



MINISTRY OF EDUCATION

Te Tāhuhu o te Mātauranga

Adult literacy and numeracy in New Zealand – Key factors

An analysis from the Adult Literacy and Life Skills Survey

This series covers research on teaching and learning in literacy, language and numeracy and analyses of international surveys on adult literacy and numeracy.

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SUMMARY

KEY FACTORS ASSOCIATED WITH ENGLISH PROSE LITERACY AND NUMERACY

Level of education completed – upper secondary and tertiary education (and especially degree qualifications) are associated with higher literacy and numeracy, and lower secondary education (or less) with low literacy and numeracy.

First language and main language spoken at home – people with English as a first language have a considerable advantage, especially in English literacy, but also in numeracy tested in English. People whose first language is not English are at less of a disadvantage if their main home language is English.

Computer use at work and at home – A significant new finding is that computer use is strongly associated with higher literacy and numeracy, especially the combination of work and home computer use. Computer use is particularly prevalent in managerial, professional, technical and clerical occupations, is associated with intensive and extensive literacy and numeracy practices, and is associated with involvement in ongoing education and/or training. Work computer use or non-use divides jobs broadly into those that require higher literacy and numeracy and those that don't. Home computer use is associated with greater involvement in personal literacy activities.

There is a large overlap between the groups of people with low literacy and low numeracy, and the group of people who do not use a computer at work.

This report is based on data from the Adult Literacy and Life Skills (ALL) Survey 2006. It analyses a number of variables that account for variation in skills within New Zealand. It explores their relationships with English prose literacy¹ and numeracy among people aged 25-65.² These variables include:

- Level of education completed, and recent further education and/or training
- Labour force status
- Computer use at work and at home
- Occupation, industry and income
- First language, main language spoken at home, place of birth and ethnic identification
- Age and gender

There were significant variations in literacy and numeracy related to all of these variables.

¹ Level of understanding of continuous text.

² This age range was chosen so that completed education and variables related to employment would be relevant to most people.

Characteristics of groups with higher prose literacy and numeracy

The percentage of people aged 25-65 having **higher** prose literacy and numeracy (ALL Levels 3, 4 and 5) was greater among groups of people with the following characteristics:

- Completion of upper secondary or tertiary education
- Taking formal or non-formal courses in the past year
- Labour force status of employed or student
- Being employed and using a computer at work
- Using a computer at home
- Especially, the combination of using a computer at work AND using a computer at home
- Being a manager, professional or technician
- Working in finance, business or community services (which include education and health)
- Having an annual gross personal income of \$40,000 or more
- Having English as a first language
- Having English as the main language spoken in the home
- Being born in New Zealand
- Having European or 'Other' ethnic identification
- Younger age
- Being male (for numeracy)

Characteristics of groups with low prose literacy and numeracy

Conversely, the percentage of people aged 25-65 having higher prose literacy and numeracy (ALL Levels 3, 4 and 5) was less, that is, the percentage of people having **low** prose literacy and numeracy (Levels 1 and 2) was greater, among groups of people with the following characteristics:

- Lower secondary education or less
- Not taking formal or non-formal courses in the past year
- Labour force status of unemployed, retired, homemaker or other
- Being employed but not using a computer at work
- Not having access to a computer at home, or using a home computer rarely
- Especially, the combination of not using a computer at work AND not using a computer at home
- Being a machine operator or elementary worker
- Working in any of the following industries:
 - Wholesale and retail trade, transport and communications
 - Manufacturing and construction
 - Agriculture, forestry, fishing and mining
- Having an annual gross personal income of less than \$40,000
- Not having English as a first language
- Having a language other than English as the main language spoken in the home
- Being born outside New Zealand
- Having Māori, Pasifika or Asian ethnic identification
- Older age
- Being female (for numeracy)

Statistical modelling

Many of the variables studied have strong associations with each other, e.g. computer use at work, occupation and industry. To clarify the picture, statistical models were developed to account for these associations and pinpoint variables with particularly strong associations with prose literacy and numeracy. Three complementary factors stood out:

- Level of education completed
- First language and main language spoken at home
- Computer use at work and at home

These three key factors – education, language and computer use – can then provide a basic framework for analysing regional and other differences in literacy and numeracy.

