

Not just for the kids: Adult skills in the 21st century



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Abstract

This paper presents a perspective on what we as educators, policymakers and citizens can learn from the development, implementation and the resulting research and insights arising from international adult skills surveys.

Background

As part of Australia's National Assessment Program (NAP), samples of Australian school-aged children participate in a number of international assessments:

- the Trends in International Mathematics and Science Study (TIMSS) is conducted in four-year cycles for Year 4 and Year 8 students and assesses mathematics and science
- the Progress in International Reading Literacy Study (PIRLS) is conducted in five-year cycles for Year 4 and Year 8 students and assesses reading
- the Programme for International Student Assessment (PISA) is conducted in three-year cycles for 15-year-olds and assesses reading literacy, mathematical literacy and scientific literacy. Other domains are offered from time to time such as problem-solving and financial literacy.

What is less well-known and acknowledged is that Australia also participates in international assessments of adult skills, and has done so since 1996. These surveys have evolved from the International Adult Literacy Survey (IALS) conducted in 1996, to the Adult Literacy and Life Skills Survey (ALLS) in 2006 through to the Programme for International Assessment of Adult Competencies (PIAAC), which was conducted in Australia in 2011–2012. Planning is currently underway for the second cycle of PIAAC, which will be conducted in 2022. PIAAC, like PISA, is conducted under the auspices of the OECD.

PIAAC is an international survey of adult skills that covers reading literacy, numeracy and problem-solving of 16-to-65-year-old adults. The Australian Bureau of Statistics (ABS) conducts these household surveys in Australia. PIAAC survey instruments are administered to a random representative sample across Australia excluding remote Indigenous adults and incarcerated adults. Australia oversamples to include a younger cohort (15-year-olds) and an older cohort (66-74 years) than the minimum international requirements. The oversampling also enables state and territory performance to be compared. PIAAC 2012 was completed using pen and paper or computer.

One unique feature of these adult surveys is that participants answer a significant number of background questions (approximately 300) which, together with the

assessment of respondents' cognitive skills, provide the potential for rich analysis. These background questions consist of a wide range of socio-demographic questions, and questions about skills' use and practices, which can be correlated with the cognitive skills assessed.

The skills use and practice questions attempt to find information about how people use their literacy and numeracy skills, both in everyday life and at work.

This paper focuses on the development and evolution of the reading and numeracy aspects of PIAAC; however, readers should also look at the findings and research in relation to problem-solving.

Evolution of the reading and numeracy assessments

As with all international assessments, PIAAC is underpinned by the development of comprehensive frameworks that define the skills to be assessed and describe and set out the constructs for developing the actual content of the tests.

Definitions and constructs

Definitions of these adult literacy and numeracy assessments and their constructs have changed as they moved into the 21st century, and are being revised and updated for PIAAC 2022. Table 1 sets out the definitions used in these adult literacy and numeracy assessments since 1996.

What changed and why?

A close reading of the changes in definitions over the 30 years in question brings to light the evolution in conceptualising skills as we've moved into the 21st century.

Reading

In reading, what is apparent, first, is the unification in the 2006 ALLS definition of the prose and document literacy division of 1996 into a single construct – 'literacy'. In the first international adult literacy survey, a polemical point was made, in the separate definitions of prose and document literacy, that reading comprises more than the comprehension of passages of connected text

Table 1 Definitions of literacy/reading and numeracy in adults skills surveys, 1996 to 2022

