NCVER

Skill matches to
job requirements

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Department of Education, Employment and Workplace Relations

A National Vocational Education and Training **Research** and **Evaluation** Program **Report**

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Publisher's note

Additional information relating to this research is available in *Skill matches to job requirements: Support document*. It can be accessed from NCVER's website <http://www.ncver.edu.au/publications/2185.html>.

To find other material of interest, search VOCED (the UNESCO/NCVER international database <http://www.voced.edu.au>) using the following keywords: Job requirements; job skill; lifelong learning, literacy, numeracy; older worker; skill analysis; workforce development.

About the research

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Skill matches to job requirements

Chris Ryan and Mathias Sinning, Australian National University

Australia's ageing population has resulted in a policy focus on keeping older workers in the workforce for longer. One set of issues is the relationship between the skills of older workers and the skill requirements of jobs available to them. There are several implications of a mismatch between skill level and skill requirements. Older workers with skills that are not being used could be put to better use. On the flip side, if the skills of older workers are not high enough to meet the requirements of their jobs, it would be difficult to encourage them to stay in the labour market longer. If this is the case, could increased participation in training by older workers help them to fulfil the requirements of their jobs, and hence encourage them to stay longer?

This report looks at the relationship between literacy and numeracy skills and their use in the workplace, paying particular attention to older workers. The analysis allows us to see whether workers in certain age groups are mismatched to their jobs, based on the literacy and numeracy skills they have.

Key findings

- Across all age groups, workers with higher literacy and numeracy skills work in jobs that make more use of their skills compared with workers with lower skills.

- Older workers make as much use of their literacy and numeracy skills at work as younger workers. Skill mismatch does not seem to be a problem that affects older workers any more than their younger counterparts. This suggests that older workers do not appear to be moving into less demanding 'transition' jobs in preparation for retirement.

A second report from this program of research, which looks at how the relationship between skill level and job requirement affects the propensity to undertake further education and training, is available from the NCVER website. An overview that summarises the findings from these two reports is also available.

Tom Karmel
Managing Director, NCVER

Informing policy and practice in Australia's training system …

Contents

Tables and figures

Tables

Figures

Executive summary

This study examines the relationship between the skills of workers and the skill requirements of the jobs in which they work in the Australian labour market and pays particular attention to older workers. We aim to generate empirical evidence on the extent to which older workers apply their skills in the workplace. Against the background of changing labour market conditions and in the light of an ageing Australian workforce, which may require individuals to work beyond current retirement age norms, it is important to assess whether older workers apply their skills at work to the same extent as younger workers.

To date, there is little empirical evidence on the relationship between direct measures of individual skills and the skill requirements of their jobs in the Australian labour market. Skill mismatches may create high costs through a loss of productivity associated with wasted skills, consequent low job satisfaction among workers and higher resulting turnover rates. With regard to the concerns about unmet demand for high-skilled workers in the Australian labour market, skill shortages could be reduced by reassigning high-skilled workers who do not make good use of their skills in their current jobs. With demographic changes, the extent to which older workers apply their skills in the workplace will become a matter of particular relevance if good use is not made of the skills of older workers.

We use two surveys conducted by the Australian Bureau of Statistics (ABS): the Survey of Aspects of Literacy (SAL) and the Adult Literacy and Life Skills (ALLS) Survey. These surveys were conducted ten years apart and contain comparable information on measures of worker skills—notably their literacy skills—as well as information on the frequency with which they undertake a range of literacy- and numeracy-related tasks. This exceeds the information available for analysis in most studies, where educational attainment is used as a proxy for skills. In addition, in this study we employ the use of skills in the workplace to construct measures of job requirements. We make use of a number of different variables that measure the tasks that individuals undertake their jobs. Specifically, job requirements are measured by self-reports of individuals about their literacy and numeracy use at work.

By comparing individual skills and skill use measures, this study provides a comprehensive descriptive analysis of skill matches to job requirements for older workers in the Australian labour market. In the first instance, the aim is to trace out the skill match of older workers to jobs by estimating a 'matching' function that reveals the skill characteristics that are relevant for jobs involving specific tasks. We also compare these patterns between workers of different ages. Nothing in our analysis should be interpreted as suggesting that skills solely determine usage at work, or any single effect in the other direction. Obviously the various interactions between usage, skills and education are complex, so we tend to talk about the 'match' of workers with skills to jobs that require their use rather than any causal relationships.

The empirical findings of this study suggest that older workers apply their skills at work more often than younger workers, suggesting that there is no reason to be concerned about the misallocation of older workers to their jobs. Instead, the quality of employment opportunities available to older workers remains relatively high. This result was persistent over time and across birth cohorts. Specifically, between the surveys, the use of literacy skills at work increased across all birth cohorts of workers as they aged in our regression analysis.

The main findings of the study are highlighted in the points below:

Literacy use:

✧ Workers with higher literacy skills use them more often at work than workers with lower literacy skills.

✧ The level of literacy use increases with higher literacy skills, but at a declining rate.

✧ The average level of literacy is higher for workers aged over 40 years than for workers aged below 40 years.

✧ The average level of literacy use increases with level of education.

✧ Differences between male and female workers in literacy use at work have disappeared over time.

✧ Full-time employees and those employed by large employers report higher levels of literacy use at work.

Numeracy use:

✧ Workers with higher numeracy skills use them more often at work than workers with lower numeracy skills.

✧ The level of numeracy use increases with higher numeracy skills, but at a declining rate.

✧ Numeracy use also increases with level of education.

✧ The average level of numeracy use tends to be higher for workers between 40 and 59 years than for workers below 40 years and workers aged 60 years and above.

✧ Female workers of nearly all ages exhibit a significantly lower level of numeracy use at work than male workers, both in 1996 and 2006.

The overall conclusion from this paper is an optimistic one: older workers make at least as much use of their skills in their jobs as their younger counterparts. On this dimension at least, there is no additional reason to be concerned about their treatment in the labour market. Policies designed to encourage older workers to continue to upgrade their skills through life, therefore, do not need to focus on impediments to their use in jobs, but on the incentives for individuals.

Introduction

This study examines the relationship between the skills of workers and the skill requirements of the jobs in which they work in the Australian labour market, paying particular attention to older workers. We aim to generate empirical evidence on the extent to which older workers apply their skills in the workplace, because we expect differences in the way workers of different ages are matched to jobs. On the one hand, workers with more experience will have had longer to find jobs that best match their skills than younger workers. However, they also tend to have lower incentives to acquire new skills and may react more slowly to changes in skill requirements at work than younger workers. Hence, they may become less suited to the jobs they were originally matched to over time, if the requirements of their jobs change. This could induce job turnover, problematic for older workers, or some reclassification of their jobs. Against the background of changing labour market conditions and in the light of an ageing Australian workforce, which may require individuals to work beyond current retirement age norms, it is important to assess whether older workers are using their skills at work to the same extent as younger workers.

To date, there is little by way of empirical evidence on the relationship between direct measures of individual skills and the skill requirements of their jobs in the Australian labour market. Mismatches between individual skills and skill requirements may create high costs through a loss of productivity associated with wasted skills and consequent low job satisfaction among workers, possibly resulting in higher turnover rates. With regard to the concerns about unmet demand for high-skilled workers, skill shortages could be reduced by reassigning high-skilled workers who do not make good use of their skills in their current jobs. With demographic changes, the extent to which older workers apply their skills in the workplace will become a matter of particular relevance if good use is not made of the skills of older workers.

We want to be able to identify the relationship between individual skills and job requirements and analyse changes in the relationship over time. Consequently, we utilise two surveys conducted by the Australian Bureau of Statistics (ABS): the Survey of Aspects of Literacy (SAL) and the Adult Literacy and Life Skills (ALLS) Survey. These surveys were conducted ten years apart and contain comparable information on measures of worker skills—notably their literacy skills—as well as information on the frequency with which they undertake a range of literacy- and numeracy-related tasks.

In most empirical analyses of job requirements and worker skills, limited information about worker skills is available and information about educational attainment is taken as a proxy for skills. In this study, in addition to the usual education-related measures of skills, we are able to use the outcomes of tests undertaken by individuals that cover their literacy and numeracy skills, as well as assessments by the individuals themselves about how good their skills are for both the requirements of their jobs and the needs of daily life.

In addition, we employ the use of skills in the workplace to construct measures of job requirements. Although indicators of skill usage do not necessarily comply with contracted job requirements, they represent reasonable measures of actual job requirements. We make use of a number of different variables that measure the tasks individuals undertake their jobs. Specifically, job requirements are measured by self-reports of individuals about their literacy use and numeracy use at work. These data, in conjunction with the objective individual skill measures, provide a much richer picture of the match of workers to jobs than is available in other data.

By comparing individual skills and skill use measures, this study provides a comprehensive descriptive analysis of skill matches to job requirements for older workers in the Australian labour market. In the first instance, the aim is to trace out the skill match of older workers to jobs by estimating a 'matching' function that reveals the skill characteristics that are relevant for jobs involving specific tasks. We also compare these patterns between workers of different ages. Nothing in our analysis should be interpreted as suggesting that skills solely determine usage at work, or any single effect in the other direction. Obviously the various interactions between usage, skills and education are complex, so we tend to talk about the 'match' of workers with skills to jobs that require their use rather than any causal relationships.

