numeracy and mathematics education?', *10th International Congress on Mathematical Education*, Topic Study Group 6 Adult and Lifelong Education, Copenhagen.
- Council of Australian Governments (COAG) 2008a, *National Agreement for Skills and Workforce Development*, COAG, Canberra.
- 2008b, *National Numeracy Review report*, COAG, Canberra.
- Council of Australian Governments Standing Council on Tertiary Education Skills and Employment 2012, *National Foundation Skills Strategy For Adults*, Standing Council on Tertiary Education, Skills and Employment, Brisbane.

- Department for Education and Skills (UK) 2003, *The Skills for Life Survey: a national needs and impact survey of literacy, numeracy and ICT skills*, DfES, London.
- Department for Innovation, Universities and Skills (UK) 2009, *Skills for Life: changing lives*, DIUS, London.
- Department of Education, Employment and Workplace Relations 2010, *Language, literacy and numeracy practioner scholarships program: program guidelines*, DEEWR, Canberra.
- Department of Industry, Innovation, Science, Research and Tertiary Education 2012, *Workplace English Language and Literacy Program: program guidelines for WELL training projects 10/2012*, DIISRTE, Canberra.
- Dingwall, J 2000, 'Improving numeracy in Canada', viewed 14 January 2012, <www.nald.ca/library/research/nls/inpub/numeracy/improve/improve.pdf>.
- FitzSimons, GE 2005, 'Numeracy and Australian workplaces: findings and implications', *Australian Senior Mathematics Journal*, vol.19, no.2, pp.27–40.
- FitzSimons, GE, Mlcek, S, Hull, O & Wright, C 2005, *Learning numeracy on the job: a case study of chemical handling and spraying*, NCVER, Adelaide.
- Gal, I, van Groenestijn, M, Manly, M, Schmitt, MJ & Tout, D 2003, *Adult numeracy and its assessment in the ALL survey: a conceptual framework and pilot results*, Statistics Canada, Ottawa.
- Gillard, J & Albanese, A 2010, *Budget 2010–11: Skills and infrastructure – building a stronger and fairer Australia*, Commonwealth of Australia, Canberra.
- Ginsburg, L 2011, 'Adult numeracy demand and provision', *Adult numeracy: a reader: four papers from CAAL's January 2011 Roundtable on Adult Numeracy*, Council for Advancement of Adult Literacy, New York, pp.1–27.
- Ginsburg, L, Manly, M & Schmitt, MJ 2006, *The Components of Numeracy*, National Center for the Study of Adult Learning and Literacy, Cambridge, MA.
- Gleeson, L 2005, *Economic returns to education and training for adults with low numeracy skills*, NCVER, Adelaide.
- Green, DA & Riddell, WC 2001, *Literacy, numeracy and labour market outcomes in Canada*, Statistics Canada & Human Resources Development Canada, Ottawa.
- Hicks, M 2010, 'A small business perspective', *Ministerial Council for Tertiary Education and Employment Industry forum 19 November 2010: Driving productivity through better use of skills*, MCTEE, Sydney.
- Hinds, S 2009, *More than rules: college transition math teaching for GED graduates at the City University of New York*, City University of New York, New York.
- Hoyles, C, Wolf, A, Molyneux-Hodgson, S & Kent, P 2002, *Mathematical skills in the workplace: final report to the Science, Technology and Mathematics Council*, Institute of Education University of London & Science, Technology and Mathematics Council, London.
- Human Resources and Skills Development Canada website 2011, viewed 25 January 2012, <www.hrsdc.gc.ca>.
- Industry Skills Councils 2011, 'No more excuses: an industry response to the language, literacy and numeracy challenge', viewed 12 December 2012, <www.isc.org.au/pdf/NoMoreExcuses_FINAL%20FINAL%20single%20page.pdf>.
- Innovation and Business Skills Australia 2009, 'Meeting of TAE10 Training and Education Training Package National Project Reference Group', 16th June 2009, IBSA, Melbourne.
- 2010a, 'TAELLN702A Analyse and apply adult numeracy teaching practices', viewed 17 December 2012, <<http://training.gov.au/Training/Details/TAELLN702A>>.
- 2010b, *User guide for TAE70110 and TAE80110*, IBSA, Melbourne.
- 2010c, *VET workforce skills in language, literacy and numeracy*, IBSA, Melbourne.
- 2011, *Environment Scan – 2011: training and education industry*, IBSA, Melbourne.
- Lifelong Learning UK 2007a, *Criteria for entry to mathematics (numeracy) and English (literacy and ESOL) teacher training in the lifelong learning sector*, LLUK, London.
- 2007b, *New overarching professional standards for teachers, tutors and trainers in the lifelong learning sector: application of the professional standards for teachers of mathematics (numeracy)*, LLUK, London.
- Mackay, S, Burgoyne, U, Warwick, D & Cipollone, J 2006, *Current and future professional development needs of the language, literacy and numeracy workforce*, NCVER, Adelaide.
- Manufacturing Skills Australia 2011, *MSA background research – foundation skills in the manufacturing industry as at November 2011 v2*, MSA, Sydney.
- Marr, B & Hagston, J 2007, *Thinking beyond numbers: learning numeracy for the future workplace*, NCVER, Adelaide.