The statistical modelling also identified significant secondary factors which can help refine analyses of differences in literacy and numeracy, including:

- Occupation
- Ethnic identification
- Age
- Gender

The secondary factor of ethnic identification applies only to people whose first language is English, and reflects an advantage for Europeans and a disadvantage for Māori and Pasifika, especially in numeracy, within this language subgroup.

When other factors are not controlled for, men are significantly more likely to have higher numeracy than women, but there is no significant gender difference in prose literacy. When other factors *are* controlled for, there is a significant positive effect for men in numeracy, and also a significant positive effect for women in prose literacy, which counteracts men's advantages in other factors including education, employment and computer use.

Key factor: Education

There was a strong association between level of education completed and the percentage of people with higher prose literacy or numeracy. People whose highest completed level was lower secondary (Year 11 or less) were much less likely to have higher prose literacy or numeracy (i.e. more likely to have low prose literacy or numeracy) compared with people who had completed upper secondary or tertiary education. People who had completed bachelors or postgraduate degrees were much more likely than those who had not, to have higher prose literacy and especially higher numeracy.

Educational qualifications have often been used as approximate indicators of literacy and numeracy. Previous analyses of the ALL survey data have highlighted a number of situations in which educational qualifications do not give a good guide to literacy or numeracy skills. This study provides a broader basis for this caution.

Key factor: Language

The ability to correctly interpret and respond to English-language literacy and numeracy tests clearly depends on English language proficiency. 10 per cent of people aged 25 to 65 had a language other than English as first language and as main home language, and another 5 per cent had a first language other than English but English as main home language.

There was a strong association between these language categories and higher prose literacy and numeracy. A majority of people with English as a first language had higher prose literacy and higher numeracy, while only a minority of people whose first language was not English had higher prose literacy or numeracy. Among those people whose first language was not English, those whose main home language was English were more likely to have higher prose literacy than those whose main home language was not English.

After controlling for other factors, the average difference in literacy and numeracy between people with English as a first and main home language and those with another language as first language and main home language was of a similar order to the difference between people with degrees and those with lower secondary education. The difference was greater for prose literacy than for numeracy.

After controlling for other factors, the average difference in literacy and numeracy between people with English as a first and main home language and those with another language as first language but English as main home language was of a similar order to the difference between people with degrees and those with upper secondary education.

Key factor: Computer use

After controlling for other factors, the average difference in literacy and numeracy between people who used a computer at work and people who were either not employed, or were employed but did not use a computer at work, was of a similar order to the difference between people with degrees and those with upper secondary education.

There was a similar but smaller difference between people who used a computer at home and those who did not.

Use of a computer at work was strongly associated with being employed in managerial, professional, technical or clerical occupations, although a significant proportion of workers in other occupational groups also used computers. People who had used a computer at work in the past year were likely to be involved in a much wider range of regular work activities related to literacy and numeracy than those who had not, and those who were involved in a greater number of types of regular literacy or numeracy activities were more likely to have higher literacy or numeracy. Computer use at work appears to pinpoint, more effectively than occupational categories, those jobs which require or encourage regular literacy and numeracy activities. This probably reflects the importance of the computer as a tool for literacy and numeracy activities. The difference in mean prose literacy and numeracy between work computer users and non-users within occupations was comparable with the difference between occupations, and was considerably greater than the differences between industries.

Similarly, people who used a computer at home were more likely to engage in a wide range of regular personal reading activities. There was a straightforward relationship between increase in the number of types of regular personal reading and higher literacy and numeracy scores.

Combination of key factors

There was a large overlap between the groups of people with higher prose literacy or numeracy and the group of people with the combination of upper secondary or tertiary education, English as a first language, and computer use at work. A majority of people with all three characteristics had higher prose literacy and numeracy, and a majority of those with higher prose literacy and numeracy had all three characteristics.

About half the people who lacked just one of these key characteristics had low literacy or numeracy. The majority of people with none or only one of the key characteristics had low literacy or numeracy.

