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Economic returns to education and training for adults with low numeracy skills

Lynne Gleeson
Centre for Health Research and Practice
University of Ballarat



An Adult **Literacy** National **Project** Report

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Additional information relating to this research is available in *Economic returns to education and training for adults with low numeracy skills: Support document.* It can be accessed from NCVER's website <http://www.ncver.edu.au>.



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Key messages

Through analysis of Australian and United States longitudinal data sets, this project discusses the benefits of further training for people with low levels of numeracy.

- The project shows that individuals with low numeracy skills are disadvantaged members of the workforce in terms of skill levels; this group is also the least likely to be given opportunities for further training, and generally undertake lower levels of training.
- When they are able to participate in on-the-job training programs, they receive positive and significant benefits, such as higher wages.
- Workers who display higher levels of skills are normally those with longer tenure and more experience.

Executive summary

This study examined the economic returns to different levels of education or types of training for adults with low numeracy skills.

Using longitudinal data sets, two discrete analyses have been completed. The first analysis uses Australian data and examines the returns to *education* (Longitudinal Survey of Australian Youth, 1975 cohort). The second analysis uses United States data and examines the returns to *training* (National Longitudinal Survey of Youth 1979).

This area of study is particularly complex, as concepts such as literacy, numeracy, basic skills and ability are difficult to define and measure. In addition, training can be defined and measured in many different ways. Years of schooling can exaggerate ability, thereby confusing the link between basic skills or ability and the returns to training. It is suggested, however, that measures of literacy or numeracy are finer indicators of an individual's basic skills, and therefore are more functional and useful for examining the economic returns to education or training.

Previous research has found that individuals with lower levels of educational attainment or lower levels of ability are less likely to receive further education or training. In combination with the impacts of the 'new economy' whereby there are fewer jobs requiring lower skill levels, this creates an environment where there are unequal opportunities with reduced job openings for those with lower skill or education levels. In industrialised countries, many jobs requiring unskilled labour have moved to cheaper labour markets, often offshore. This trend suggests a growing mismatch between the skills required by the labour market and the skill levels of workers with low levels of numeracy or literacy—with obvious impacts on employment opportunities for adults with lower education and fewer skills. Already disadvantaged adults with low skills are least likely to participate in further education or training, and are most likely to be in jobs with minimal opportunities for training programs.

Examining the returns to further education or the types of training for the low literacy or low numeracy groups provides additional insights into how education or training can be effectively targeted to increase skills and therefore wages for these groups. The implication is that public policy can be developed to encourage adults with low literacy or low numeracy skills to invest in higher amounts of education and training, and thus to receive higher rates of return.

The analysis of the Australian data relating to the likelihood of specific groups of workers receiving further education shows that, by comparison with adults with very high numeracy skills, adults in the very low or low numeracy groups are less likely to receive further education. However, with greater job tenure or higher work experience, this group of workers is more likely to receive further education.

In the context of the returns to education for adults, the analysis of the Australian data set shows that there are higher earnings for males and individuals who have greater work experience and higher levels of schooling. When examining the results for the very low numeracy group, there were positive and significant returns for adults in this group when they have greater work experience.

The results of the analysis of the United States data set show that, by comparison with adults with very high numeracy skills, adults with very low or low numeracy skills are less likely to receive

training of any type, but adults in this category who have higher levels of formal schooling or who have greater work experience are more likely to receive training.

In its analysis of the returns to training for adults, the United States data set indicates that there are higher wages for individuals who have greater work experience, job tenure or a higher number of jobs. In addition, on-the-job training and apprenticeship training are significant and positive, indicating a positive impact on earnings. When examining the results for the very low numeracy group, on-the-job training is significant, with a positive impact on earnings. Similar to the overall results, greater job tenure, greater work experience and a higher number of jobs are also significant and positive, indicating higher earnings for this group.

The results from both the Australian and United States analyses indicate that adults with very low or low numeracy skills choose lower levels of education.

The two data sets cannot be directly compared, as they relate to different populations and different policy contexts. Moreover, the participants in each survey are at different life stages. Within this context, it is important to be mindful that the interpretation of these results from a public policy perspective should be done cautiously.

Given the caveat noted above, when the likelihood of receiving education or training is examined, both the Australian and the United States data sets have similar results. Individuals in the very low and low numeracy groups are less likely to receive further education or training. While individuals in these groups are the most disadvantaged in terms of skill levels, they are also the least likely to receive any assistance in gaining additional skills. However, when examining the returns to training using the Australian data set, the results indicate that individuals in the very low numeracy group have positive and significant impacts on earnings when they have greater work experience. In this same context, the analysis of the United States data set indicates that individuals in this group, when they participate in on-the-job training programs, experience positive and significant impacts on their earnings.

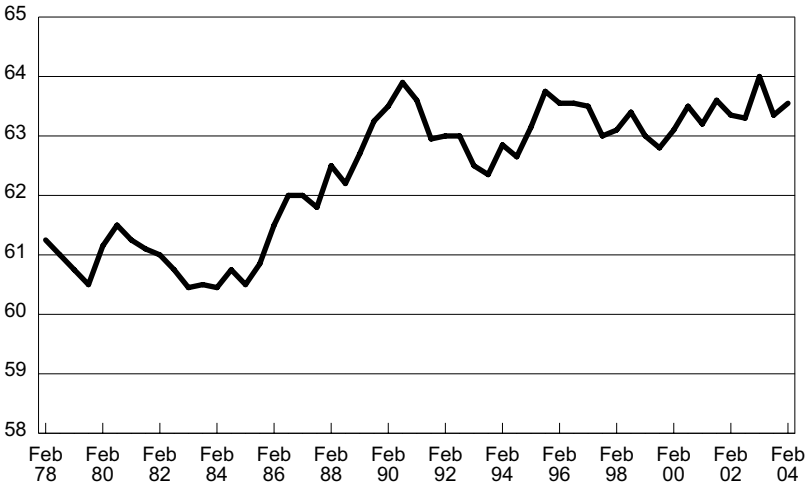
These results have important public policy implications. When groups are separated according to numeracy skill levels, the type of training is important.