Survey (year)	Literacy/Reading	Numeracy
IALS – 1996	<p><i>Document literacy:</i> The knowledge and skills required to locate and use information contained in various formats, including job applications, payroll forms, transportation schedules, maps, tables, and graphics.</p> <p><i>Prose literacy:</i> The knowledge and skills needed to understand and use information from texts including editorials, news stories, poems, and fiction.</p>	<p><i>Quantitative Literacy:</i> The knowledge and skills required to apply arithmetic operations, either alone or sequentially, to numbers embedded in printed materials such as balancing a cheque book, figuring out a tip, completing an order form, or determining the amount of interest on a loan.</p> <p>Note: Quantitative literacy was assessed in IALS as one of three dimensions of literacy.</p>
ALLS – 2006	<p><i>Literacy</i> is using printed and written information to function in society, to achieve one’s goals, and to develop one’s knowledge and potential.</p> <p><i>Document literacy:</i> the knowledge and skills required to locate and use information contained in various formats, including job applications, payroll forms, transportation schedules, maps, tables and graphics.</p> <p><i>Prose literacy:</i> the knowledge and skills needed to understand and use information from text, including editorials, news stories, poems and fiction.</p>	<p><i>Numeracy</i> is the knowledge and skills required to effectively manage and respond to the mathematical demands of diverse situations.</p>
PIAAC 2012 (cycle 1)	<p><i>Literacy</i> is the ability to understand, evaluate, use and engage with written texts to participate in society, to achieve one’s goals, and to develop one’s knowledge and potential.</p>	<p><i>Numeracy</i> is the ability to access, use, interpret, and communicate mathematical information and ideas, in order to engage in and manage the mathematical demands of a range of situations in adult life.</p>
PIAAC 2022 (cycle 2)	<p><i>Literacy</i> is accessing, understanding, evaluating and reflecting on written texts in order to achieve one’s goals, to develop one’s knowledge and potential and to participate in society.</p>	<p><i>Numeracy</i> is accessing, using and reasoning critically with mathematical content, information and ideas represented in multiple ways in order to engage in and manage the mathematical demands of a range of situations in adult life.</p>

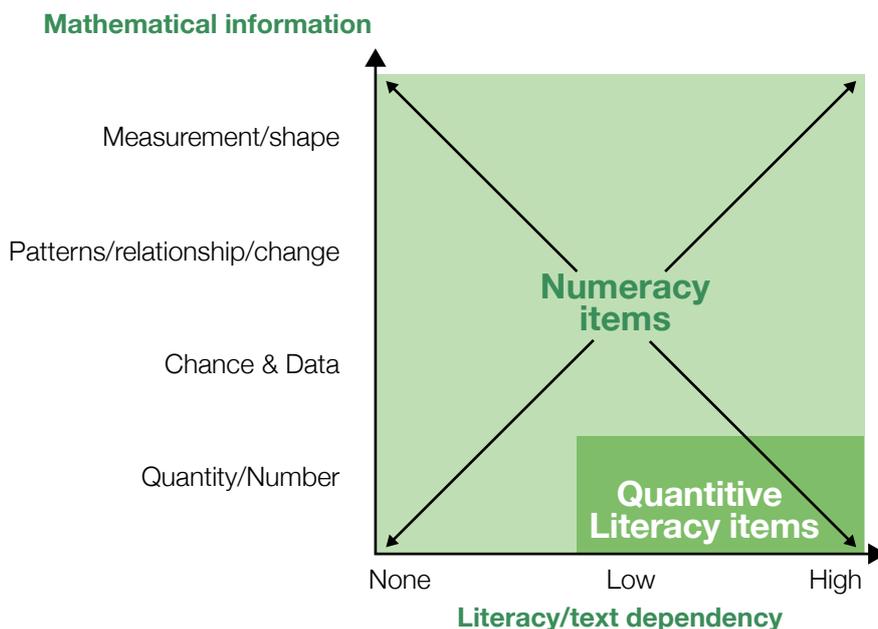


Figure 1 Numeracy versus quantitative literacy

(‘prose literacy’, which is the traditional, school-based idea of ‘reading’). It includes the ability to deal with texts such as forms, graphs, tables, maps and diagrams – the kind of reading that makes up the bulk of many adults’ engagement with texts. By 2006, this expanded notion of reading was generally accepted so the division into two types of reading literacy was not needed.

A second marked feature of the 2006 ALLS definition is the new, confident statement about the purpose of literacy in the contemporary world: that literacy is needed ‘to function in society, to achieve one’s goals, and to develop one’s knowledge and potential’. The purposes are economic, social and personal, penetrating every aspect of adult life.

A third change is introduced in the PIAAC definition of 2022: ‘evaluate’ now accompanies ‘understand’ and ‘use’ from the previous definitions. We see here the articulation of a growing awareness that critical literacy is a key element of 21st-century life – a capacity that goes beyond the merely functional uses of literacy that are represented by ‘understand’ and ‘use’.

Finally (so far), in the new definition of literacy for PIAAC 2022, ‘access’ is included, picked up from the numeracy definition of PIAAC 2012. Access is a term that takes a 21st-century meaning that relates to the ability to search for and extract information from digital and online sources. This skill in its full sense requires not just a mechanical or technical competence, but draws also on advanced cognitive competence in analysing, selecting and critiquing from what is typically, in the online context, a plethora of possibilities.