Of people aged 25-65 with low prose literacy or numeracy, those with lower secondary education or less, and those whose first language was not English, were considerably over-represented. A majority of people with low prose literacy or numeracy had not used a computer at work in the past year, just as a majority of those who had not used a computer at work had low prose literacy and numeracy.

This high degree of overlap between the groups of people with low prose literacy and low numeracy, and the group who had limited or no use of computers is of considerable importance. It indicates that programmes seeking to use information and communication technologies in improving people's literacy and numeracy need to take into account their likely lack of proficiency in using computers. Programmes aimed at introducing non-computer users to ICT need to allow for the likely low literacy and numeracy of learners. It also indicates that there may be scope for combining upskilling in ICT and literacy and numeracy in integrated programmes.

1 INTRODUCTION

This report outlines the relationships between literacy and numeracy and a number of key variables which are relevant to variation in literacy and numeracy within New Zealand, using data from the Adult Literacy and Life Skills (ALL) Survey 2006. Some of these variables have not been extensively explored in previous work, particularly computer use at work and at home, and first language and main home language. This report also deals with variables which have been investigated in earlier reports, particularly to see how they relate to computer use and language, and also because this report covers the age range 25-65 rather than the full survey age range of 16-65.

This report serves as preparation for further reports analysing geographical variation in literacy and numeracy of adults aged from 25 to 65.

1.1 The Adult Literacy and Life Skills (ALL) Survey 2006

The Adult Literacy and Life Skills (ALL) Survey was an international survey coordinated by the Organisation for Economic Cooperation and Development (OECD) and Statistics Canada. The main data collection for the New Zealand survey was carried out between May 2006 and March 2007. All survey respondents were interviewed face to face and their English literacy, numeracy and problem solving skills were directly tested during the interviews. The survey achieved a representative national sample of 7,131 New Zealanders aged 16 to 65. The survey also collected extensive background information on demographic characteristics, language, education, employment, income, health, literacy and numeracy practices and the use of information and communication technologies.

1.2 Age range used in this analysis

The respondents in the ALL Survey formed a representative sample of people aged 16 to 65. The analyses in this report, however, are based only on the data from the subset of people aged 25 to 65. Initial study of the full sample indicated that the key factors related to literacy and numeracy included the highest level of education completed and employment-related factors such as occupation and computer use at work. These factors do not apply to the majority of people aged 16 to 24 who are still in education. For the projected geographical analyses, there is also the issue that people in this age group also tend to be geographically mobile, with many moving between regions for study and work. They are not necessarily in their region of origin and are not necessarily living in their current region of residence on a long-term basis. Accordingly a separate analysis is required for the 16-24 age group.

1.3 Literacy and numeracy in ALL

The ALL survey tested skills in English across four domains:

- **Prose literacy** – the ability to read continuous texts, such as news stories and instruction manuals
- **Document literacy** – the ability to read discontinuous texts, such as maps and timetables
- **Numeracy** – the ability to read and work with numeric information
- **Problem solving** – the ability to reason in situations where no routine procedure exists.

The tests were designed to assess skills across the full range of competency, from limited to highly-developed skills. The tests were designed to cover general, cognitive skill levels and did not attempt to assess specialist knowledge and skills (Satherley and Lawes, 2007).

The literacy and numeracy skills measured in the ALL survey are reported either as scores ranging from 0 to 500, or more commonly, in terms of five levels, from Level 1 (very low skills) to Level 5 (very high skills). A detailed description of the levels is given in Chapter 10. In this report the levels are grouped into low skills (Levels 1 and 2) and higher skills (Levels 3, 4 and 5).

The four skills measured in the ALL survey are highly correlated with one another, as shown in Table 1. The strongest correlation was between document literacy and prose literacy. The weakest correlations were between prose literacy and numeracy and between numeracy and problem solving.

Table 1
Correlations between skills for people aged 25-65

	Document literacy	Numeracy	Problem Solving
Prose literacy	0.93	0.83	0.90
Document literacy		0.89	0.89
Numeracy			0.83

Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

The focus in this report is on prose literacy and numeracy. Of the literacy or numeracy measures, these are the most distinct, and together they provide a good overall picture of literacy and numeracy.