Public policies can be effectively targeted to adults with very low or low numeracy skills, who are most likely to be disadvantaged in terms of participating in further education programs. In addition, policies can be directed towards supporting individuals with very low or low numeracy skills in the workplace, as individuals in these groups have higher earnings when they have greater work experience.

Adults with low literacy or numeracy skills and the labour force

The labour force, by definition, includes all non-institutionalised persons who are working or looking for work. Labour force participation has changed significantly over the last century as more women have entered the workforce. In April 2004, the participation rate in the Australian labour force was 63.7%, which included 55.8% of women and 72.0% of men. Within Australia, the participation rate for women has increased from 43.5% in February 1978 to 55.8% in April 2004. This change in the labour force participation rate for women has also occurred within the United States, increasing from 48.8% to 59.0% in the same time period. In addition, immigration is playing an increasing role within the United States, as greater numbers of immigrants are entering the labour force, many with fewer skills (United States Department of Labor 1999). Figure 1 illustrates the trend in the labour force participation rate in Australia from February 1978 to February 2004.

Figure 1: Labour force participation rate in Australia (%)



In the United States in 1999, a joint study examining the relationship between literacy and employment was undertaken by the Departments of Commerce, Education, and Labor, the National Institute for Literacy, and the Small Business Administration. This study found that 70% of the unemployed are at the lowest literacy levels, and 5% were at the highest literacy levels. The study also found that workers with lower literacy and educational skills faced greater difficulties in finding employment, experienced longer periods of unemployment, and often received less training when they were employed (United States Department of Commerce 1999*)*. Census reports have consistently indicated that the median family income is lowest for those with the lowest levels of education.

Table 1 summarises the labour force status of adults using quantitative literacy levels instead of educational levels in the United States. Quantitative literacy is measured using the 1992 National Adult Literacy Survey, where level 1 represents lower skill levels and level 5 represents higher skill levels. This table indicates increased unemployment levels for those with lower quantitative literacy or numeracy skills. In contrast, adults who are employed tend to have higher quantitative literacy or numeracy skills.

Table 1: Distribution of adults by quantitative literacy levels and labour force status: 1992

	Literacy level (%)					
	1	2	3	4	5	Total
Employed full-time	13	23	35	23	6	**100**
Employed part-time	15	27	36	18	4	**100**
Employed, not at work	17	24	36	19	4	**100**
Unemployed	28	32	28	10	2	**100**
Out of labour force	37	27	24	10	2	**100**

Source: United States Department of Education (1999)

Defining and measuring literacy, numeracy, low basic skills and training

This section discusses the broad definitions and measurement of literacy, numeracy, low basic skills and training. The terms 'low skills' or 'basic skills' are often used interchangeably with 'low literacy', 'low numeracy' or 'low educational levels', and are discussed in the following sections. An in-depth discussion of the definitions of literacy, numeracy and basic skills is outside the scope of this paper; these concepts are briefly introduced here within the context of providing background information for the specific measures used in the econometric models and data analysis which are discussed later in this paper.

Defining and measuring literacy

The definition of literacy has changed dramatically over time. Initially, 'literate' referred to the ability to sign one's own name, whereas it now includes the skills for participating in problem-solving and decision-making within a work environment. In addition, the expectations of literacy have also increased with each generation. Literacy can be defined contextually and shaped by social, cultural, and work influences. Within Australia, Lonsdale and McCurry (2003) have recently reviewed the conceptualisation of literacy, concluding that there is no universally accepted definition of literacy within the literature. These authors have suggested that there are three ideological frameworks for conceptualising literacy within Australia:

- a cognitive, individual-based model associated with a psychometric tradition, quantifiable levels of ability, and a deficit approach to 'illiteracy', which is assumed to be both an outcome of individual inadequacy, and a causal factor in unemployment
- an economics-driven model generally associated with workforce training, multiskilling, productivity, 'functional' literacy and notions of human capital
- a sociocultural model which is most commonly associated with contextualised and multiple literacy practices, a valuing of the 'other', and a strong critical element.

(Lonsdale & McCurry 2003, p.5)

Within the United States, a formal definition of literacy was included in the *National Literacy Act 1991*, where it was defined as:

> … an individual's ability to read, write, and speak in English, and compute and solve problems at levels of proficiency necessary to function on the job and in society, to achieve one's goals, and develop one's knowledge and potential.

The 1992 National Adult Literacy Survey study discussed earlier, reflected this definition of literacy, and created a literacy continuum which accepted that individuals had different skill levels in different areas. The survey developed three areas of literacy, including prose literacy, document literacy and quantitative literacy. Within these three scales, it developed different skill levels within each scale, with level 1 reflecting lower skill levels, and level 5 representing higher skill levels (National Institute for Literacy 1998).

In summary, both the Australian and the United States definitions are consistent with literacy being measured on a continuum, and clearly identify that literacy skills for each individual are needed at a level of proficiency necessary to function in different roles. It should also be noted that, in addition to difficulties in defining literacy, several studies have examined objective versus self-assessed measures of literacy (OECD 1992; Charette & Meng 1994). These studies concluded that it was likely there could be a large amount of measurement error in self-assessed reporting of literacy skills, and it was clearly preferable to use objective and direct measures to assess literacy levels rather than relying on self-reported measures. This need for an objective measure of literacy has been fundamental in the selection of data sets within this study, and will be discussed further in the following sections.