Our study further provides evidence on the relationship between educational attainment, broad occupational categories and skill requirements and investigates variations in job requirements across birth cohorts by separating age, period and cohort effects. This analysis provides something of a check on our job requirement measure—we would expect job requirements to increase with educational attainment and be higher among high-skill occupations.

The next chapter describes the data used for the analysis, while later chapters provide evidence about the relationship between worker skills and skill requirements for different age groups, separately for literacy and numeracy. A final chapter considers the implications of the findings.

Description of the data

The analysis uses information from two cross sections of data collected ten years apart by the ABS, the Survey of Aspects of Literacy (SAL), collected in 1996, and the Adult Literacy and Life Skills (ALLS) Survey, both undertaken as part of international projects.

Survey of Aspects of Literacy, 1996

The Survey of Aspects of Literacy was a national survey designed to measure certain aspects of the literacy and numeracy skills of Australians. Personal interviews were carried out over a nine-week period between May 1996 and July 1996. The sample consists of 9302 respondents aged 15 to 74 years living in private dwellings, but excluded persons living in remote and sparsely settled areas. The data include information about the literacy and numeracy skills of individuals deemed necessary for the use of printed material typically found at work, at home, and in the community (ABS 1996a, 1996b). The International Adult Literacy Survey (IALS)[1] was part of an international project led by Statistics Canada.

There were two major components to the survey:

✧ Self-assessed reports by individuals of their reading, writing and basic mathematical skills for the needs of daily life and their main job:
  ◆ Respondents were asked a series of questions to obtain background socio-demographic information (such as age, gender etc.).
  ◆ Respondents were asked to rate their reading, writing and basic mathematical skills.
  ◆ Information was collected about the frequency with which respondents undertook selected literacy and numeracy activities in daily life and at work, and about their English and other language skills.

✧ An objective test-based assessment of literacy and numeracy skills, with respondents asked to undertake a set of tasks:
  ◆ Each respondent was asked to complete six relatively simple literacy-related tasks.
  ◆ Those who completed two or more of these correctly were then given 46 additional tasks drawn from a pool of 108, using commonplace examples of printed material and requiring varying degrees of comprehension and arithmetic skills.

The Survey of Aspects of Literacy includes three objective skill measures:

✧ document literacy: the effective use of information contained in materials such as tables, schedules, charts, graphs and maps

✧ prose literacy: the skills required to understand and use information from various kinds of prose texts, including texts from newspapers, magazines and brochures

✧ quantitative literacy: the ability to perform arithmetic operations using numbers contained in printed texts or documents. This is a very narrow measure of the numeracy skills of individuals.

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[1] The questionnaire and task booklets were administered in English and people with poor English language were excluded from the survey. This might have excluded a lot of migrants, and probably Indigenous Australians. Since remote and very remote areas were excluded from the sampling frame, a significant proportion of Indigenous population was excluded from the survey as well.

Studies that have analysed aspects of the Australian labour market using the Survey of Aspects of Literacy include Chiswick, Lee and Miller (2003) and Miller and Chiswick (1997), while the international collections have been studied extensively, most notably in Canada (see, for example, Riddell & Green 2002, 2003; Boothby 2002; Krahn & Lowe 1998).

Adult Literacy and Life Skills Survey, 2006

The Adult Literacy and Life Skills Survey was conducted in Australia as part of an international study coordinated by Statistics Canada and the Organisation for Economic Co-operation and Development (OECD). Personal interviews were carried out from July 2006 to January 2007 in private dwellings throughout non-remote areas of Australia. The sample consists of 8988 respondents aged 15 to 74 years.

The Adult Literacy and Life Skills Survey is divided into two sections:

✧ A background questionnaire including individual and household information such as general demographic information, linguistic information, parental information, labour force activities, literacy and numeracy practices in daily life and at work, frequency of reading and writing activities, participation in education and learning, social capital and wellbeing, information and communication technology, personal and household income.

✧ After the background questionnaire, each respondent was asked to complete a set of six basic questions. Only respondents who correctly answered a minimum of three questions of this basic component moved onto a main component, consisting of three blocks designed to measure (ABS 2006):
   ◆ document literacy: the efficient use of information contained in various formats, including job applications, payroll forms, transportation schedules, maps, tables and charts
   ◆ prose literacy: the knowledge and skills required to understand and use information from various kinds of narrative texts, including texts from newspapers, magazines and brochures
   ◆ numeracy: the ability to effectively manage and respond to the mathematical demands of diverse situations
   ◆ problem-solving: goal-directed thinking and the ability to act in situations for which no routine solution is available
   ◆ health literacy: the knowledge and skills required to understand and use information relating to health issues such as drugs and alcohol, disease prevention and treatment, safety and accident prevention, first aid, emergencies and staying healthy.

Like the Survey of Aspects of Literacy, individuals also provided self-assessments of their English reading and writing skills for the needs of daily life and their main job.

Measures of job tasks and individual literacy

Based on the information available in the two data sets, two types of scales were developed for use in the empirical analysis that follows:

✧ measures of job tasks

✧ measures of individual literacy.

Measures of job tasks reflect reports by individuals of the frequency with which they undertook literacy and numeracy tasks at work. Respondents in both surveys were asked a partially overlapping set of questions about the literacy and numeracy tasks they undertook at work. These included, for example, how often they wrote 'reports or articles', or 'letters or memos', or how often they filled in forms such as 'bills, invoices or budgets', or how often they calculated 'prices, costs or budgets'. The measures of individual literacy we use are document literacy, prose literacy, numeracy (using scales contained in the data) and self-assessed skills (based on a scale we develop).

We place all the scales we developed onto a 0–500 range, consistent with the literacy and numeracy scales provided in the ABS data. The support document to this report provides a detailed description of the empirical approach that was applied to generate these measures.

The measures of individual literacy in the 2006 data contain both an underlying, continuous score on a 0–500 range and a summary indicator in the form of a five-point scale (with known thresholds from the underlying scale). However, the literacy skill levels of the 1996 survey were only published in Australia on the same summary five-point scale used in the 2006 survey. To overcome this problem, we predict a continuous scale for 1996, given the observed five-point scale scores of individuals and a small set of other characteristics. The support document to this report sets out how we predict the continuous 1996 literacy measures in more detail.

It is important to note that a 1:1 comparison of these scales is not possible. For that reason, the following empirical analysis concentrates on the comparison of relative differences within a certain scale rather than on a comparison of absolute differences.

Table 1 includes the means and standard deviations of job task and individual literacy measures for male and female workers of both surveys. All measures range on a 0–500 scale. The numbers reveal that the average literacy use of males and females in their jobs has increased between 1996 and 2006, with the increase appearing to be more substantial for employed females. There also appears to be a substantial increase in average numeracy use.[2]

Table 1   Descriptive statistics: Measures of job tasks and individual literacy, 1996 and 2006

| | Mean value by gender and year | | | |
| | 1996 | | 2006 | |
	Males	*Females*	*Males*	*Females*
Measures of job tasks				
Literacy use	288.5	268.8	295.5	292.9
	(110.9)	(105.8)	(121.2)	(113.6)
Numeracy use	270.6	233.2	288.1	260.3
	(91.1)	(85.5)	(94.6)	(97.5)
Measures of individual literacy				
Document literacy	285.4	286.5	286.8	288.5
	(48.4)	(45.4)	(51.3)	(45.5)
Prose literacy	280.8	291.8	280.8	291.3
	(47.4)	(46.2)	(48.9)	(44.1)
Numeracy			285.8	276.9
			(53.2)	(48.3)
Self-assessed skills	347.3	350.3	366.5	398.1
	(56.7)	(47.3)	(96.8)	(84.5)
Number of observations	2870	2589	2749	2537

Notes: Weighted numbers based on weights provided by ABS. Standard deviations in parentheses.
Source: ABS (1996a, 2006a, Basic Confidentialised Unit Record File).

These changed requirements across the workforce appear to reflect changes within occupations, but not because the occupational distribution changed substantially over the decade. Although the occupational classification changed between the 1996 and 2006 surveys, there are three broad occupational categories that remained roughly comparable: managers and administrators, professionals, and trade occupations. Literacy and numeracy use increased between surveys in each of these occupations for females and generally for males, with the exception that literacy use in trade occupations fell by a small amount for males. These estimates are presented in table 2.

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[2] Since there are five plausible values for each literacy domain, we use the average of these values in our analysis. Robustness checks suggest that this procedure does not affect our results qualitatively.

Table 2   Skills use by workers, 1996 and 2006

| | Mean value by gender and year | | | |
| | 1996 | | 2006 | |
	Males	*Females*	*Males*	*Females*
Literacy use				
Managers and administrators	342.3	296.0	353.1	343.3
	(87.1)	(104.3	(88.1)	(91.9)
Professionals	356.9	324.2	360.2	340.1
	(76.0)	(86.0	(76.4)	(85.7)
Trades	257.6	211.1	250.3	231.4
	(107.2)	(92.1	(123.7)	(142.5)
Total	284.4	264.9	292.3	290.3
	(112.7)	(108.3	(121.4)	(113.9)
Numeracy use				
Managers and administrators	316.6	279.1	343.1	319.1
	(69.0)	(79.5)	(69.6)	(79.3)
Professionals	283.0	240.9	304.4	266.3
	(81.9)	(85.5)	(76.8)	(88.6)
Trades	280.1	229.8	301.7	282.3
	(87.8)	(93.3)	(91.8)	(105.8)
Total	266.5	229.1	291.2	264.2
	(92.4)	(86.6)	(94.7)	(97.0)
Number of observations	2921	2648	2825	2594

Notes: Weighted numbers based on weights provided by ABS. Standard deviations in parentheses.
Source: ABS (1996a, 2006a, Basic Confidentialised Unit Record File).