Numeracy

In developing the argument to replace the previous quantitative literacy (QL) component of IALS with numeracy in ALLS, the numeracy expert group needed to show why numeracy was a broader and significantly different measure. While there is a clear connection and relationship between numeracy and the IALS QL measure, there are significant differences. Numeracy covers a much wider breadth of mathematical skills and purposes and is also not as heavily dependent on literacy skills where tasks are embedded in text (as they were in IALS 1996). Figure 1 illustrates the differences and highlights the wider coverage of content and item types in numeracy in ALLS compared with quantitative literacy in IALS.

As with literacy, the framework and assessment developed from the first delivery of numeracy in ALLS through to PIAAC 2022, has evolved to recognise the growing awareness that critical numeracy, like critical literacy, is a key element of 21st century life that goes beyond a merely functional perspective on numeracy. The definition and construct for numeracy in PIAAC cycle 2 has attempted to reflect the impact of the

changing demands of 21st-century society and of workplaces (e.g. see Binkley et al., 2012; Foundation for Young Australians, 2017; Griffin, McGaw, & Care, 2012; Hoyles, Noss, Kent, & Bakker, 2010; Partnership for 21st Century Skills, 2016; Pellegrino & Hilton, , 2012). 21st-century skill requirements are more demanding, and require more critical, reflective reasoning skills and the ability to interpret and understand a broader range of texts and materials, and that, increasingly, the new skills interact with the digital world and technology. As a result the revised numeracy definition has some new emphases: *reasoning critically* with mathematical content, information and ideas *represented in multiple ways*.

Australian performance in PIAAC 2012

Five levels of proficiency are described in PIAAC, although Level 1 has been split into Below Level 1 and Level 1, given the high numbers of adults performing at Level 1.

Table 2 shows the proficiency descriptions for the top and the lower two levels of PIAAC, and the percentage of Australians achieving each level.

Figure 2 shows the distribution of Australia’s performance across the different levels defined for PIAAC 2012 for both literacy (reading) and numeracy.

In September 2017, the OECD released a targeted country report on Australia’s performance in PIAAC, *Building Skills for All in Australia: Policy Insights from the Survey of Adult Skills* (OECD, 2017). This closer examination of Australia’s performance revealed the following key challenges:

- numeracy represents a particular challenge in Australia
- signs of poor numeracy performance can be traced back to initial schooling
- women have weaker numeracy skills than men
- there is a relatively large gap between the most proficient and least proficient adults in literacy and in numeracy
- many well-educated adults have low literacy and/or numeracy skills
- young women in Australia are much more likely to not be in employment, education or training (NEET) than young men. (OECD, 2017, p. 9)

The report concluded:

Taken together, although Australia’s average results are not poor, the challenges presented by adults with low basic skills may lead to Australia being left behind in terms of innovation and economic growth by countries that have been more successfully investing in the skills of all their people. (OECD, 2017, p. 9)

Table 2 Proficiency levels of PIAAC Cycle 1, with percentage of Australians per level

Level	Percentage of Australians at this level	The types of tasks completed successfully at each level of proficiency	
		Reading	Numeracy
Below Level 1	Reading: 3.7% Numeracy: 6.5%	The tasks at this level require the respondent to read brief texts on familiar topics to locate a single piece of specific information. There is seldom any competing information in the text and the requested information is identical in form to information in the question or directive. The respondent may be required to locate information in short continuous texts. However, in this case, the information can be located as if the text were non-continuous in format. Only basic vocabulary knowledge is required, and the reader is not required to understand the structure of sentences or paragraphs or make use of other text features. Tasks at this level do not make use of any features specific to digital texts.	Tasks at this level require the respondents to carry out simple processes such as counting, sorting, performing basic arithmetic operations with whole numbers or money, or recognising common spatial representations in concrete, familiar contexts where the mathematical content is explicit with little or no text or distractors.
1	Reading: 10.4% Numeracy: 15.3%	Most of the tasks at this level require the respondent to read relatively short digital or print continuous, non-continuous, or mixed texts to locate a single piece of information that is identical to or synonymous with the information given in the question or directive. Some tasks, such as those involving non-continuous texts, may require the respondent to enter personal information onto a document. Little, if any, competing information is present. Some tasks may require simple cycling through more than one piece of information. Knowledge and skill in recognising basic vocabulary determining the meaning of sentences, and reading paragraphs of text is expected.	Tasks at this level require the respondent to carry out basic mathematical processes in common, concrete contexts where the mathematical content is explicit with little text and minimal distractors. Tasks usually require one-step or simple processes involving counting, sorting, performing basic arithmetic operations, understanding simple percentages such as 50%, and locating and identifying elements of simple or common graphical or spatial representations.
2	Reading: 30.1%; Numeracy: 32.5%		
3	Reading: 37.9%; Numeracy: 31.3%		
4	Reading: 14.5%; Numeracy: 10.9%		
5	Reading: 1.2% Numeracy: 1.4%	At this level, tasks may require the respondent to search for and integrate information across multiple, dense texts; construct syntheses of similar and contrasting ideas or points of view; or evaluate evidence-based arguments. Application and evaluation of logical and conceptual models of ideas may be required to accomplish tasks. Evaluating reliability of evidentiary sources and selecting key information is frequently a requirement. Tasks often require respondents to be aware of subtle, rhetorical cues and to make high-level inferences or use specialised background knowledge.	Tasks at this level require the respondent to understand complex representations and abstract and formal mathematical and statistical ideas, possibly embedded in complex texts. Respondents may have to integrate multiple types of mathematical information where considerable translation or interpretation is required; draw inferences; develop or work with mathematical arguments or models; and justify, evaluate and critically reflect upon solutions or choices.