In later chapters, the main statistic used as a measure of prose literacy or numeracy among people in a particular category is the percentage of people aged 25-65 in Levels 3, 4 and 5 ('higher prose literacy' or 'higher numeracy'). Higher prose literacy or numeracy can then be directly compared with a number of variables in their more easily expressed form (for example, 'using a computer at work' rather than 'not using a computer at work' – see section 3.2, or 'having English as a first language' rather than 'not having English as a first language' – see section 5.1). Expressing the associated variables in this way also avoids potential technical problems with the statistical reliability of estimates.³

Readers may be particularly interested in the percentage of people with low literacy or numeracy, that is, the percentage in Levels 1 and 2. If the percentage with higher literacy or numeracy (Levels 3, 4 and 5) is x , then the percentage with low literacy or numeracy (Levels 1 and 2) is simply $100-x$.

1.4 Comparison with International Adult Literacy Survey (IALS) 1996

The International Adult Literacy Survey was the precursor of the Adult Literacy and Life Skills Survey. The international results have been summarised in reports by the OECD and Statistics Canada (1995, 2000). Data collection for IALS took place in New Zealand in 1996, with 3,311 respondents completing the full survey and another 922 only basic demographic data. IALS provided measures of prose literacy and document literacy which are comparable with the ALL

³ Almost all estimates provided in this report are of acceptable data quality in terms of Statistics Canada's (2002) guidelines for the ALL survey. However, a small number of estimates are of marginal reliability in terms of these guidelines. Where this is the case, the marginal quality of the estimates will be expressly stated in a Note to the relevant table or figure.

measures. IALS also included a measure of ‘quantitative literacy’ which differed in important ways from numeracy as measured in ALL, so that quantitative literacy in IALS is not comparable with numeracy in ALL.

Culligan et al. (2004) carried out an analysis of the IALS data from the 3,311 respondents who completed the full survey, and developed a set of estimates for the proportion of people with low literacy in New Zealand territorial local authorities (TLAs). These estimates were based on a classification tree model which was then applied to 1996 Census data.⁴

Their measure of low literacy was a composite variable derived from the three literacy measures: prose, document and quantitative. Because ALL has no quantitative literacy measure it is not possible to calculate a comparable statistic from the ALL data. However, their TLA estimates for the proportions of people with low literacy are almost all below the IALS national estimates for Level 1 and Level 2 prose literacy (47 per cent) and document literacy (51 per cent) as reported by Satherley, Lawes and Sok (2008a), which suggests that their definition of low literacy leads to systematically lower proportions than a definition based on aggregating Level 1 and Level 2 (as used in this report).

In the classification tree model developed by Culligan et al. (2004, pp.5-6), the strongest predictor was educational attainment. The second strongest predictor was ethnicity, although they note that this variable could be confounded with language proficiency. Other important factors were labour force participation, occupation, industry and income. All these factors are considered in this analysis of the ALL data, and the modelling used here produces results which are broadly consistent with those of Culligan et al., in that two of the main predictive factors highlighted in this report are completed education and language proficiency (first and main home language), along with computer use, which was not asked about in the IALS survey and hence not considered by Culligan et al.

1.5 Statistical models

The simultaneous effect on prose literacy and numeracy of a number of factors is represented by ordinary least-squares regression models which are detailed in Appendix A.

Models based on education completed, work and home computer use, first language and home language account for 43 per cent of the variation in prose literacy scores and also 43 per cent of the variation in numeracy scores.

Broadly speaking, these basic models indicate that higher prose literacy and numeracy is more likely to be found among those who have completed higher levels of education, who have used a computer at work, have access to a computer at home and use it for at least five hours a month, and have English as both a first language and main home language; and conversely, lower scores are more likely to be found among people without these characteristics.

The main difference between the basic models for prose literacy and numeracy is that not having English as either a first language or main home language has a stronger effect on prose literacy than on numeracy. Prose literacy is 1.2 standard deviations lower for people in this category than for similar people with English as both a first and main home language, while the corresponding difference for numeracy is 0.9 standard deviations.