Table 1 also contains summary estimates of the individual skill scales. While the difference in document literacy between male and female workers is relatively small, the average level of prose literacy is higher for women than for men. These measures show little change between 1996 and 2006.[3] Since these skills increase with possession of educational qualifications, and educational attainment in the population has increased over the past decade, these results imply some kind of decrease in the average skill levels associated with formal qualifications. While this seems broadly borne out in changes in the estimated skill level averages associated with educational attainment across the surveys, the changes are small and typically not statistically significant.

The numeracy skills of male workers (only observed in 2006) are higher than those of female workers.[4] Finally, while the self-assessed skills of men and women do not differ substantially in 1996, men report considerably lower skill levels than women in 2006.

Overall, the data presented in table 1 indicate that both skills and job tasks may differ between men and women. However, they do not allow inferences about the significance of these differences or even the relationship between job task and literacy measures. The following chapters provide a comprehensive analysis of these issues.

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[3] This is consistent with the published data in ABS (2008). Table 16 of ABS (2008) contains a comparison of the prose and document literacy levels of employed people in the two surveys on the five-point scale. The distributions in the two surveys show no obvious change.

[4] The quantitative literacy domain, derived from the 1996 SAL, cannot be compared with the expanded measure of adult numeracy of the 2006 ALLS (ABS 2006b). For that reason, this report only considers the measure of the 2006 survey.

Literacy use at work

This chapter contains an analysis of the literacy use scale. It focuses on:

✧ the relationship between literacy skills and literacy use at work

✧ the relationship between educational attainment, occupation and literacy use

✧ the variation in literacy use across birth cohorts and over time.

Document and prose literacy

Literacy use and document literacy

Figure 1 reveals a positive relationship between document literacy and literacy use at work for 2006, indicating that workers with relatively high literacy skills use these skills more often at work than workers with relatively low literacy skills. The functional relationship between literacy use at work and document literacy is not linear, with the extent of literacy use at work increasing more slowly at higher literacy skill levels.[5]

Figure 1   Literacy use and document literacy, 2006

Note: Middle line vertically shows the mean literacy use conditional on individual document literacy skills. Remaining lines show (from the bottom) the 10th, 25th, 75th and 90th percentiles of the distribution of literacy use conditional on individual document literacy skills.

Source: ABS (2006a, Basic Confidentialised Unit Record File).

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[5] 'Literacy use at work' reflects reports by individuals of the frequency with which they undertook literacy and numeracy tasks at work.

The relationship between document literacy and literacy use is depicted in figure 1. The middle line shows the mean relationship between these phenomena, but is estimated with uncertainty. Hence, we also provide information about the distribution around this mean relationship in lines showing how far people at different points of the distribution were away from the mean. The key point of the figure is that those with high levels of skills (between 350 and 400 on the horizontal axis) are distributed more narrowly around the mean than thos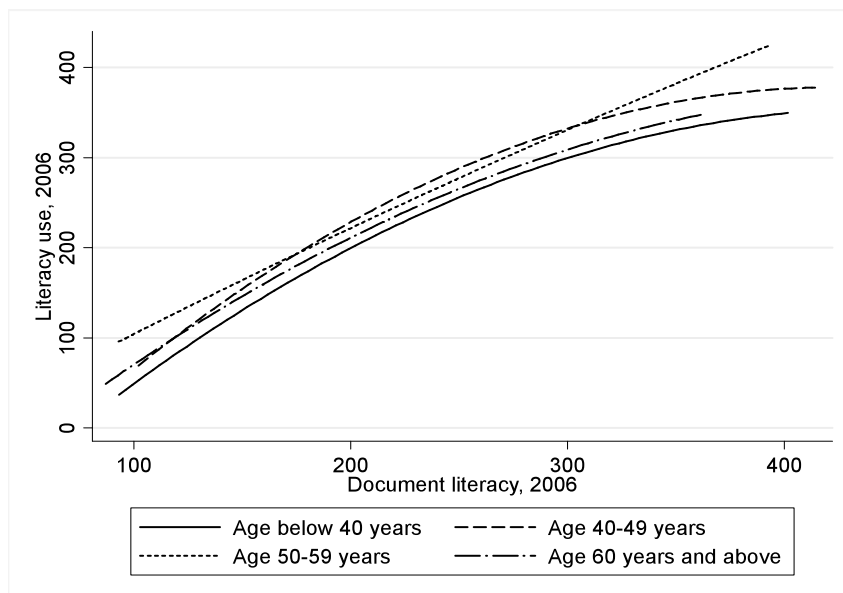e in the middle of the skill range. High-skill workers are concentrated in relatively high-skill-use jobs, while people in the middle of the skill distribution are spread more disparately across high- and low-skill-use jobs.

A report by the Organisation for Economic Co-operation and Development (OECD 2005) contains an analysis of the skills mismatch using literacy skills and literacy use at work across those countries involved in the first wave of the Adult Literacy and Life Skills Survey, drawing on the analysis of Krahn and Lowe (1998) of the earlier International Adult Literacy Survey. It used the five-point scale to group respondents into two skill-level categories (1 and 2—low skill, versus 3 to 5—high skill) and split usage into above- and below-median categories. This provided a four-way classification that made it possible to compare the match of workers to jobs across countries. In general, about 60 per cent of workers were well matched—either high-literacy-skill workers to jobs with high requirements, or low-skill-workers to low-requirement jobs. The balance was of workers with either skill surpluses or deficits. In most countries, more workers had surplus literacy skills than were in deficit. The same seems to be true in Australia. Using the same approach and the data used in figure 1, about 60 per cent of workers appear to be well matched, with 26 per cent of workers with good literacy skills but in low-use jobs and 13 per cent of workers with low skills in high-use jobs.

The functional relationship between document literacy and literacy skills presented in figure 1 is an average over the whole sample of workers. However, the extent to which workers may apply their skills at the workplace may vary considerably across age groups. Figure 2 compares the relationship between document literacy and literacy use of four different age groups in 2006. For simplicity, the confidence intervals are omitted.

Figure 2   Literacy use and document literacy by age group, 2006

Source: ABS (2006a, Basic Confidentialised Unit Record File).
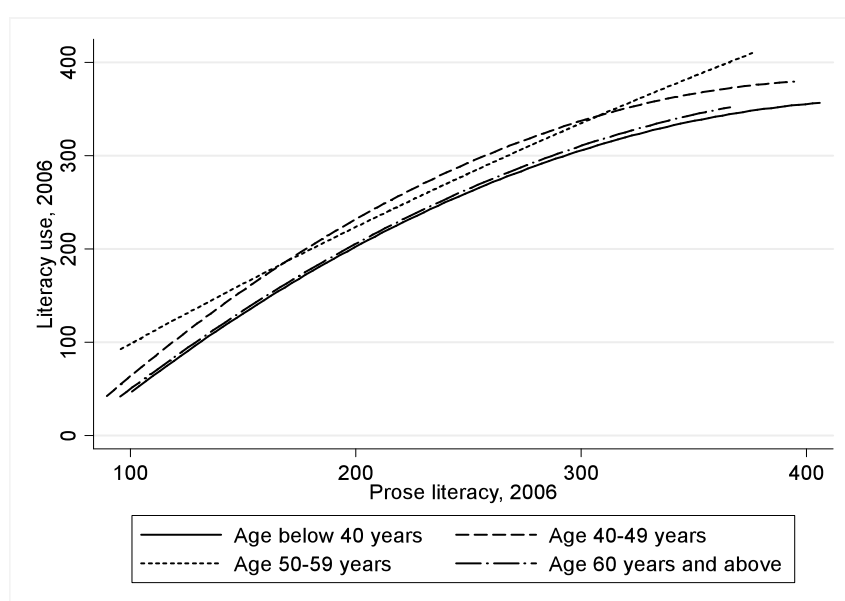
The relationship for workers below 40 years is located below the functions for workers in the other age groups, showing that workers in the youngest group apply their literacy skills less often in the workplace than older workers. The function for workers aged 50–59 years is situated above the functions for younger workers and decreases at a much lower rate (in fact, the function is nearly

linear), suggesting that workers aged 50–59 years apply their document skills in the workplace more often than the other groups. Finally, the function for workers aged 60 years and above is closer to that of the relationship for workers aged 40 years or younger. Despite this decline in the application of skills for the oldest group of workers, generally the functions reflect that older workers apply their skills at work at least as often as younger workers.

Literacy use and prose literacy

In addition to document literacy, prose literacy is available in the data. Figure 3 depicts the relationships between prose literacy and literacy use at work for the different age groups in 2006. The observed relationships are very similar to those of figure 2, indicating that both prose literacy and document literacy are equally important when explaining skill requirements at the workplace.