Defining and measuring numeracy

As discussed in the previous literacy section, there is a close relationship between literacy, quantitative literacy and numeracy. Charette and Meng (1998) used a numeracy measure from the Literacy Skills Used in Daily Activities to obtain an objective measure of skills, but found that the numeracy tasks were influenced by literacy skills. They concluded therefore that numeracy could not be measured independently of literacy. The authors found that numeracy was often a statistically significant determinant of labour market status, and that both literacy and numeracy contribute to the explanation of the number of weeks worked and have a positive, and significant, impact on the incomes of those who work. Rivera-Batiz (1991) examined the specific role of quantitative literacy in identifying the probability of full-time employment, and found that scores on the quantitative literacy test were a strong determinant of the probability of being employed full-time.

Castleton and McDonald (2002) summarised the definitions of prose, document and quantitative literacy that have been used with the National Adult Literacy Survey, the International Adult Literacy Survey and the Survey of Aspects of Literacy, which represents the International Adult Literacy Survey in Australia. Quantitative literacy was defined as follows:

> Quantitative literacy is the ability to perform arithmetic operations using numbers contained in printed texts or documents. The effective use of numbers contained in printed material involves being able to locate numbers and extract them from material that may contain similar but irrelevant information and being able to perform arithmetic operations when the operations to be used must often be inferred. This type of literacy has a strong element of numeracy. However, because quantitative literacy relates to the ability to extract and use numbers from printed texts and documents, it is referred to as a type of literacy.
>
> (Castleton & McDonald 2002, p.10)

Johnston (2002) discussed the definition of quantitative literacy used in the Australian Survey of Aspects of Literacy. Again, quantitative literacy was considered to be a subset of numeracy, and did not include some skills that might be included in a more specific definition of numeracy. Johnston questioned whether some of these numeracy skills might include tasks that are not embedded in printed text, more complex operations or algebra. Other skills might include reading and interpreting graphs, charts and tables, or invoices.

Defining and measuring low basic skills

There have been many different measures used to identify low basic skills, including educational levels, the National Adult Literacy Survey literacy tests, the Armed Forces Qualifying Test, and numeracy tests. Education levels have often been used as a proxy for literacy or numeracy skills, particularly for early school leavers. Generally, individuals who have not finished the ninth grade are considered to have the lowest skill levels.

The Armed Forces Qualifying Test is a composite test from the Armed Services Vocational Aptitude Battery. This composite test includes sub-test questions on word knowledge, paragraph comprehension, arithmetic reasoning, and numerical operations, and has been commonly used as a measure of ability and basic skills (Rivera-Batiz 1991; Veum 1995).

As an alternative approach to using the Armed Forces Qualifying Test, some researchers have measured low basic skills using the 1992 National Adult Literacy Survey, which includes tests of both mathematical and reading comprehension skills. Comparing the National Adult Literacy Survey results with those from the Armed Forces Qualifying Test found the results of the two measures to be quite similar, specifically in relation to the percentage of the population with low basic skills (Levenson, Reardon & Schmidt 1999). Table 2 was developed by Carnevale and Desrochers (1999), and summarises the relationships between skills, education and literacy levels, using the 1992 National Adult Literacy Survey as the measure of literacy.

Table 2: The National Adult Literacy Survey paradigm

Skill level	Approximate educational equivalence	NALS skill level
Minimal	Dropout/early school leaver	Level 1
Basic	Below average high school graduate	Level 2
Competent	Some post-secondary education	Level 3
Advanced/superior	Bachelor's degree or more	Level 4/5

Note: NALS = National Adult Literacy Survey.
Source: Carnevale & Desrochers (1999)

Defining and measuring training

The definition and measurement of training are fundamental concepts when examining the returns to training for adults with low literacy or low numeracy skills. Bassi (1994) has argued that there is a basic difference between training and education. He states that education is general, and therefore portable across organisations. This makes it difficult for organisations to recoup their investments in education. In contrast, training provides skills specific to an organisation, or occupation, and is therefore less portable. As a logical consequence, the organisation will move towards providing organisation-specific training rather than general and portable education, since they can recoup their investment.

A review of the literature indicates several broad classifications of 'training'. Some researchers (Lynch 1992; Veum 1995) separate training into 'on-the-job' and 'off-the-job' categories. Two other classifications of training include 'formal' and 'informal' (Lowenstein & Spletzer 1998b), and 'general' and 'specific' (Lynch 1992; Lowenstein & Spletzer 1998c). Lynch (1991a, 1991b, 1992) conducted a number of studies using the National Longitudinal Survey of Youth 1979 data set, using 'on-the-job', 'off-the-job' and 'apprenticeships' as training classifications. These training classifications are distinct from any formal training, such as full-time school.

In the Australian literature Hager (1994) clarified the terms 'on-the-job' and 'off-the-job' within the context of assessment. On-the-job is within an actual workplace situation, and is distinguished by what he terms 'crucial features', which include physical surroundings, time demands, and rewards and incentives of an actual workplace, as well as training that is part of the candidate's job. Off-the-job training occurs in circumstances which, although it replicates or simulates many of the features of an actual workplace situation, lacks the crucial features specified for on-the-job training.

The Australian National Training Authority (ANTA) distinguishes off-the-job training as occurring away from a person's job, possibly on-site or off-site at a training provider. On-the-job training is defined as being undertaken in the workplace as part of the productive work of the learner. These modes of learning delivery are distinguished from the apprenticeship scheme which:

> … is a system of training regulated by law or custom which combines in-the-job training and work experience while in paid employment with formal off-the-job training … Traditionally, apprenticeships were in trade occupations (declared vocations) and were of four years' duration. (ANTA website)

Schofield (2000) in her recent review of apprenticeship training in Victoria notes that apprenticeships and traineeships form part of what is traditionally known as 'employment-based

structured learning'. Schofield discusses the changes in delivery of apprentices and offers a summary.