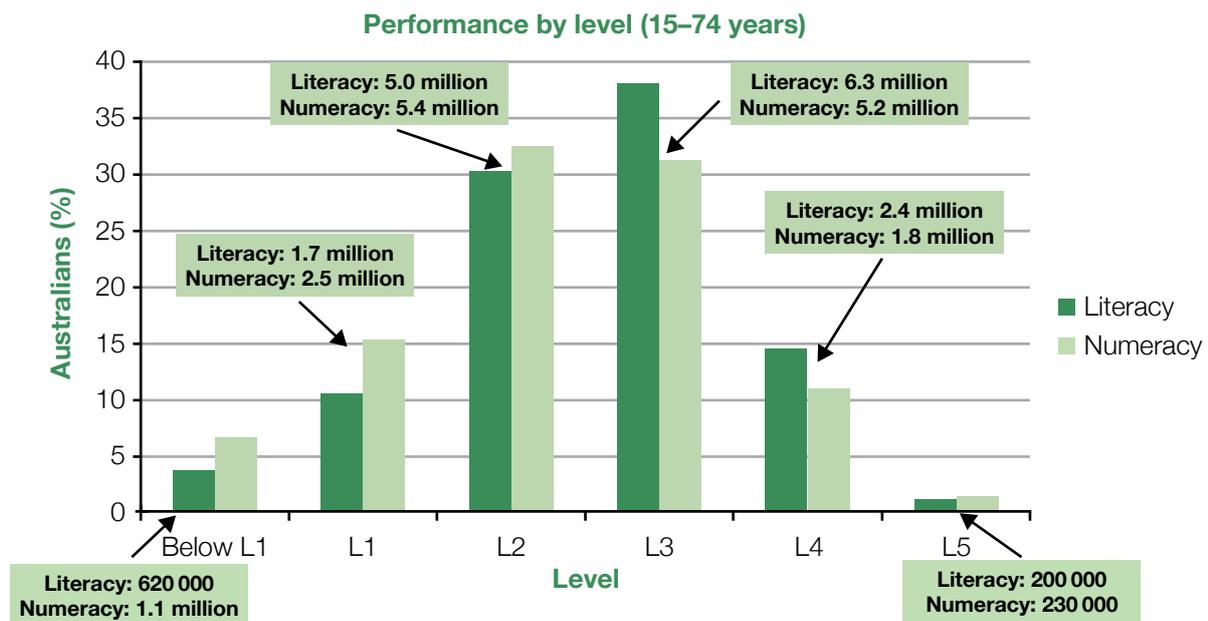


Figure 2 Proportions of persons in Numeracy in PIAAC 2012. Total Australian population aged 15–74 years

Research outcomes

Based on three cycles of international assessments of adult literacy and numeracy skills (IALS, ALLS and PIAAC), research indicates, among a number of other findings, that people with higher literacy and numeracy skills are significantly more likely to be employed, to participate in their community, to experience better health, and to engage in further training. They also earn more on average (see OECD, 2013; OECD, 2016). As well, the research demonstrates that each extra year of education improves literacy and numeracy skills.

An example of the analytic potential of PIAAC is shown in the graph in Figure 3.