Extended models which include the variables in the basic models but also incorporate variables based on occupation, ethnic identification, gender, age and deprivation have only slightly more

⁴ In contrast, analyses are developed in this report with a view to applying them to ALL survey data rather than Census data.

predictive value, accounting for 45 per cent of the variation in prose literacy scores and 47 per cent of the variation in numeracy scores.

Broadly speaking, in addition to the effects represented by the basic models, the extended models indicate that higher prose literacy and numeracy scores are more likely to be found (all other factors being equal) among people in managerial, professional or technical occupations, and among those with low deprivation (that is, New Zealand Deprivation Index below the median). Among people with English as a first language, Māori and Pasifika are somewhat more likely than Europeans to have low prose literacy and considerably more likely to have low numeracy. When all the other variables in the models are taken into account, women are slightly more likely than men to have higher prose literacy, but men are more likely to have higher numeracy. Age (older or younger than 45) does not have an effect on prose literacy, but younger people (aged 25-44) are more likely to have higher numeracy. The effects of these additional variables in the extended models are statistically significant (apart from the non-effect of age on prose literacy) but some of these effects are quite small compared to the effects of the variables (relating to education, computer use and language) in the basic models.

The differences between prose literacy and numeracy in the effect of first and home language are still evident in the extended models. Also evident is that ethnic group, gender and age have a stronger effect on numeracy scores than on prose literacy scores, and in the case of gender, the effect is in the opposite direction. These differences between prose literacy and numeracy show up in the descriptive analysis of variation in relation to language, age, gender and ethnic identification in later sections.

As noted above, in the model developed by Culligan et al. (2004) for estimating low literacy on the basis of the IALS results, the strongest predictor after education was ethnicity, but they noted that this could be confounded with language proficiency, and the Census data they were using did not provide data on language proficiency, particularly in English. Knowledge of English is clearly relevant to analysing the results of literacy and numeracy tests carried out in English.

In the extended models based on the ALL data in this report, because the ALL questionnaire included the questions on first and main home languages, it has been possible to some extent to separate the effects of ethnic identification and English language proficiency, and find that the effect of not having English as a first language (which applied to a majority of people with Pasifika and Asian ethnic identification) was greater than the effect of having English as a first language but having Māori or Pasifika ethnic identification. Both kinds of effects are substantial, and are apparent even when some control for variation in socioeconomic status is provided by including the New Zealand Deprivation Index in the model. If first language (or main home language) were left out of the models, then ethnic identifications would appear to be particularly powerful predictors of literacy and numeracy because they would incorporate both the language effects and the non-language ethnic effects.

1.6 Structure of this report

The next five chapters explore the relationships between prose literacy and numeracy and a number of key variables, in a way which is guided by the statistical modelling. Chapter 2 considers the extent to which prose literacy and numeracy are associated with the level of education completed, and with recent formal or non-formal study. Chapter 3 explores the associations with labour force status and computer use at work and at home, while Chapter 4 explores in more depth the relationships between computer use, literacy and numeracy activities at work and at home, and literacy and numeracy skills. Chapter 5 deals with the associations of prose literacy and numeracy with occupation, industry and income. Chapter 6 outlines the associations with first language and main home language, birthplace and ethnic identification.

Chapter 7 contains some observations on the relationships between prose literacy and numeracy and demographic factors, namely age and gender. Chapter 8 provides a descriptive approach to analysing the combined effects of education, computer use and language.

Chapter 9 attempts to crystallise the overall picture, and Chapter 10 and Appendix A provide further in-depth and technical information on the variables and methods used in this study.

2 EDUCATIONAL FACTORS

Education is a key factor associated with adult literacy and numeracy. In general, literacy and numeracy scores tend to be better the higher the level of educational attainment.

However, education is not the only factor strongly associated with literacy and numeracy. There are significant groups of people whose literacy and numeracy skills do not match their educational attainment, either because they have low skills in spite of high attainment, or high skills in spite of low attainment (Smyth and Lane, 2009). Later chapters will elucidate the relationships between literacy and numeracy and computer use and other employment-related factors, between literacy and numeracy and language factors, and between literacy and numeracy and demographic factors.