> For at least the past forty years in the case of apprenticeships and for fifteen years in the case of traineeships, training has been delivered in a single mode: on-the-job training in the workplace plus off-the-job training traditionally in a TAFE institution [publicly funded government college] (for apprenticeships) and in various education or training institutions (in the case of traineeships). (Schofield 2000, vol.1, p.2)

Barron, Berger and Black (1997) compared different measures of training in the United States to examine the incidence of training and the number of hours spent in training. They compared multiple surveys over the last two decades, including the 1982 Employment Opportunity Pilot Project, the 1992 Small Business Administration survey, the National Longitudinal Survey of the High School Class of 72, the National Longitudinal Survey of Youth 1979 and the Current Population Surveys. The measures were different in each of these surveys, but fundamentally included formal and informal training, and on-site (on-the-job) and off-site (off-the-job) training.

Lynch concluded that one of the major training measurement issues is the difficulty in distinguishing between general and organisation-specific types of training. Loewenstein and Spletzer (1998b) conducted a study using the 1993 National Longitudinal Survey of Youth 1979 (United States) data to identify the amount of informal training that occurs in on-the-job training, and have concluded that the combination of formal and informal training is a more accurate representation of training. Other studies indicate that there is a great deal of error in the measurement of on-the-job and informal training variables (Barron, Berger & Black 1997; Loewenstein & Spletzer 1998b). This appears to be due to difficulties in clearly identifying the types of training and in recognising and measuring the amount of informal training that occurs.

Changing demands on job skills

As discussed earlier, the evolution of the 'new economy' has created changes in skill demands, resulting in a decline in the number of low-skilled jobs available. This has led to an excess supply of people with low skills, resulting in declining wages. There has been a corresponding increase in the number and wages of high-skilled jobs (Juhn, Murphy & Pierce 1993; Bowers & Swaim 1994; Howell & Wieler 1998; Carnevale & Descrochers 1999; United States Department of Labor 1999). In addition, low-wage jobs are growing more rapidly than low-skill jobs. Low-wage jobs are often in the service sector and may require increased computer, language and mathematical skills. This is in contrast to the manual skills required in low-skilled jobs (Howell & Wolff 1991).

In the Australian context, there has been some debate about whether the pattern of increased demand for individuals with higher skills has also been apparent. Earlier work by Cully (1999, in Wooden 2000a) suggested that this trend towards increased demand for skills was not replicated in the Australian context. However, work by Wooden (2000a, 2000b) suggested that these results may have been sensitive to the time periods within the business cycle. His analysis demonstrated that the results in an Australian context are consistent with experiences in other international contexts, when similar periods within the business cycle are used as the basis for comparison.

This trend suggests a growing mismatch between the skills required by the labour market and the skill levels of workers with low numeracy or literacy skills. Thus, already disadvantaged adults with low skills are the least likely to receive specific training, and are the most likely to be in jobs with minimal opportunities for general training. Examining returns to training for the low literacy or low numeracy groups provides some additional insights into how training can be effectively targeted to increase wages for these groups.

Adults with low basic skills and the likelihood of receiving training

Many researchers found that the likelihood of receiving training increased with the level of education (Lillard & Tan 1986; Lynch 1991b; Bowers & Swaim 1994; Veum 1995). Blandy et al. (2000) completed an Australian study, and compared the likelihood of receiving training with the level of educational attainment. The results of this study were consistent with other studies, and showed that individuals with higher levels of education were more likely to receive training. They also examined training using the number of hours of training rather than receipt of any training, and these results indicated that an individual with a lower level of education who is selected for training receives more hours of training than an individual with a higher level of education (Blandy et al. 2000). This result supports other studies that indicate that individuals with higher education levels are more likely to receive training. However, when the hours of training are examined instead of the number of episodes of training, individuals with lower education levels who are selected for training are more likely to receive more hours of training.

The United States Bureau of Labor Statistics (1993) examined the likelihood of receiving training for both different educational levels and for different aptitude levels, with aptitude being measured by the Armed Forces Qualifying Test. This comparison was intended to identify the different influences of education and aptitude on training. The Bureau of Labor Statistics researchers concluded that aptitude plays a role independent of schooling in the receipt of training, and that those with higher aptitudes will receive more training in each educational level. In addition, for each Armed Forces Qualifying Test level, those with more education are more likely to receive training. These results are summarised in table 3.

Lower rates of participating in training have clear policy implications for adults with low basic skills, including adults with low numeracy skills. Adults who have low numeracy skills may not have completed school, may have inconsistent work histories, or may be in sections of the labour market with high unemployment. For any of these reasons, the likelihood of receiving training is reduced. In effect, this further disadvantages adults who have lower skill levels. This, combined with the impacts of the 'new economy' where there are fewer jobs requiring lower skill levels, creates an environment where there are unequal opportunities with reduced job openings for those with lower skill or education levels. Thus, already disadvantaged adults with low skills are least likely to receive specific training, and are the most likely to be in jobs with minimal opportunities for general training.

Table 3: Variation in the receipt of training by education level and Armed Forces Qualifying Test score

Education/AFQT score	Received training (%)
Less than high school	7.6
AFQT < 50	5.6
50<=AFQT<65	10.3
65<=AFQT<80	11.1
AFQT>=80	13.9
High school graduate	16.5
AFQT < 50	7.9
50<=AFQT<65	15.0
65<=AFQT<80	18.6
AFQT>=80	22.3
Some college	24.8
AFQT < 50	13.4
50<=AFQT<65	21.2
65<=AFQT<80	25.2
AFQT>=80	27.4
College graduate	30.6
AFQT < 50	24.2
50<=AFQT<65	26.7
65<=AFQT<80	28.1
AFQT>=80	31.3

Note: AFQT = Armed Forces Qualifying Test.

Source: United States Bureau of Labor Statistics (1993)

Economic returns to education and training

This study follows from previous research (Gleeson 2002) that examined the economic returns to training for adults with low literacy skills using a United States data set, the National Longitudinal Survey of Youth 1979. This study focused on the economic returns to training using numeracy rather than literacy skills to separate the data sets. Two data sets were used in the current study, the National Longitudinal Survey of Youth 1979 and the Longitudinal Survey of Australian Youth (1975 cohort), to examine economic returns to education or training for adults with low numeracy skills in both Australia and the United States. The Australian analysis examines returns to education, using qualifications received, for adults with low numeracy skills. The United States analysis examines returns to training, using training received for on-the-job and off-the-job training models.