Figure 3   Literacy use and prose literacy by age group, 2006

Source: ABS (2006a, Basic Confidentialised Unit Record File).

Educational attainment and occupation

Educational attainment

Given the relationship between literacy skills and job requirements, it might be expected that highly educated workers apply their literacy skills at work more often than less educated workers. Table 3 presents the levels of literacy use at work by the highest level of education, gender and age group of employed respondents in 2006. The data indicate that:

✧ The average level of literacy use increases with level of education for both male and female workers.

✧ The average level of literacy use tends to be higher for workers between 40 and 49 years than for workers below 40 years for most levels of educational attainment.

✧ Differences between men and women aged 40–49 years and those aged 50–59 years vary substantially across different levels of education. Overall, the application of literacy skills at work seems to be about the same for male and female workers of the two age groups.

✧ The average level of literacy use is lower for male and female workers above 60 years than for those between 40 and 59 years.

✧ The average level of literacy use was similar for men and women across the age groups in 2006.

Table 3   Literacy use at work by highest educational attainment, gender and age group, 2006

	Literacy use at work by age group			
	Below 40 years	40–49 years	50–59 years	60 years and above
Males				
Postgraduate degree, graduate diploma/graduate certificate	361.5	383.0	389.6	375.1
Bachelor degree	321.8	357.5	367.6	334.3
Advanced diploma/diploma	331.4	365.2	344.0	299.3
Certificate III/IV	293.0	311.1	283.1	254.2
Certificate I/II	239.7	216.9	240.1	147.1
Year 12	280.5	311.6	332.0	324.7
Year 11	228.6	307.4	285.5	256.8
Year 10	226.7	294.1	274.5	216.8
Year 9	171.0	189.8	229.9	286.4
Year 8 or below	176.3	194.7	190.4	180.9
Total	285.3	318.0	306.5	266.6
Number of observations	1269	698	542	240
Females				
Postgraduate degree, graduate diploma/graduate certificate	339.8	360.5	365.8	328.8
Bachelor degree	343.6	344.4	343.5	346.3
Advanced diploma/diploma	329.5	318.4	326.1	309.6
Certificate III/IV	285.1	296.2	312.0	277.2
Certificate I/II	188.8	283.1	299.7	283.8
Year 12	278.9	306.6	307.3	292.5
Year 11	244.0	304.0	277.2	244.1
Year 10	218.1	239.0	257.7	222.1
Year 9	127.4	238.7	216.9	225.8
Year 8 or below	212.9	193.3	152.3	163.9
Total	288.8	304.1	296.1	272.9
Number of observations	1214	638	502	183

Notes: Weighted numbers based on weights provided by ABS.
Source: ABS (2006a, Basic Confidentialised Unit Record File).

In sum, the numbers in table 3 indicate that the level of literacy use at work is higher for highly educated workers. Moreover, workers aged between 40 and 59 years apply their literacy skills at work more often than workers below 40 years, while the level of literacy use is lower among workers aged above 60 years. These findings are in line with the relationship between literacy skills and literacy use presented in figures 2 and 3.

Occupational category

In addition to educational attainment, the application of literacy skills at work may vary substantially across occupational groups. Table 4 summarises the mean levels of literacy use at work by occupation, gender and age group in 2006.

The numbers reveal that high-skilled male and female workers (managers and professionals) use their literacy skills more often at work than workers in other occupations (such as machine operators and labourers). Similar to table 3, the numbers in table 4 reflect the same relationship between literacy skills and literacy use across age groups.

Table 4   Literacy use at work by occupation, gender and age group, 2006

	Literacy use at work by age group			
	Below 40 years	40–49 years	50–59 years	60 years and above
Males				
Managers	351.1	350.7	356.6	261.8
Professionals	346.5	379.2	386.7	359.9
Technicians and trades workers	273.7	299.1	259.2	210.9
Community and personal service workers	261.6	363.8	341.7	294.8
Clerical and administrative workers	320.7	343.3	325.2	310.4
Sales workers	302.6	337.2	333.4	335.9
Machinery operators and drivers	239.3	229.8	190.9	235.4
Labourers	179.7	210.6	180.3	137.8
Total	285.3	318.0	306.5	266.6
Number of observations	1269	698	542	240
Females				
Managers	342.3	348.2	338.9	291.1
Professionals	341.5	350.3	344.9	326.3
Technicians and trades workers	258.4	248.4	295.7	262.9
Community and personal service workers	238.1	295.9	292.9	340.0
Clerical and administrative workers	315.9	319.0	298.4	273.0
Sales workers	234.9	277.8	255.0	149.7
Machinery operators and drivers	178.5	168.0	154.0	88.5
Labourers	158.2	128.2	127.3	131.3
Total	288.8	304.1	296.1	272.9
Number of observations	1214	638	502	183

Notes: Weighted numbers based on weights provided by ABS.
Source: ABS (2006a, Basic Confidentialised Unit Record File).

Determinants of literacy use

So far, we have shown that the relationship between the literacy skills of workers and their use at work has a number of predictable features. The functional relationship between literacy skills and their use at work appears to be quadratic rather than linear, indicating that the level of literacy use at work is increasing with higher skills, but at a declining rate. The use of skills increases with higher educational attainment and in higher-skill occupations. However, to investigate whether these patterns remain when other determinants of literacy use are taken into account, it is necessary to estimate a multivariate regression model. The estimates of such a model can answer a number of interesting questions, such as:

✧ Are there significant differences in the use of literacy at work between male and female workers?

✧ Does the relationship between education and literacy use remain once the actual skills of workers are taken into account?

✧ Does literacy use differ significantly between full-time and part-time workers?

✧ Is literacy use associated with employer size?

✧ Is document literacy associated with increased literacy use at work once other factors are taken into account and is the shape of the relationship apparent in figure 1 robust to the incorporation of these other effects?

✧ Are higher self-assessed skills also associated with increased literacy use at work?

✧ Does literacy skill use at work differ significantly over time and across birth cohorts?

✧ To what extent do ageing effects contribute to observed patterns in literacy use over time?

To answer these questions, the following regression equation is estimated for the pooled data from the 1996 and 2006 surveys (all explanatory variables have an associated parameter that we estimate):

$$
\begin{aligned}
\text{Literacy use} \\
\text{At work}
\end{aligned}
\quad = \quad
\begin{aligned}
&\text{intercept} + \text{year or survey indicator} \\
&+ \text{document literacy} + \text{document literacy squared} \\
&+ \text{self-assessed skills} + \text{self-assessed skills squared} \\
&+ \text{female indicator} + \text{female x year indicator} \\
&+ \text{highest level of education indicators} \\
&+ \text{full-time employment indicator} \\
&+ \text{employer size indicators} \\
&+ \text{birth cohort indicators} \\
&+ \text{birth cohort x year or survey indicators} \\
&+ \text{residuals.}
\end{aligned}
$$

Table 4 shows the estimates of a linear regression model. The equation is statistically significant and explains almost 30 per cent of the variation among workers in their literacy use at work. The coefficients of literacy and self-assessed skills (and literacy and self-assessed skills squared) have the expected signs; that is, the positive coefficients indicate that high-literacy skills are associated with high levels of literacy use at work, while the negative coefficients of the squared terms suggest a declining rate as in figure 1.

In general, variables are interpreted to have a significant effect on the dependent variable of a regression equation where their t-value (parameter estimate/standard error) exceeds 1.96. The parameters on such variables are said to be statistically different from zero at the 95 per cent level. Using this criterion, the coefficients of literacy and self-assessed skills variables can be considered significantly different from zero. Only the squared term of self-assessed skills is not significantly different from zero, suggesting that the relationship between self-assessed skills and literacy use at work is linear.

Since the estimates of the literacy use equation are influenced strongly by the way in which the equation is specified, it is necessary to take a closer look at all variables that were included in the regression equation:

✧ *Intercept*: the intercept denotes a constructed level of literacy use for a hypothetical observation, given that all variables of the model are equal to zero. Since some of the variables in the regression model are different from zero for all observations, an economic interpretation of the intercept is not possible.

✧ *Year indicator*: the coefficient of the year indicator suggests that the level of literacy use at work may have increased between 1996 and 2006. However, this effect is not statistically significant.

✧ *Female indicators*: after controlling for relevant determinants, gender differences in literacy use at work are not significant. However, the t-ratio of the interaction term between female and the year indicator suggests that women have increased their literacy use at work between 1996 and 2006.

✧ *Highest level of education*: the coefficients of the indicator variables for the highest level of education of individuals suggest that education is positively associated with increased use of literacy skills at work. Compared with the reference group (that is, the group of workers with education below Year 12), all levels of education considered in the regression equation are associated with higher literacy use at work, indicating that education is an important contributor to the application of literacy use at work.

✧ *Full-time employment:* literacy use at work is about 55 points higher (half a standard deviation higher) for full-time rather than part-time employed workers, suggesting that workers in full-time jobs apply their literacy skills at work more often than workers in part-time jobs.

✧ *Employer size*: the coefficients of the variables denoting the number of persons employed at the location of the individual's main job suggest that employer size is a strong predictor of literacy use at work. Employment at larger establishments is positively associated with increased literacy use, suggesting that large companies tend to require workers to undertake more complex tasks in their jobs.