- McHugh, M 2008, 'Adult literacy in Australia: results from the 2006 Adult Literacy and Life Skills Survey', *Literacy Link*, vol.28, no.1.
- McIntosh, S & Vignoles, A 2000, *Measuring and assessing the impact of basic skills on labour market outcomes*, Centre for the Economics of Education, London.
- Ministry of Education, New Zealand Government 2009, *Numeracy for adults: latest findings from teaching and learning research*, Ministry of Education, Dunedin, NZ.
- MPR Associates & US Department of Education, Office of Vocational and Adult Education 2011, *Building on Foundations for Success: guidelines for improving adult mathematics instruction*, OVAE, Washington, DC.
- National Audit Office 2008, *Skills for Life: progress in improving adult literacy and numeracy: a report by the Comptroller and Auditor General*, Stationery Office, London.
- National Institute of Adult Continuing Education 2011, *Numeracy counts: NIACE Committee of Inquiry on Adult Numeracy Learning: final report: chaired by Dame Mary Marsh MBE*, NIACE, Leicester.
- National Quality Council 2009, *Foundation skills in VET products for the 21st Century*, NQC, Melbourne.
- National Skills Standards Council, 2012, 'Determination for trainer and assessor competencies', viewed 30 November 2012, <www.nssc.natese.gov.au/policies/determination_for_trainer_and_assessor_competencies>.
- O'Donoghue, J 2003, 'Mathematics or numeracy: does it really matter?', *Adults Learning Maths Newsletter*, no.18, pp.1–5.
- Parsons, S & Bynner, J 2005, *Does numeracy matter more?*, National Research and Development Centre, London.
- Perkins, K 2009, *Adult literacy and numeracy: research and future strategy*, NCVET, Adelaide.
- Productivity Commission 2011, *Vocational education and training workforce: research report*, Productivity Commission, Canberra.
- QIA Skills for Life Improvement Programme 2008, 'Entry assessments for mathematics (numeracy) teacher training: exemplar entry assessment tasks', viewed 22 February 2012, <<http://www.docstoc.com/docs/74234905/Exemplar-entry-assessments-for-Numeracy-teacher-training>>.
- Richardson, S 2004, *Employers' contribution to training*, NCVET, Adelaide.
- Roberts, A & Wignall, L 2010, *Briefing on foundation skills for the National VET Equity Advisory Council*, NVEAC, Melbourne.
- Schick, R 2005, *Employer investment in workplace literacy programmes*, Workbase: The NZ Centre for Workforce Literacy Development, Auckland.
- Shomos, A 2010, *Links between literacy and numeracy skills and labour market outcomes: Productivity Commission staff working paper*, Productivity Commission, Melbourne.
- Skills Australia 2010a, *Australian workforce futures: a national workforce development strategy*, Department of Education, Employment and Workplace Relations, Canberra.
- 2010b, *Creating a future direction for Australian vocational education and training: a discussion paper on the future of the VET system*, Department of Education, Employment and Workplace Relations, Canberra.
- 2011, *Skills for prosperity: a roadmap for vocational education and training*, Department of Education, Employment and Workplace Relations, Canberra.
- Southwood, S 2011, 'Basic skills in the United Kingdom: how it has evolved over the past decade: adapted from a presentation at a CAAL roundtable on adult numeracy', *Adult numeracy: a reader: four papers from CAAL's January 2012 Roundtable on Adult Numeracy*, Council for Advancement of Adult Literacy, New York, pp.39–50.
- Steering Committee for the review of Government Service Provision 2011, *National Agreement performance information 2010: National Agreement for Skills and Workforce Development*, Productivity Commission, Canberra.
- Swain, J, Baker, E, Holder, D, Newmarch, B & Coben, D 2005, '*Beyond the daily application*': making numeracy teaching meaningful to adult learners, National Research and Development Centre, London.
- Tout, D 2008, *Response to COAG National Numeracy Review: submission no.NNR 42*, Centre for Adult Education, Melbourne.
- 2010, 'Submission 27 – Mathematical Association of Victoria Council: Education and Training Workforce Study – Vocational Education and Training', viewed December 2012, <http://www.pc.gov.au/_data/assets/pdf_file/0020/100559/sub027.pdf>.
- Tout, D & Motteram, G 2006, 'Teaching mathematics in context', in *Foundation numeracy in context*, ACER Press, Melbourne, pp.1–21.