There have been many studies that have examined the economic returns to education and training. In Australia, studies examining the returns to education have focused largely on educational attainment using years of education as a measure, including school completion, vocational education and training (VET) or technical and further education (TAFE) certificates, apprenticeships or traineeships, or higher education degrees. In the United States, studies examining the returns to education have examined returns for completion of high school, the General Educational Development certificate, associate (sub-baccalaureate) or college (baccalaureate) degrees.

Studies examining returns to training have usually focused on returns for on-the-job, off-the-job or apprenticeship training programs, using variables such as race, gender, amount of time employed, college major, and ability. Some studies have examined the returns to education for individuals who have not completed high school, but these studies have used either years of schooling or completion of high school or the General Educational Development certificate as measures of education.

The human capital model (see appendix 1 located in the support document on the NCVER website <http://www.ncver.edu.au>) is used in this study as the theoretical framework by which to examine the returns to education and training. This model assumes that individuals will make a rational choice about an investment of time and money into education or training. The fundamental basis of the model is that there are increased earnings following investments in education or training. When ability levels are included in the human capital model, individuals with lower skill levels, and thus lower productivity in the workplace, tend to have lower returns to education or training. The public policy implication for this study is that individuals with low numeracy skills will choose lower levels of education or training.

Human capital refers to a worker's skills and knowledge, and represents gains from their investments in education and training. It is widely accepted that educated workers are more productive because they can use their skills more effectively, change more quickly and learn while on the job. As implied by the human capital model, it is expected that additional training or education would increase productivity and therefore increase wages.

Those with higher education start working with higher base wages and have more rapid wage growth. Previous studies that examine the returns to education or training have generally focused on earnings or wages, job turnover and hours/weeks employed, as a measure of economic returns (Lynch 1992; Eck 1993; Veum 1995, 1998; Royalty 1996; Krueger & Rouse 1998; Parent 1999).

A brief review of the literature is provided here to provide the context for this study. Firstly, the literature reviewing the returns to education is presented. Secondly, the literature reviewing returns to training is presented, and finally, a summary of the literature regarding returns to training using numeracy or literacy as a measure is presented.

Returns to education

Studies examining the economic returns to education or training have often compared different groups and programs. Some studies have analysed returns for race or gender (Lynch 1991a, 1991b; Barron, Black & Loewenstein 1993; Olsen & Sexton 1996; Kimmel 1997). Other studies have examined the returns for different levels of education or different training programs (Eck 1993; Ashraf 1994; Monk-Turner 1994; Saint-Paul 1994; Cao, Stromsdorfer & Weeks 1995; Grubb 1997).

When examining the economic returns to education, one group of studies looked at adults who completed high school or its equivalent, two-year or four-year university degrees (Cao, Stromsdorfer & Weeks 1995; Grubb 1995, 1997; Leigh & Gill 1997; Tyler, Murnane & Willett 2000). These groups are then compared with those who did not complete the same educational level. The results support positive returns to training for workers with higher levels of education. Other studies also examined the returns to education for two-year and four-year university degrees, and concluded that the economic returns are quite variable, depending on race, gender, different credentials, and fields of study (Rumberger & Thomas 1993; Monk-Turner 1994; Grubb 1995, 1997; Leigh & Gill 1997).

Ryan (2002) completed an Australian study that examined the individual economic returns to training for vocational education and training, using wage regression equations. This study examined the different returns to different VET qualifications, and included work and study combinations. The results indicated that individuals who completed VET qualifications generally received higher wages, and that wages varied according to the qualification level achieved.

Marks and Fleming (1998) examined the influences on hourly earnings of Australian youth, and included a range of social and demographic variables. School achievement levels were included as a variable, measured by years of schooling and qualifications, including apprenticeships, completion of Year 12, diplomas, degrees, and TAFE certificates and diplomas. The results indicated school achievement level had a moderate and positive effect on earnings, and that the effects of years of schooling increased with age.

Long (2001) examined the effect of firm-based training on earnings, using educational attainment, experience and training, as indicators of human capital. The results of this study demonstrated that both the level of education and experience had a strong and positive effect on earnings. In addition, structured training had a positive effect, but the effects of unstructured training were not clear.

Tyler, Murnane and Willett (2000) compared annual income by General Educational Development certificate test scores of high school dropouts from New York State and Florida. Skills were measured by using the certificate's sub-test scores for reading, writing and mathematics, as well as vocabulary and general knowledge. Higher test scores represented higher basic skill levels. The test scores were matched with annual income measured from social security data, and the researchers found that higher skills translated to higher earnings.

In summary, studies examining the returns to education have generally shown that there are positive returns for workers with higher levels of education. While many studies have compared different characteristics of groups, such as race, gender or different levels of education, there appear to be no studies that have separated the data set according to the numeracy skill levels of the individuals.

Returns to training

Veum (1995) analysed the returns to training, and concluded that different training programs provide different economic returns, depending on multiple variables. Estimating the relationship between wages and training is dependent on the quality of data on training, and this is difficult because the definition of training often excludes the impacts of informal training (Veum 1998).

A group of studies have examined the differences in wages by race and/or gender following training (Lynch 1991a, 1993; United States Bureau of Labor Statistics 1993; Barron, Black & Loewenstein 1993; Robst 1994). Hill (1995) found that women who received training had increased wages and increased labour force participation rates compared with women who had not received training or education. Barron, Black and Loewenstein (1993) found that men received more training than women, and that women were employed in positions with shorter on-the-job training than men. In addition, these researchers found that employers will train workers who are less likely to quit, which in turn results in more men receiving training. Long and Lamb (2002) examined returns to training for Australian youth between the 1980s and the 1990s, using two data sets. The results indicated that there were differences between males and females in both the incidence of training and the amount of training received. In addition, more women were participating in training in the 1990s.