✧ *Birth cohort effects*: almost all coefficients of the birth cohort indicators are significantly positive, indicating that differences between the reference cohort and other birth cohorts are important in analysing the determinants of literacy use at work. The coefficients are steadily increasing for older birth cohorts, suggesting that older workers have jobs that require more use of literacy skills than the reference group, which consists of workers who were born between 1977 and 1991. Since the coefficient of the oldest group of workers (1922–41) is smaller than the coefficient of the second oldest group (1942–46), it is possible that there is some old-age decline in literacy use at work, although the difference is not significant.

✧ *Ageing effects*: the coefficients of the birth cohort indicators show that the level of literacy use at work differs across birth cohorts. Given this result, one might also expect variations in the level of literacy use over the life cycle. It is important to note that the coefficients of the birth cohort indicators do not represent life-cycle effects, because they measure differences *between* birth cohorts at a point in time. Life-cycle (or ageing) effects may only be identified by considering changes *within* a birth cohort over time. This can be achieved by interacting birth cohort and time indicators. The coefficients of these indicators are not significantly different from zero, suggesting that ageing effects have no influence on the level of literacy use at work.

In sum, the results of the regression analysis answer a number of interesting questions. Literacy use at work increases with literacy skills, although at a declining rate, while the relationship between self-assessed skills and literacy use at work was linear. Moreover, while differences between male and female workers are not significant, the results suggest that the level of literacy use at work of female workers may have increased over time. Educational attainment appears to be a contributor to the application of literacy use at work. In addition, full-time employment and the size of the employer were strong predictors of the application of literacy skills at work. Finally, while differences between birth cohorts exist, changes within birth cohorts over time are not significant, indicating that ageing effects have no influence on the level of literacy use at work. The following section provides a more detailed discussion of the relationship between demographic factors and literacy use at work.

Table 5   Determinants of literacy use

	Estimate	Std. error	t ratio
Intercept	-306.319	39.731	-7.71
Year 2006	46.500	52.903	0.88
Literacy skills			
Document literacy	2.459	0.277	8.85
Document literacy squared/100	-0.338	0.047	-7.12
Self-assessed skills			
Self-assessed skills	0.338	0.114	2.95
Self-assessed skills squared/100	-0.053	0.019	-2.74
Female			
Female	-0.715	3.379	-0.21
Female x Year 2006	10.882	4.990	2.18
Highest level of education			
Year 12	14.663	5.164	2.84
Certificate I/II/certificate not further defined	29.761	6.640	4.48
Certificate III/IV	25.627	4.744	5.40
Advanced diploma/diploma	55.730	5.248	10.62
Bachelor degree	68.687	5.475	12.54
Postgraduate degree, graduate diploma/graduate certificate	75.021	5.383	13.94
Full-time employed	54.650	3.908	13.98
Employer size			
20–99	10.547	5.336	1.98
100–499	17.032	5.126	3.32
500 and over	27.051	3.494	7.74
Birth cohort*			
Birth cohort 1972–76	15.300	8.720	1.75
Birth cohort 1967–71	35.302	8.498	4.15
Birth cohort 1962–66	39.772	8.279	4.80
Birth cohort 1957–61	45.323	8.045	5.63
Birth cohort 1952–56	46.771	8.413	5.56
Birth cohort 1947–51	47.571	8.510	5.59
Birth cohort 1942–46	51.010	8.883	5.74
Birth cohort 1922–41	41.590	8.591	4.84
Interaction with time effect*			
Birth cohort 1972–76	18.771	10.359	1.81
Birth cohort 1967–71	1.425	10.206	0.14
Birth cohort 1962–66	5.979	10.017	0.60
Birth cohort 1957–61	2.814	9.862	0.29
Birth cohort 1952–56	-6.651	10.693	-0.62
Birth cohort 1947–51	0.233	10.683	0.02
Birth cohort 1942–46	-16.455	12.186	-1.35
Birth cohort 1922–41	4.212	14.501	0.29
R-squared	0.2947		
F ratio	81.59		

Notes: Number of observations: 10 745. Weighted linear regression based on weights provided by ABS. The regression further includes interaction terms between all variables and year indicators. *Reference group: birth cohort 1977–91.

Source: ABS (1996a, 2006a, Basic Confidentialised Unit Record File).

Demographic factors
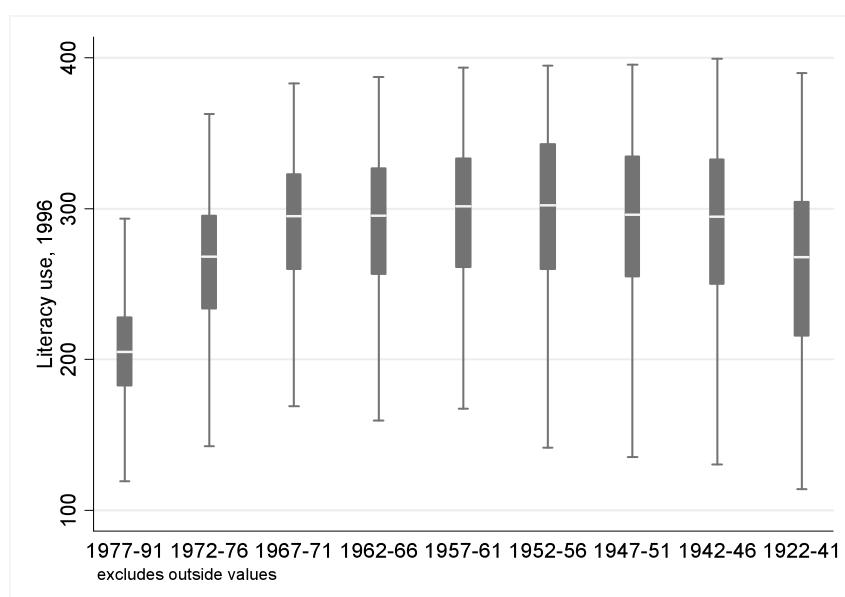
Variation across birth cohorts

Given the estimates presented in table 5, a *prediction* may be calculated for each person within a certain birth cohort. This prediction denotes the individual level of literacy use that would prevail for each person, given the set of observed characteristics considered in the regression model.

Figure 4 shows box plots of the predicted levels of literacy use for each of nine birth cohorts in 1996. Each box plot depicts the level of literacy use of a birth cohort through five summary statistics (outliers were removed):

◇ the smallest observation

◇ the 0.25-percentile

◇ the 0.5-percentile (median)

◇ the 0.75-percentile and

◇ the largest observation.

Figure 4 reveals that the level of literacy use of the youngest birth cohort (1977–91) is substantially lower than the corresponding levels of the older birth cohorts. This result reflects the observation of the regression model, where older workers reported significantly higher levels of literacy use at work than the youngest birth cohort. While the predicted level of literacy use is so much lower for the youngest birth cohort, the differences seem to be less severe for older birth cohorts. Lower levels of literacy use at work for the youngest cohort possibly reflect that many of them will be studying or in 'student' jobs, which may have lower levels of literacy use. Note that the box plots indicate that the level of literacy use is higher for older birth cohorts but seems to decline in old age. Again, this result is in line with the observed relationship between age and literacy use at work presented in the previous tables and figures.

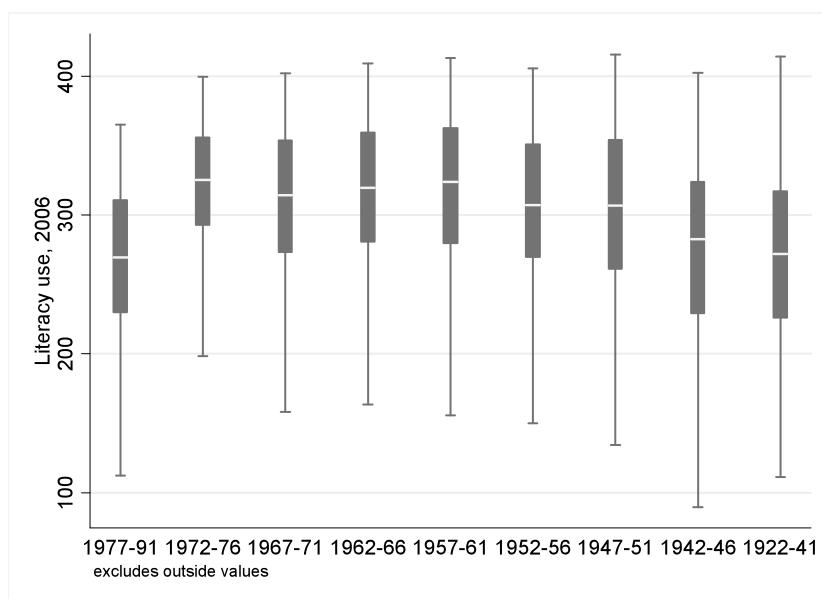**Figure 4   Predicted literacy use by birth cohort, 1996**

Source: ABS (2006a, Confidentialised Unit Record File).

The predicted levels of literacy use at work by birth cohort in 2006 are presented in figure 5. While the median level of literacy use at work in 1996 was at or below 300 points of the literacy use scale (see figure 4), the median level of literacy use is above 300 points for most birth cohorts in 2006,

indicating that most birth cohorts experienced an increase in their level of literacy use at work. Only the levels of literacy use of the youngest and the two oldest birth cohorts have remained below 300 points, confirming the relationship between birth cohorts and literacy use already described by figure 4.