- Tout, D & Schmitt, MJ 2003, 'The inclusion of numeracy in adult basic education', in *Annual Review of Adult Learning and Literacy: volume 3*, eds J Comings, B Garner & C Smith, Jossey-Bass, San Francisco, pp.152–202.
- Townsend, R & Waterhouse, P 2008, *Whose responsibility? Employers' views on developing their workers' literacy, numeracy and employability skills*, NCVET, Adelaide.
- van Groenestijn, M 2003, 'Numeracy: a challenge for adult education', in *Quantitative literacy: why numeracy matters for schools and colleges: proceedings of the National Forum on Quantitative Literacy held at the National Academy of Sciences in Washington, DC, 1–2 December 2001*, eds BL Madison and LA Steen, National Council on Education and the Disciplines, Princeton, NJ, pp.229–34.
- Wake, G 2010, 'What makes mathematics 'functional'? Where should we look for an answer?', *European Numeracy Seminar: the whats and hows of adult numeracy, February 2010*, Norwegian Institute for Adult Learning, Oslo.
- Whatman, J, Shagen, S, Vaughan, K & Lander, J 2009, *Engaging young people/young adults in literacy, language and numeracy: a literature review*, Department of Labour, Wellington.
- Wheelahan, L & Moodie, G 2010, *The quality of teaching in VET: final report and recommendations*, Australian College of Educators, Mawson, ACT.
- Williams, J & Wake, G 2007, 'Black boxes in workplace mathematics', *Educational studies in mathematics*, vol.64, no.3, pp.317–43.

Appendix A

Table A1 Number of questions per Australian Core Skills Framework numeracy level in the numeracy assessment tool

ACSF numeracy level	Number of questions
1	1
2	5
3	9
4	8
5	1
Total	24

Note: A copy of the numeracy assessment tool and a description of how it was developed are available in the support document.