Other studies examined the returns to training from current and previous employers (Olsen & Sexton 1996; Veum 1998; Loewenstein & Spletzer 1998a, 1998c; Parent 1999). Parent (1999) concluded that training with both the previous and current employer has a positive effect on wages. Completed periods of training with the previous employer have larger effects on wages than completed periods of training paid for by the current employer (Loewenstein & Spletzer 1998a). Black and Lynch (1996) examined productivity, and found that past training raises current productivity.

Lynch (1992), using the National Longitudinal Survey of Youth 1979 data set, examined the training received by individuals who did not graduate from college. She used on-the-job, off-the-job and apprenticeships as training classifications, and found different probabilities of receiving training by race and gender. In addition, she found that training after completing high school raised wages significantly. However, she also found that adults who have not completed high school received lower wages during the training period.

Other studies examined general and specific training, including who paid for the training. Lynch (1992) demonstrated that employers and individuals shared the costs for adults who did not have a high school diploma, and that more general training was provided to these individuals. In contrast, Loewenstein and Spletzer (1998a) found that employers often pay the costs of off-site general training, with few costs passed on to workers. The implication is that employers are paying for general training. These authors suggested that if employers can share the returns to general training, the worker would be less likely to pay for the cost of training, and that sharing the returns to training provides the employer with an incentive to share the cost. The provision of general and specific training, including who pays, is important in the context of the human capital model, discussed further in the following section.

In summary, many studies examining the returns to training have compared different characteristics of groups, such as race or gender, in relation to the incidence of training and the amount of training received. Several studies examined the economic returns to training from previous and current employers. Other studies demonstrated that different training programs provided different economic returns. Some studies have examined general and specific training, including who paid for the training. Work from Lynch (1992) and Veum (1995, 1998) has examined the returns to training when the data set is separated by educational level or by ability, but there appear to be no studies that have separated the data set to examine the returns to training according to the numeracy skill levels of the individuals.

Returns to education or training for adults with low literacy or numeracy skills

There has been a recent shift towards a stronger emphasis on measuring the returns to training using literacy, numeracy or basic skills as a measure of functional skills. McIntosh and Vignoles (2001), using literacy measures from the National Child Development Survey and the International Adult Literacy Survey, found higher wage returns associated with greater literacy and numeracy skills. Ishikawa and Ryan (2002), using the National Adult Literacy Survey, found positive returns associated with basic skills learned in school. Finnie and Meng (2001) found that literacy and numeracy skills have impacts separate from education levels, in explaining the probability of being employed, unemployed or receiving welfare.

Dougherty (2003) examined the contributions of literacy and numeracy to earnings, and the relationship between numeracy, literacy and years of schooling. The results of that study suggest that numeracy has a highly significant and positive effect on earnings, mostly through its effect with years of schooling. In addition, the results indicated that there appeared to be increasing returns to the impact of numeracy. Literacy was found to have a smaller and less significant impact on earnings. Green and Riddell (2001, 2003) examined the effect of literacy and numeracy skills on earnings of the individual, and found that both literacy and numeracy skills have a significant impact, particularly combined with the effects of schooling.

While Ishikawa and Ryan (2002) note that their findings support basic skills education in job training for out-of-school adults, little research has been done to address the returns to training for adults with low literacy or low numeracy skills. In summary, many studies have examined the returns to education for completing high school or its equivalent, and two-year or four-year university degrees. Other studies have examined the returns to training, using on-the-job, off-the-job and apprenticeship categories to analyse economic returns. However, there are few studies in either the education or training literature that examine the economic returns to training for those who have not completed Year 12 at school.

In this study, it is suggested that differentiating by numeracy level is likely to be a better measure of an individual's functional skills and likelihood to receive training. In addition, it is important to understand the returns to training for adults with low numeracy skills, as well as understanding the sources of types of training received by these individuals. This will enable policies for public funds to be more effectively targeted towards individuals who are least likely to receive training, and to develop policies that are most effective in assisting individuals with low numeracy skills to gain higher returns to training.

Results of the analysis

Four models are used to determine which groups receive training and to analyse the returns to different types of training for adults with low numeracy skills.

A probit model is used to estimate the probability of a particular numeracy group receiving training, and a regression model with dependent variable log wage (ordinary least squares) is used to estimate the returns to different types of training using the Australian data set.

A logistic regression and a log wage fixed effects regression model is used with the United States data set.

Details of the data sets, variables used in the analysis and results can be found in appendix 2 (see support document at NCVER's website <http://www.ncver.edu.au>).

Australian data—participation in education

The first result when examining the likelihood of receiving education indicates that adults with low numeracy skills are less likely to receive education of any type. Education incidence is summarised in table 4 by education level and numeracy level.

Table 4: Participation in education programs by numeracy level (%)

Type	Very low	Low	High	Very high
Number in each numeracy level	1044	1633	1962	1018
Year 11 or 12	44.3	62.3	77.0	87.3
Apprenticeship/traineeship	10.5	13.2	12.1	9.2
TAFE certificate	16.1	18.4	16.4	11.1
Diploma/assoc diploma	6.6	11.9	13.2	9.2
Degree, postgraduate study, other qualification	8.9	16.8	36.5	58.6

Incidence measures the percentage of adults in the sample, by numeracy level, who participated in a particular type of education program. For example, 44.3% of adults in the very low numeracy group participated in schooling in Year 11 or 12 at some time during the study period (1989–2000), as measured by their activity in October of the survey year. In contrast, 87.3% of adults with very high numeracy skills participated in the same level of schooling. This indicates that adults with high or very high numeracy skills are at least twice as likely to participate in secondary school education (defined as participation in Year 11 or 12 at school) compared with adults with very low numeracy skills. These results are also apparent when examining participation in higher education, including degrees, postgraduate study or other qualifications. More specifically, the results indicate that 8.9% of adults in the very low numeracy group participate in the higher education level, by comparison with 58.6% of adults from the very high numeracy group.