The data demonstrate that adults with high proficiencies in literacy and in numeracy are much more likely, compared to those with lower skills, to report good health, to be employed, to have higher earnings, and to have positive social dispositions and take part in community life. The odds ratios shows the likelihood of positive social and economic outcomes among highly proficient adults (those scoring at Level 4/5) compared with less proficient adults (those scoring at Level 1 or below) were considerably higher for numeracy in the areas of health, employment and high salary, compared to literacy. These data show that numeracy can play a more important role than literacy in both human and social capital terms.

The value of PIAAC and some key messages for Australia

Participation in international surveys of learning and skills can provide very practical information to inform policy and practice

Information relevant to teaching and learning stems from the theoretical frameworks, constructs and descriptions of the adult skills assessments and from the research based on the rich data set of empirical information about adult literacy and numeracy performance and their background data. It is essential to go behind and beyond the initial and media-focused messages from such assessments about the results to look at the definitions and frameworks themselves, and what the related research tells us about teaching and learning. This is equally, if not more important, than the results themselves. Building on the empirical and theoretical research emanating from such international assessments and their frameworks strengthens the links between testing, research and practice.

We will briefly outline two uses of such international adult skills surveys. The first example is a pragmatic outcome related to the development of a literacy and numeracy assessment for graduating teachers. The second illustrates what the results tell us about Australia's foundation skills as we move further into the 21st century.

Likelihood of positive social and economic outcomes among highly literate or numerate adults

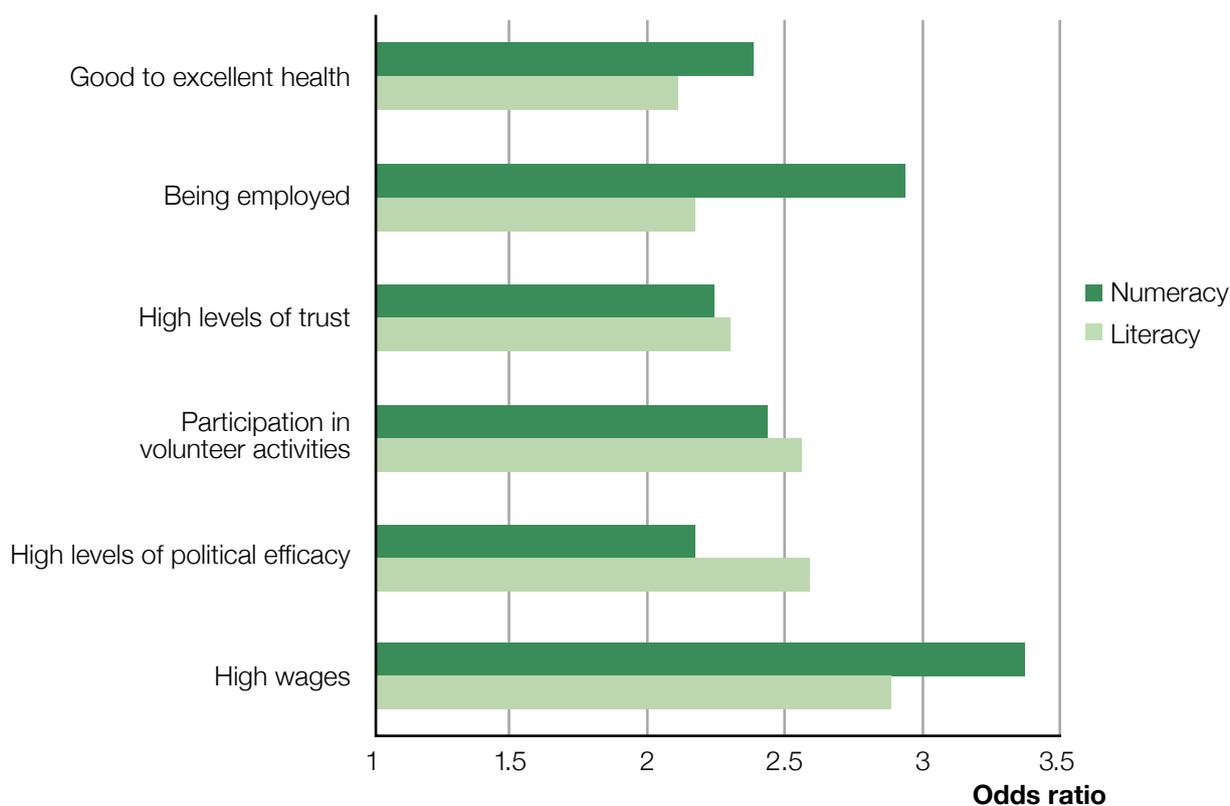


Figure 3 Likelihood of positive social and economic outcomes among highly literate or numerate adults (OECD, 2013b)