Although changes in the level of literacy use at work over time appear to be relatively large for some birth cohorts, the ageing effects presented in table 5 were not significant, suggesting that the level of literacy use at work does not increase automatically with age. Instead, other factors seem to exist that are responsible for inter-temporal changes in literacy use. A much more detailed analysis is required to identify these factors.

Figure 5   Predicted literacy use by birth cohort, 2006

Source: ABS (2006a, Basic Confidentialised Unit Record File).

Gender gap

In addition to time, birth cohort and age effects, gender differences represent another important demographic factor that may partly describe the observed variations in literacy use at work. The estimates presented in table 5 showed that differences between male and female workers were not significant after a set of other relevant determinants of literacy use were taken into account. However, the coefficient of the interaction term between female and year indicator has suggested that differences between male and female workers might have changed over time.

To gain a better understanding of the relationship between these demographic dimensions and the level of literacy use, a number of unconditional regression models were estimated separately for each year and birth cohort, using the following regression equation:

Literacy use at work   =   intercept + female indicator + residuals

Table 6 provides the estimated coefficients of the respective female indicator for each birth cohort in 1996 and 2006. The t-ratios of the estimates for 1996 reveal that average female workers of the birth cohorts 1922–57 exhibited a significantly lower level of literacy use at work than average male workers of the same birth cohorts, pointing to a substantial gap in the use of literacy skills at work between male and female workers.

However, the estimates of the unconditional gender gap in literacy use in 2006 indicate that the differences between male and female workers of the birth cohorts 1922–1957 have narrowed between 1996 and 2006. Moreover, since the estimated coefficients in 2006 are insignificant for all

birth cohorts, the results even suggest that the gender gap in literacy use at work has completely disappeared over this decade.

Although differences between male and female workers have diminished over time within each birth cohort, it is important to note that the estimates do not imply that differences between *comparable* male and female workers have disappeared, because an unconditional regression model was estimated (that is, without controlling for other relevant factors, such as those of table 5).

Table 6   Gender differences in literacy use by year and birth cohort

	Estimate	Std. error	t ratio	N
1996				
Birth cohort 1977–91	0.583	12.156	0.05	271
Birth cohort 1972–76	14.588	9.437	1.55	532
Birth cohort 1967–71	-10.306	8.006	-1.29	694
Birth cohort 1962–66	-13.256	7.852	-1.69	767
Birth cohort 1957–61	-25.896	6.817	-3.80	832
Birth cohort 1952–56	-33.810	7.987	-4.23	682
Birth cohort 1947–51	-14.201	8.612	-1.65	649
Birth cohort 1942–46	-47.035	10.331	-4.55	465
Birth cohort 1922–41	-46.866	9.866	-4.75	567
2006				
Birth cohort 1977–91	4.545	7.108	0.64	1161
Birth cohort 1972–76	14.807	8.256	1.79	622
Birth cohort 1967–71	-2.635	8.400	-0.31	700
Birth cohort 1962–66	-16.101	8.480	-1.90	683
Birth cohort 1957–61	-11.617	9.232	-1.26	653
Birth cohort 1952–56	-7.231	10.319	-0.70	562
Birth cohort 1947–51	-14.280	10.868	-1.31	482
Birth cohort 1942–46	12.257	14.358	0.85	292
Birth cohort 1922–41	-9.496	23.932	-0.40	131

Notes: The estimated coefficients denote the unconditional gap between men and women. Weighted linear regression models were estimated separately by birth cohort, using weights provided by ABS.
Source: ABS (1996a, 2006a, Basic Confidentialised Unit Record File).

Summary

This chapter analyses the relationship between literacy skills and literacy use at work and investigates variations in literacy use across different levels of educational attainment, occupation and birth cohorts.

The results may be summarised as follows:

✧ The relationship between document literacy and literacy use at work is positive, reflecting that high-skilled workers use their skills more often at work than low-skilled workers.

✧ The functional relationship between literacy use at work and document literacy is not linear. Instead, literacy use at work is increasing more slowly at higher literacy skill levels.

✧ The use of literacy skills in the workplace is higher for older workers up to age groups 50–59 years, after which literacy use begins to decline.

✧ Workers aged 50–59 years use their document skills in the workplace more than any of the other age groups.

✧ The use of document skills in the workplace seems to decline for workers aged 60 years and above compared with other groups of mature workers.

◆ The relationship between prose literacy and literacy use is similar to the relationship between document literacy and literacy use, suggesting that both prose literacy and document literacy are equally important when explaining skill requirements at the workplace.

◆ The average level of literacy use increases with level of education.

◆ The average level of literacy use is higher for workers between 40 and 59 years than for workers below 40 years and workers aged 60 years and above.

◆ The results of a regression analysis reveal that:
  • Literacy use at work increases with literacy skills, although at a declining rate, while the relationship between self-assessed skills and literacy use at work is linear.
  • Differences between male and female workers are not significant, while the level of literacy use at work of female workers seems to have increased over time.
  • Educational attainment appears to be a relevant contributor to the application of literacy use at work.
  • Full-time employment and the size of the employer are strong predictors for the application of literacy skills at work.
  • While differences between birth cohorts exist, changes within birth cohorts over time are not significant, indicating that ageing effects have no influence on the level of literacy use at work.

◆ An investigation of the (unconditional) gender gap in literacy use suggests that:
  • Average female workers of the birth cohorts 1922–57 exhibit a significantly lower level of literacy use at work than average male workers of the same birth cohorts in 1996, pointing to a substantial gap in the use of literacy skills at work between older male and female workers.
  • The gender gap in literacy use at work has completely disappeared between 1996 and 2006.
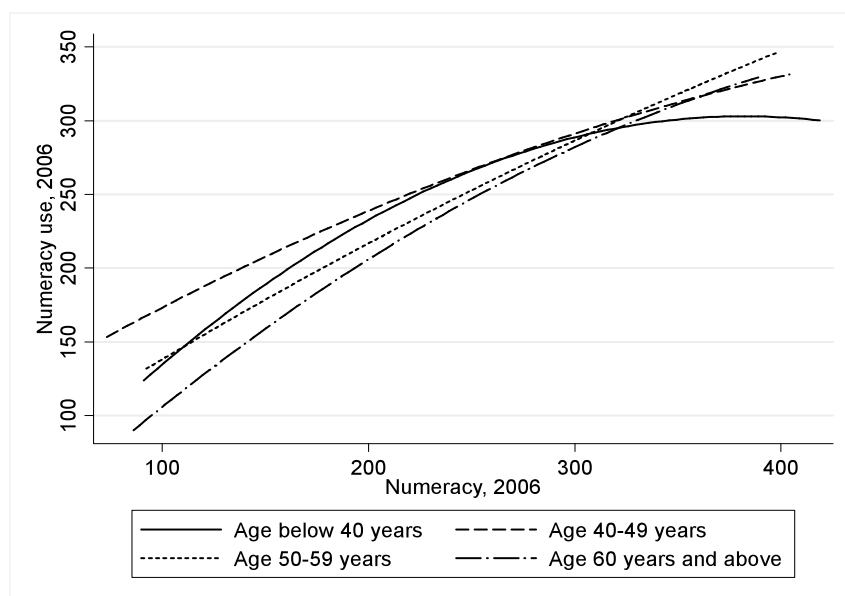
Numeracy use at work

This chapter contains an analysis of the numeracy use scale. It focuses on:

✧ the relationship between numeracy skills and numeracy use at work

✧ the relationship between educational attainment, occupation and numeracy use

✧ the variation in numeracy use across birth cohorts and over time.

Numeracy skills

Figure 6 displays the relationship between numeracy and numeracy use at work by age group in 2006. The functions reveal that workers with relatively high numeracy skills use numeracy more often in their jobs than workers with relatively low numeracy skills. Similar to figures 2 and 3 (document and prose literacy), the functional relationship between numeracy achievement and numeracy use is quadratic rather than linear, suggesting that the level of numeracy use increases with higher numeracy skills, but at a declining rate.

Figure 6   Numeracy use and numeracy by age group, 2006

Source: ABS (2006a, Basic Confidentialised Unit Record File).

The extent to which workers apply their numeracy skills in the workplace varies considerably across age groups. The function of workers below 40 years is located below the function of workers aged 40–49 years, indicating that young workers are relatively less likely to apply their numeracy skills at work than older workers. At the same time, the major part of the function of workers aged 50–59 years is located below the functions of younger workers, suggesting that the application of numeracy skills at work in 2006 declines again after the age of 50 years. The

function of workers aged 60 years and above is situated even further below the other functions, confirming an old-age decline in the application of numeracy skills at the workplace. However, since the functions of the two oldest age groups have a linear rather than a quadratic character, the ability to transform numeracy skills into numeracy use at work seems to be the highest for older workers with relatively high numeracy skills.

Educational attainment and occupation

Educational attainment

Table 7 reports the average levels of numeracy use at work by the highest level of education, gender and age group in 2006.