In contrast to participation in schooling and higher education programs, the pattern of participation in apprenticeships and traineeships and in TAFE certificate programs is very different. Higher percentages of adults in the very low and low numeracy groups participate in apprenticeships or traineeships and TAFE certificate programs. More specifically, 16.1% of adults

in the very low numeracy group have participated in a TAFE certificate program, compared with 11.1% of adults in the very high numeracy group. This pattern is also apparent for apprenticeship and traineeship programs, but the difference between the groups is not as large.

It is expected that education or training opportunities differ depending on occupational choice, educational achievement, ethnicity, location and gender, but even after controlling for these factors, adults with low numeracy skills are significantly less likely to participate in further education programs of any type. Since measures of the other occupation codes were not significant and did not add to the sensitivity or specificity of the model, they were dropped from the analysis.

The basic finding of lower training likelihoods for adults in the lower numeracy groups is particularly important. These results support policies where training programs are targeted towards adults with low numeracy skills. In the following log wage regression analysis, this result is further enhanced by the significance of the returns to further education and training for adults with low numeracy skills.

The results of the probit analysis are presented in table 7 in appendix 2 in the support document.

Australian data—returns to different types of training

The results of the log wage regression analysis are presented in table 8 in appendix 2.

In summary, the overall log wage model (model 1) results indicate that males have higher wages than females, and that individuals who continue with formal schooling also have higher wages. In addition, work experience is significant and positive, indicating higher earnings for individuals with greater work experience. For adults in the very low numeracy group, individuals have higher earnings if they have greater work experience. For adults in the very high numeracy group, individuals have higher earnings if they have greater levels of education or more work experience. Please note that participation in Year 11 and 12 may be collinear with the numeracy variables in model 1.

United States data—participation in training

Following the approach in the Longitudinal Survey of Australian Youth analysis, the first result in the National Longitudinal Survey of Youth 1979 analysis indicates that adults with low numeracy skills are less likely to receive training of any type. The incidence of training is summarised in table 5 by training type and numeracy level. Again, incidence measures the percentage of adults in the sample, by numeracy level, who have participated in a particular training type. For example, 18.2% of adults in the very low numeracy group participated in at least one episode of on-the-job training at some time during the study period (1989–2000). In contrast, 40.9% of adults with very high numeracy skills participated in on-the-job training during the same period. This indicates that adults with high or very high numeracy skills are at least twice as likely to participate in on-the-job training compared with adults with very low numeracy skills. This pattern is also reflected for off-the-job and apprenticeship training programs.

Table 5: Training incidence by numeracy level (%)

Type	Very low	Low	High	Very high
On-the-job	18.2	32.0	44.1	40.9
Off-the-job	11.9	21.4	25.6	26.1
Apprenticeship	1.4	2.2	4.4	2.3

Consistent with the methodology presented in the Longitudinal Survey of Australian Youth analysis, it is expected that education or training opportunities differ depending on occupational choice, educational achievement, race, location and gender, but even after controlling for these factors, adults with low numeracy skills are significantly less likely to participate in further education programs of any type. Results of the logistic regression analysis using National Longitudinal Survey of Youth 1979 data is presented in table 9 in appendix 2.

In general, the results of the logistic regression analysis using the National Longitudinal Survey of Youth 1979 data set indicate that adults with very low or low numeracy skills are less likely to receive training of any type, and adults who have higher levels of formal schooling, have greater work experience or are union members are more likely to receive training.

United States data—returns to different types of training

Lynch (1992), using a log wage regression model and the National Longitudinal Survey of Youth 1979 data set, found that being white, male, married, healthy, living in a standard metropolitan statistical area (SMSA), being a union member or having greater job tenure, work experience or years of schooling had significant and positive impacts on wages. High unemployment rates had a significant and negative impact on wages. When examining training, Lynch found that previous off-the-job, previous apprenticeship, current on-the-job or current apprenticeship training increased wages significantly. When examining the returns to training for different educational levels, she found that current on-the-job training was positive and significant for those with higher education.

The significant results of the log wage fixed effects regression analysis are summarised in table 11 in appendix 2.

When examining the results for the very low numeracy group (model 2), on-the-job training is significant with a positive impact on earnings. Union membership, having greater job tenure, greater work experience and a higher number of jobs are also significant and positive, indicating higher earnings. As expected, receiving higher amounts of welfare is significant with a negative impact on wages.

Model 5 presents the results for the very high numeracy group. Consistent with the other models, union membership is significant and positive for adults with very high numeracy skills, and having greater work experience or job tenure is significant and positively related to earnings for this group. None of the training coefficients is significant for this group.

In summary, the overall log wage model (model 1) indicates that on-the-job and apprenticeship training is significant, with a positive impact on wages. In addition, union membership, greater work experience, job tenure and number of jobs are also significant and positive in this model. For adults with very low numeracy skills, on-the-job training is significant and positive. Again, union membership, job tenure, number of jobs and increased work experience are also positive and significant for this group. For adults with very high numeracy skills, none of the training variables is significant, although greater work experience and job tenure are significant and positive for wages for this group, as is union membership.

Limitations of the data

There are several caveats which should be noted concerning the methodology which has been selected for this study. The selected methodology has been based on previous studies, in particular, the studies from Lynch (1991a, 1991b, 1992, 1993) and Veum (1993, 1995, 1998), and has been used to examine returns to education and training, particularly when the data set is separated according to skill levels of the individuals.

It should be noted that the structure of the models used in this study does not address or consider any interaction effects of the variables. This limitation should be acknowledged and considered when interpreting the findings.

In addition, it should be noted that log wages are commonly used to measure the returns to training or education. However, the use of log wages measures the percentage change in wages, rather than the real change in wages. More specifically, a 1% increase in wages for individuals in the very low numeracy group is not the same as a 1% increase in wages for individuals in the higher numeracy groups. Again, this should be considered when interpreting the findings from this study.