Literacy and numeracy standards for graduating teachers

PIAAC 2012 data were able to contribute in to the development of the the assessment of literacy and numeracy standards for students graduating from initial teacher education (ITE) programs – henceforth referred to as ‘the test’ – which was introduced nationally in Australia in 2016.¹

In 2011, all Australian education ministers agreed to a national approach to the accreditation of ITE programs, including the expectation that all students who graduated from ITE courses would need to be in the top 30 per cent of the population for personal literacy and numeracy. With this goal, it was agreed that a national assessment of literacy and numeracy would be instituted. A framework for the test and the development of assessment material began in 2013. As part of this development, national panels of experts were assembled to set standards for minimum achievement in personal literacy and numeracy. These standards – set in the first instance in relation to the panel members’ experience of what could reasonably be expected in

the way of literacy and numeracy of students at the end of an ITE program – were ‘indicative’, and helped to frame the design of the assessment and the difficulty of the test material. Once assessment questions had been developed, and piloting undertaken, the indicative standards were revisited, reviewed and modified, to result in provisional standards, which were set and applied to the first round of pilot testing in 2015 and then again reviewed and confirmed by a larger trial test and a second round of standard setting, which was applied from mid-2016, when the test was officially launched. Notwithstanding these successive rounds of trial testing and standard setting, it was yet to be determined whether the test had identified the top 30 per cent of the population in literacy and numeracy. The difficulty here was that no national data collection or metric exists that robustly measures the literacy and numeracy competence of the Australian population – that is, apart from the international adult literacy surveys.

Accordingly, in order to check on how closely the applied standards of personal literacy and numeracy adopted for the first year of the test approximated to the top 30 per cent of the population, a methodology was

¹ The authors gratefully acknowledge the work of our ACER Senior Research Fellow Ray Peck, who prepared a description of the process of standard setting in the Literacy and Numeracy Test for Initial Teacher Education students, including the use of PIAAC data to validate the standards.

applied to equate the test with Australia's performance in PIAAC 2012 – using data that were now available from the ABS and OECD. Sets of items that had been administered to the representative sample of Australian adults in PIAAC, in 2011–12, were included (as unscored items) in the test administered to ITE students in 2017. Once sufficient numbers of responses had been obtained from the test administration, psychometric analysis was undertaken to locate the performance of the top 30 per cent of all adult Australians in PIAAC and place these results on the literacy and numeracy scales for the ITE test.

The analysis found that the essentially judgemental approach that had been implemented in setting the standards on the test was very close to the statistical equating. For numeracy, the panel of experts had set the standard only three points lower than that indicated by the statistical equating: 107 instead of 110 scale points. For literacy, the panel of experts had set the standard just one point lower than the statistically derived standard: 106 instead of 107 scale points. This was a remarkable result, and a tribute to the expertise of the literacy and numeracy panellists. The numeracy standard on the test was subsequently raised marginally, to match the PIAAC-based standard and thus conform with the standard of matching the top 30 per cent of the adult population. The literacy standard was maintained unadjusted, given its almost exact match to the judgemental standard.

Regardless of the actual outcome and consequences of this exercise, this case study indicates the value of Australia's participation in PIAAC and its forerunners: that participation made possible the empirical confirmation of a national education policy that would otherwise have remained notional.

Australia's foundation skills – are we prepared for the 21st century?

Australia's ALLS and PIAAC results, no matter how you read them, demonstrate unequivocally that a significant number of Australian aged from 15 to 74 years do not have access to sufficient foundation skills in reading and numeracy to be able to cope equitably with life and work in the 21st century (OECD, 2017). This is consistent with Australia's most recent performance on PISA (2015) and its measure of the abilities of 15-year-olds. The capacity to make considered decisions requires good foundational literacy and numeracy skills – whether they be instantaneous decisions at a workplace or when out shopping, or following written instructions about a medical or health matter, or making decisions about financial matters, or understanding the implications of gambling. The results of these surveys show that millions of Australian

teenagers and adults do not have such foundational skills and they are, potentially, disempowered, especially as we move further into the 21st century and its demands for higher level and more flexible skills.

Conclusion

It will be crucial to see how Australian adults perform in PIAAC 2022, and to reflect on these results from both a policy level in relation to adult education, but also in relation to how school education is preparing young people for the world as adults.

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