Table A2 Participant specialist adult training qualifications by qualification level and numeracy proficiency level

Level	Specialist adult training qualification	Numeracy level
Masters	Masters Applied Linguistics	Nil
	Masters TESOL	Nil
	Masters in Applied Linguistics (TESOL)	Nil
	Masters Education (TESOL)	Nil
	Masters Language and Literacy	Nil
Graduate diploma/ graduate certificate	Vocational Graduate Certificate Adult LLN Practice	ACSF level 3/4
	Graduate Diploma TESOL	Nil
	Graduate Diploma ABE	Unknown
	Graduate Diploma Adult Education	Unknown
	Graduate Diploma Adult Education (TESOL)	Unknown
	Graduate Diploma TESOL/ALBE	Unknown
	Graduate Diploma Literacy and TESOL	Nil
	Graduate Certificate TESOL	Nil
	Graduate Certificate Language and Literacy	Nil
	Graduate Certificate Language and Literacy Education	Nil
Degree	Bachelor Education (TESOL)	Nil
	Bachelor Adult Learning and Development	Unknown
	Bachelor of Arts Teaching English Language and Literacy	Nil
Advanced diploma	Advanced Diploma of Language, Literacy and Numeracy Practice in VET	ACSF level 5
Diploma	Diploma Adult TESOL	Nil
	Diploma TEFLA	Nil
	Diploma Education (ESL/Japanese)	Nil
Certificate IV	Certificate IV TESOL	Nil

Notes: Some participants held no specialisation and some participants held more than one specialisation. ABE = Adult Basic Education. ALBE = Adult Literacy and Basic Education. TEFLA = Teaching English as a Foreign Language to Adults. TESOL = Teachers of English to Speakers of Other Languages.

Table A3 Number of participant specialist adult training qualifications by qualification level and area of specialisation

Level	Adult training specialisation	
	English language and/or literacy	Numeracy
Masters	8	0
Graduate diploma/graduate certificate	16	6
Degree	3	1
Advanced diploma	1	0
Diploma	3	0
Certificate IV	2	0

Note: Some participants held no specialisation and some participants held more than one specialisation.

Table A4 Numeracy assessment results for all participants by assigned score and Australian Core Skills Framework numeracy level

ACSF numeracy level	Credits	Insufficient evidence	Not attempted
1	39	2	3
2	116	48	12
3	295	111	34
4	207	103	42
5	5	33	6
Total	657	264	91

Notes: Credit was assigned where an answer was correct or where the answer was incorrect but the correct procedure was followed, there was evidence that the highest numeracy skill requirement of the question was demonstrated or the answer was more right than wrong. Insufficient evidence was assigned where there was evidence the participant had attempted the question but had not provided sufficient evidence for credit to be applied. Not attempted was assigned where there was no evidence of an attempt to answer the question.

Table A5 Numeracy assessment results for LLN specialist participants only by assigned score and Australian Core Skills Framework numeracy level

ACSF numeracy level	Credits	Insufficient evidence	Not attempted
1	17	2	1
2	48	25	7
3	125	52	23
4	93	44	23
5	2	14	4
Total	283	123	54

Notes: Credit was assigned where an answer was correct or where the answer was incorrect but the correct procedure was followed, there was evidence that the highest numeracy skill requirement of the question was demonstrated or the answer was more right than wrong. Insufficient evidence was assigned where there was evidence the participant had attempted the question but had not provided sufficient evidence for credit to be applied. Not attempted was assigned where there was no evidence of an attempt to answer the question.

Table A6 Numeracy assessment results for vocational specialist participants only by assigned score and Australian Core Skills Framework numeracy level

ACSF numeracy level	Credits	Insufficient evidence	Not attempted
1	22	0	2
2	68	23	5
3	170	59	11
4	114	59	19
5	3	19	2
Total	374	141	37

Notes: Credit was assigned where an answer was correct or where the answer was incorrect but the correct procedure was followed, there was evidence that the highest numeracy skill requirement of the question was demonstrated or the answer was more right than wrong. Insufficient evidence was assigned where there was evidence the participant had attempted the question but had not provided sufficient evidence for credit to be applied. Not attempted was assigned where there was no evidence of an attempt to answer the question.

Support document details

Additional information relating to this research is available in *Seeking the N in LLN: support document*. It can be accessed from NCVER's website <<http://www.ncver.edu.au/publications/2627.html>>.

Details include:

- Numeracy assessment tool development
- Detailed focus group results
- Detailed numeracy assessment observations
- Appendices A to F
- References

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