A more rigorous examination of ordinary least squares, fixed effects and random effects was considered in a similar study examining the returns to training for adults with low literacy skills using the National Longitudinal Survey of Youth 1979 data set (Gleeson, Peterson & Pratt 2005). Following from this previous work, the models in this study using the National Longitudinal Survey of Youth 1979 data set were run using a fixed effects regression analysis.

The analysis was completed for both data analyses using a pooled data set. The sample from the National Longitudinal Survey of Youth 1979 data set is pooled data on nine individual cross-sections across 12 years. The sample from the Longitudinal Survey of Australian Youth data set is pooled data on 13 individual cross-sections across 13 years. The respondents were sampled to be representative of the population at the time. The National Longitudinal Survey of Youth 1979 data collection commenced in 1979, and the Longitudinal Survey of Australian Youth 1975 cohort data collection commenced in 1989. The models selected included the entire population membership.

Self-selection of participants for training and education can result in a bias, and this bias has been raised in previous studies. It should be noted that if training was extended to other individuals in each group, the returns to training or further education may not be as positive for other members of the group. This is an important caveat on the public policy implications from this study.

Conclusions

This study examined the economic returns to different levels of education or types of training for adults with low numeracy skills.

The two data sets which have been analysed in this study can not be directly compared, as they relate to different populations, different policy contexts, and the participants in each survey are at different life stages. As a result of these differences, the interpretation of results between the two contexts should be undertaken with caution. However, within these caveats, there are some interesting similarities in the results.

Firstly, both the Australian and the United States analyses have similar results when the likelihood of receiving education or training is examined. Individuals in the very low, and low numeracy groups are less likely to receive further education or training. While individuals in these groups are the most disadvantaged in terms of skill levels, they are also the least likely to receive any form of assistance to gain additional skills through further education or training programs. These results are consistent with the human capital model, in that individuals with lower skills are less likely to participate in further education or training programs.

When examining the returns to education for adults using the Australian data set with all variables included in the model, the results show that there are higher earnings for males and individuals who have greater work experience and higher levels of schooling. When examining the results for the very low numeracy group, there were positive and significant returns for adults in this group if they have greater work experience. As a comparison, adults in the very high numeracy group had higher wages when they had more education, greater work experience and were employed in several of the occupation groups.

The results from these Australian analyses support the human capital model, indicating that adults with very low or low numeracy skills choose lower levels of education. Public policies can be effectively targeted to those adults with very low or low numeracy skills who are most likely to be disadvantaged in terms of participating in further education programs. In addition, policies can be directed towards supporting individuals with very low or low numeracy skills in the workplace, since individuals in these groups show higher earnings when they have greater work experience.

An examination of the returns to training for adults using the United States data set with all variables included in the model, shows that there are higher wages for individuals who are union members, have greater work experience, job tenure or a higher number of jobs. In addition, on-the-job training and apprenticeship training are significant and positive, indicating a positive impact on earnings. The results for the very low numeracy group indicate that on-the-job training is significant, with a positive impact on earnings. Similar to the overall results, union membership, greater job tenure, greater work experience and a higher number of jobs are also significant and positive, indicating higher earnings for this group.

It should be noted that there are significant differences between apprenticeship programs in Australia and in the United States. In the United States, apprenticeships are commonly conducted with union involvement or support, and apprenticeships include a significant amount of competency-based training and standards. In effect, this limits job advancement until a competency standard is achieved. In contrast, the Australian apprenticeship system is a combination of workplace learning and classroom learning, with less emphasis on union-initiated training

programs. The results of this study indicate that there is a strong relationship between wages and union membership. This is consistent with apprenticeship training in the United States being based on a competency standards model, where qualifications through experience and training are required before progressing to the next level.

Again, the results from the United States analyses support the human capital model, indicating that adults with very low or low numeracy skills choose lower levels of training. These results support the need for public policy programs to be specifically targeted at individuals who have lower skill levels, as they are less likely to participate in training programs. In addition, the results of the log wage regression equation using the United States data set indicate that the wages for adults who are in the very low numeracy group show positive and significant impacts when they are participating in on-the-job training programs.

There has been a broad shift in the public policy directions for adult literacy programs whereby individuals are encouraged to move away from welfare and into the workforce. Public policies within both Australia and the United States have moved towards supporting skills development in the workplace.

Welfare reform within Australia and the United States has occurred during a period of strong economic growth, which has supported the transition of adults from welfare into the workforce. As indicated by the literature, the likelihood of receiving training is lower for adults who have lower skill levels, are first entering the labour market, are not consistently attached to the labour force, and are looking for work in areas where there are high unemployment levels. This is particularly important when considering the long-term effectiveness of welfare reform. Since it is expected that welfare recipients as a group have lower skill levels, it is questionable whether the early success of welfare reform can be sustained in a slower economy. Moreover, the long-term growth in wage income for individuals who no longer receive welfare may be hindered by limited training opportunities.

Previous research demonstrates that adults with lower skills are less likely to receive training, and that individuals with higher numeracy or literacy skills are likely to have higher wages. This research shows that disadvantaged adults with low skills are least likely to receive specific training, are most likely to be in jobs with minimal opportunities for general training, and are most likely to choose lower levels of education or training. The implication from both the previous research and the results from this study is that public policy can be developed to encourage adults with low literacy or low numeracy skills to invest in higher amounts of education and training, and thus to receive higher rates of return.

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Support document details

Additional information relating to this research is available in *Economic returns to education and training for adults with low numeracy skills: Support document*. It can be accessed from NCVER's website <http://www.ncver.edu.au>. The document contains:

- ✧ Appendix 1: The human capital model
- ✧ Appendix 2: Selection and analysis of the data sets
- ✧ Appendix 3: Log wage regression results—LSAY
- ✧ Appendix 4: Log wage regression results—NLSY79



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