Table 7   Numeracy use at work by highest educational attainment, gender and age group, 2006

| | Numeracy use at work by age group | | | |
	Below 40 years	40–49 years	50–59 years	60 years and above
Males				
Postgraduate degree, graduate diploma/graduate certificate	306.3	319.7	332.7	315.5
Bachelor degree	293.8	316.9	295.8	323.4
Advanced diploma/diploma	305.7	317.9	317.4	278.3
Certificate III/IV	306.8	313.6	293.7	254.4
Certificate I/II	320.9	354.0	171.4	155.2
Year 12	286.0	298.0	286.7	274.8
Year 11	256.8	293.0	241.8	248.5
Year 10	267.9	281.8	258.8	252.0
Year 9	194.1	202.3	220.2	252.9
Year 8 or below including never attended school	196.2	241.7	189.8	254.6
All education levels	286.9	301.6	282.2	268.9
Number of observations	1269	698	542	240
Females				
Postgraduate degree, graduate diploma/graduate certificate	280.8	268.6	282.5	229.6
Bachelor degree	286.1	259.4	286.6	268.4
Advanced diploma/diploma	294.9	270.3	253.0	272.1
Certificate III/IV	265.7	267.3	267.6	209.8
Certificate I/II	204.7	289.0	264.8	313.6
Year 12	274.4	260.0	240.0	241.0
Year 11	248.6	286.6	258.4	251.7
Year 10	220.5	236.6	226.0	203.9
Year 9	227.1	193.8	197.8	199.8
Year 8 or below including never attended school	183.1	224.1	167.4	131.8
All education levels	267.8	260.2	248.6	229.8
Number of observations	1214	638	502	183

Notes: Weighted numbers based on weights provided by ABS.
Source: ABS (2006a, Basic Confidentialised Unit Record File).

The data in table 7 indicate that:

✧ The average level of numeracy use increases with education for both male and female workers.

♦ The average level of numeracy use tends to be higher for workers between 40 and 49 years than for workers below 40 years.

♦ Differences between men and women aged 40–49 years and those aged 50–59 years vary substantially across different levels of education.

♦ The average level of numeracy use tends to be lower for male and female workers above 60 years than for those between 40 and 59 years.

♦ Male workers appear to use their numeracy skills more often than female workers.

Overall, the numbers in table 7 suggest that the average level of numeracy use tends to be higher for workers between 40 and 59 years than for workers below 40 years and workers aged 60 years and above. This result is in line with the relationship between numeracy skills and numeracy use presented in figure 6.

Occupational category

Table 8 reports the mean levels of numeracy use by occupational category, gender and age group in 2006.

Table 8   Numeracy use at work by occupation, gender and age group, 2006

	Numeracy use at work by age group			
	Below 40 years	40–49 years	50–59 years	60 years and above
Males				
Managers	344.0	341.1	333.9	272.5
Professionals	295.3	312.4	316.2	299.0
Technicians and trades workers	308.9	315.0	290.1	272.4
Community and personal service workers	223.6	288.3	216.0	233.4
Clerical and administrative workers	286.3	281.3	271.4	284.3
Sales workers	301.9	331.9	320.5	335.8
Machinery operators and drivers	256.9	219.0	195.2	235.9
Labourers	220.1	237.0	174.0	158.0
Total	286.9	301.6	282.2	268.9
Number of observations	1269	698	542	240
Females				
Managers	313.3	327.5	303.1	271.1
Professionals	275.5	264.6	268.4	225.9
Technicians and trades workers	271.8	241.3	279.1	345.9
Community and personal service workers	229.3	231.1	212.6	200.9
Clerical and administrative workers	283.9	274.3	256.0	248.6
Sales workers	264.7	270.3	219.5	141.0
Machinery operators and drivers	195.9	229.0	151.7	105.5
Labourers	191.3	138.3	145.8	114.2
Total	267.8	260.2	248.6	229.8
Number of observations	1214	638	502	183

Notes: Weighted numbers based on weights provided by ABS.
Source: ABS (2006a, Basic Confidentialised Unit Record File).

The data in table 8 suggest that:

♦ High-skilled workers (such as managers and professionals) tend to apply their numeracy skills more often than workers in other occupations.

♦ The levels of numeracy use are lowest among low-skilled workers (such as machine operators and labourers).

♦ The average level of numeracy use tends to be higher for workers between 40 and 59 years than for workers below 40 years and workers aged 60 years and above.
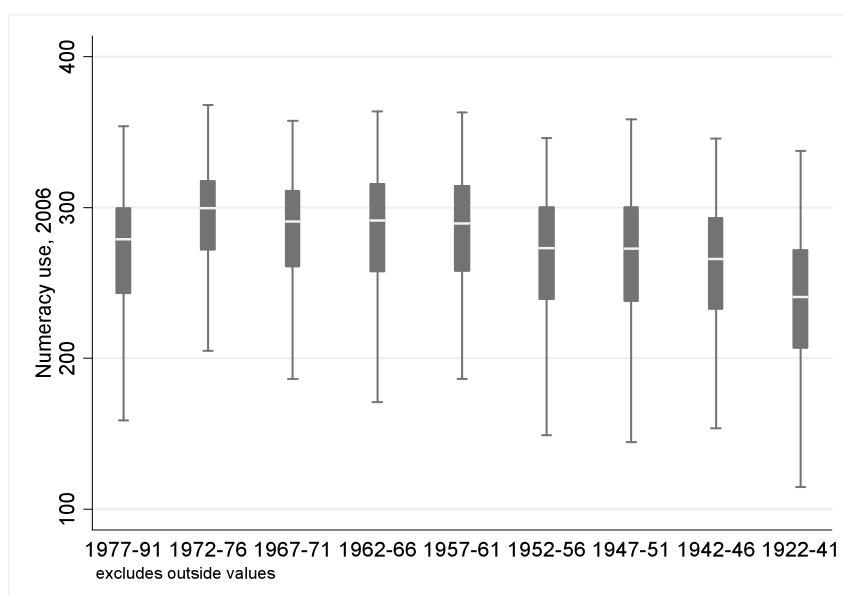
Overall, these numbers are consistent with the average levels of literacy use by occupation presented in table 4.

Demographic factors

Variation across birth cohorts

The last chapter presented the estimates of a regression model of the determinants of literacy use at work. A similar regression model without time effects was estimated to investigate the determinants of numeracy use at work in 2006. Given the estimates of this model, the predicted level of numeracy use at work was calculated for each of nine birth cohorts.

Figure 7   Predicted numeracy use by birth cohort, 2006

Source: ABS (2006a, Basic Confidentialised Unit Record File).

Figure 7 depicts the predicted levels of numeracy use at work for each birth cohort in 2006. The box plots suggest that the level of numeracy use of the youngest birth cohort (1977–91) is lower than the levels of more mature birth cohorts. Moreover, the level of numeracy use is declining over the four oldest birth cohorts, indicating that numeracy use at work is lower for older generations. This result is in line with the observed relationship between age and literacy use at work displayed in figure 6.

Gender gap

Finally, similar to the analysis of the gender gap in literacy use at work presented above, a number of unconditional regression models were estimated separately for each year and birth cohort to investigate the relationship between demographic dimensions and the level of numeracy use. Specifically, a regression model of the following form was employed:

Numeracy use at work   =   intercept + female indicator + residuals

Table 9 includes the estimated coefficients of the respective female indicator for each birth cohort in 1996 and 2006. The t-ratios of the estimates for 1996 reveal that average female workers of the birth cohorts 1922–71 exhibited a significantly lower level of numeracy use at work than average male workers of the same birth cohorts, pointing to a substantial gap in the use of numeracy skills at work between male and female workers. In contrast to results presented in the previous chapter on literacy use, the unconditional gender gap in numeracy use does not disappear in 2006. Instead, the differences in numeracy use between male and female workers of the birth cohorts 1972–91 have even become significant in 2006, suggesting that the gender gap seems to be persistent over time and across birth cohorts.

Since an unconditional regression model was estimated, it should be noted that the estimates do not represent differences between male and female workers with similar characteristics.

Table 9   Gender differences in numeracy use by year and birth cohort

	Estimate	Std. error	t ratio	N
1996				
Birth cohort 1977–91	1.387	10.182	0.14	271
Birth cohort 1972–76	-8.313	7.586	-1.10	532
Birth cohort 1967–71	-29.195	6.813	-4.29	694
Birth cohort 1962–66	-35.989	6.566	-5.48	767
Birth cohort 1957–61	-38.312	6.098	-6.28	832
Birth cohort 1952–56	-65.775	6.748	-9.75	682
Birth cohort 1947–51	-46.829	7.212	-6.49	649
Birth cohort 1942–46	-63.515	7.687	-8.26	465
Birth cohort 1922–41	-44.577	7.756	-5.75	567
2006				
Birth cohort 1977–91	-16.556	5.653	-2.93	1161
Birth cohort 1972–76	-14.198	7.185	-1.98	622
Birth cohort 1967–71	-27.090	7.054	-3.84	700
Birth cohort 1962–66	-41.046	7.051	-5.82	683
Birth cohort 1957–61	-41.838	7.558	-5.54	653
Birth cohort 1952–56	-34.936	8.547	-4.09	562
Birth cohort 1947–51	-31.840	8.970	-3.55	482
Birth cohort 1942–46	-44.904	12.095	-3.71	292
Birth cohort 1922–41	-27.925	18.079	-1.54	131

Notes: The estimated coefficients denote the unconditional gap between men and women. Weighted linear regression models were estimated separately by birth cohort, using weights provided by ABS.
Source: ABS (1996a, 2006a, Basic Confidentialised Unit Record File).

Summary

In this chapter, the relationship between numeracy skills and numeracy use at work was investigated and variations in numeracy use across different levels of educational attainment, occupation and birth cohorts were examined.

The main findings of the empirical analysis are as follows:

✧ Workers with relatively high numeracy skills use numeracy more often in their jobs than those with relatively low numeracy skills.

✧ The level of numeracy use increases with higher numeracy skills at a declining rate.

✧ Workers aged 40–49 years have the highest ability to apply their numeracy skills at work.

✧ The ability to apply numeracy skills at the workplace declines for workers aged 50 years and above.

✧ The average level of numeracy use is increasing with higher levels of education.

✧ The average level of numeracy use tends to be higher for workers between 40 and 59 years than for workers below 40 years and workers aged 60 years and above.

✧ Average female workers of nearly all birth cohorts exhibit a significantly lower level of numeracy use at work than average male workers both in 1996 and 2006.

Implications

This study provides empirical evidence on the match of worker skills and job requirements in the Australian labour market, paying particular attention to older workers. The empirical findings of this study indicate that older workers apply their skills more often at work than younger workers, suggesting that there is no reason to be concerned that older workers are mismatched to their jobs. Instead, due to the (on average) higher labour market experience, the quality of employment opportunities available to older workers remains relatively high. This result is persistent over time and across birth cohorts.

Important results drawn from this analysis include:

✧ *Literacy skills and literacy use at work*: workers with higher literacy skills use these skills more often at work than workers with lower literacy skills. The level of literacy use increases with higher literacy skills, but at a declining rate. Moreover, the relationship between prose literacy and literacy use is similar to the relationship between document literacy and literacy use, suggesting that both prose literacy and document literacy are important when explaining skill requirements at the workplace. The findings suggest that the average level of literacy use is higher for workers aged over 40 years than for workers aged below 40 years and that the average level of literacy use increases with level of education. In addition, differences between male and female workers in literacy use at work have disappeared over time, while full-time employees and those employed by large employers report higher levels of literacy use at work.

✧ *Numeracy skills and numeracy use at work*: workers with higher numeracy skills use these skills more often at work than workers with lower numeracy skills. Similar to literacy use, the level of numeracy use increases with higher numeracy skills, but at a declining rate. Numeracy use also increases with level of education. The results suggest that the average level of numeracy use tends to be higher for workers between 40 and 59 years than for workers below 40 years and workers aged 60 years and above. Finally, in both 1996 and 2006 female workers of nearly all ages exhibit a significantly lower level of numeracy use at work than male workers.

This study of skill matches is part of a broader research program, which will analyse aspects of this topic as it informs a number of other debates, including:

✧ *Over-education*: a growing literature on 'over-education' suggests that more educated young cohorts are not matched to jobs of the same 'quality'—in terms of wages or occupational status—than older less-educated cohorts managed to enjoy (Sicherman 1991; Voon & Miller 2005; Miller 2007; Dolton & Silles 2008).

✧ *Consequences of misallocation*: misallocation of workers may generate potential costs in terms of low job and life satisfaction among workers, higher consequent turnover rates and a loss of potential productivity (Miller 2007; Mavromaras, McGuinness & Wooden 2007).

✧ *'Out of equilibrium' behaviour*: workers may respond to 'out of equilibrium' situations by undertaking education and training to upgrade their skills (Messinis & Olekalns 2007) or searching for transition jobs on the way to retirement (Borland 2005).

✧ *Job complexity and remuneration*: an understanding of the nature and breadth of tasks undertaken by workers in their jobs may also help us understand a little better the nature of careers and the way people are remunerated (Rosen 1987; Boothby 2002; OECD 2005).

Finally, the measures of job requirements used in this report (literacy use and numeracy use) are positively correlated (the correlation coefficient is 0.584). Consequently, in addition to the separate analysis of these measures, a consideration of the complexity of workers' jobs in terms of the range and difficulty of the tasks they are expected to perform may provide a better understanding of aspects of the Australian labour market and its interaction with education and training institutions.

We have already addressed one of these issues in a parallel project looking at whether workers in jobs that are demanding in terms of their skill requirements respond by undertaking more education and training to upgrade their skills (see Ryan & Sinning 2009). We find evidence in this report that both literacy and numeracy use in jobs have increased between 1996 and 2006, presumably a reflection of technological change. While older workers are in jobs with literacy and numeracy requirements as high as those of younger workers, they may be less likely to embrace technological innovation in the same way. Our related research suggests that the relationship between relative job requirements and individual skills influences participation in education and training by workers. This was true across all age groups, although older workers still remain less likely to participate than younger workers.

The overall conclusion from this paper is an optimistic one: older workers make at least as much use of their skills in their jobs as younger ones. While there are concerns about older workers being disadvantaged in the labour market in other dimensions, including their experience if displaced from their jobs, their ability to use their literacy and numeracy skills if they are employed is not one of them—older workers with the same measured literacy skills as younger workers do not report they make less use of their skills at work. On this dimension at least, there is no additional reason to be concerned about their treatment in the labour market. The lower levels of investment in education and training by workers as they age would appear not to be related to their ability to use skills, but perhaps by the short time they have to recoup the costs of acquiring them. Policies designed to encourage older workers to continue to upgrade their skills through life, therefore, do not need to focus on impediments to their use in jobs, but on the incentives facing individuals.

References

ABS (Australian Bureau of Statistics) 1996a, *Aspects of literacy: Profiles and perceptions, Australia, 1996,* cat.no.4226.0, ABS, Canberra.

——1996b, *Aspects of literacy: Assessed skill levels Australia 1996*, cat.no.4228.0, ABS, Canberra.

——2006a, *Adult Literacy and Life Skills Survey: Summary results, Australia*, cat.no.2880.0, ABS, Canberra.

——2006b, *Adult Literacy and Life Skills Survey: User guide*, cat.no.4228.0.55.002, ABS, Canberra.

——2008, *Adult Literacy and Life Skills Survey, Summary results*, cat.no.4228.0, ABS, Canberra.

Boothby, R 2002, *Literacy skills, occupational assignment and the returns to over- and under-education,* cat.no.89-552, no.9, Statistics Canada, Ottawa.

Borland, J 2005, 'Transitions to retirement: A review', working paper no. 3/05, Melbourne Institute of Applied Economic and Social Research, Melbourne.

Chiswick, B, Lee, YL & Miller PW 2003, 'Schooling, literacy, numeracy and labour market success', *Economic Record*, vol.79, no.245, pp.165–81.

Dolton, PJ & Silles, MA 2008, 'The effects of over-education on earnings in the graduate labour market', *Economics of Education Review*, vol.27, no.3, pp.125–39.

Krahn, H & Lowe, GS 1998, *Literacy utilization in Canadian workplaces*, Statistics Canada and Human Resources Development Canada, Ottawa and Hull.

Mavromaras, K, McGuinness, S & Wooden, M 2007, 'Overskilling in the Australian labour market', *Australian Economic Review*, vol.40, no.3, pp.307–12.

Messinis, G & Olekalns, N 2007, 'Skill mismatch and training in Australia: Some implications for policy', *Australian Economic Review*, vol.40, no.3, pp.300–6.

Miller, PW 2007, 'Overeducation and undereducation in Australia: Policy forum: Education and skill mismatches in the labour market', *Australian Economic Review*, vol.40, no.3, pp.292–9.

Miller, PW & Chiswick, BR 1997, 'Literacy, numeracy and the labour market', in *Aspects of literacy: Assessed skill levels in Australia 1996,* cat.no.4228.0, ABS, Canberra.

OECD (Organisation for Economic Co-operation and Development) 2005, *Learning a living: First results of the Adult Literacy and Life Skills Survey*, OECD, Paris.

Riddell, WC & Green, DA 2002, 'Literacy skills, non-cognitive skills and earnings: An economist's perspective', in *Towards evidence-based policy for Canadian education,* eds P de Broucker and A Sweetman, McGill-Queen's University Press and John Deutsch Institute for the Study of Economic Policy, Montreal and Kingston, pp.123–53.

——2003, 'Literacy and earnings: An investigation of the interaction of cognitive and unobserved skills in earnings generation', *Labour Economics*, vol.10, no.2, pp.165–84.

Rosen, S 1987, 'The theory of equalizing differences', in *Handbook of Labour Economics, volume I*, eds O Ashenfelter and R Layard, Elsevier Science Publishers, Amsterdam.

Ryan, C & Sinning, M 2009, *Job requirements and lifelong learning for older workers*, NCVER, Adelaide.

Sicherman, N 1991, 'Overeducation in the labour market', *Journal of Labour Economics*, vol.9, no.2, pp.101–22.

Voon, D & Miller, PW 2005, 'Undereducation and overeducation in the Australian labour market', *Economic Record*, vol.81, pp.22–33.

Support document details

Additional information relating to this research is available in *Skill matches to job requirements: Support document*. It can be accessed from NCVER's website <http://www.ncver.edu.au/publications/2185.html>. It contains:

✧ Development of scales

✧ Definition of variables

✧ Descriptive statistics.

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