2.1 Level of education completed

Survey respondents were asked to state the highest level of education they had completed. There is some ambiguity here because it is possible to complete a level without attaining a qualification appropriate to that level. This is an issue particularly with the school levels (Year 10, 11, 12 and 13).

Highest level of education completed, prose literacy and numeracy

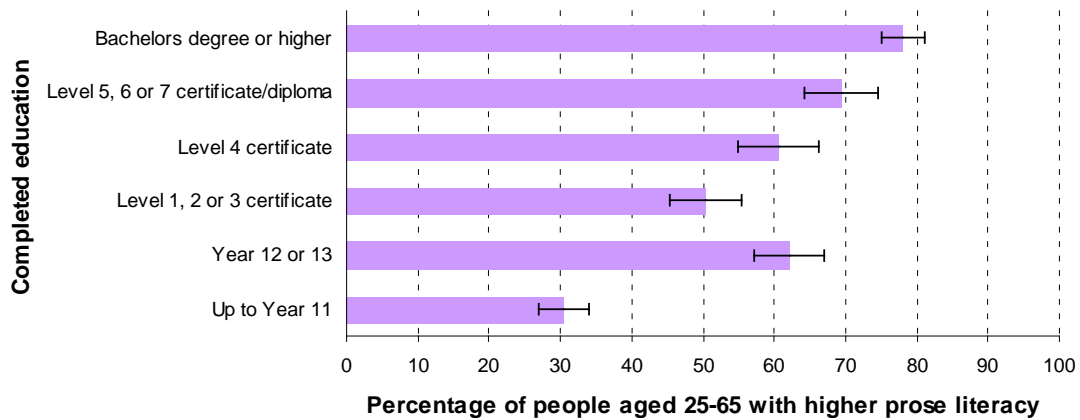
Figures 1 and 2 show the percentage of people aged 25-65 with higher prose literacy or numeracy (levels 3, 4 and 5) according to the highest level of education completed, using a detailed breakdown of education levels.

For those whose highest completed level was at school, the percentage with higher prose literacy or numeracy was considerably smaller among those who had only completed Year 11 or less than among those who had completed Year 12 or 13.

For people who had completed post-school education programmes, the percentage with higher prose literacy or numeracy increased with the level of study. In the case of prose literacy, the percentage was smaller among those who had completed level 1 to 3 certificates (who may not have completed Year 12 or 13 at school) than among those who had completed Year 12 or 13. The percentage with higher prose literacy or numeracy among people who had completed a bachelors or postgraduate degree was significantly greater than among those who had completed lower level programmes. This advantage for degree-holders was greater in the case of numeracy than for prose literacy.

Figure 1

Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by level of education completed

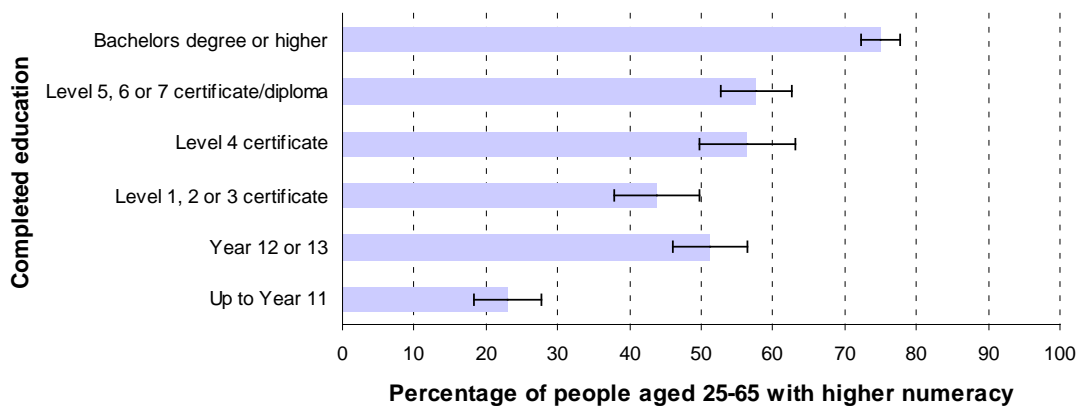


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 2

Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by level of education completed

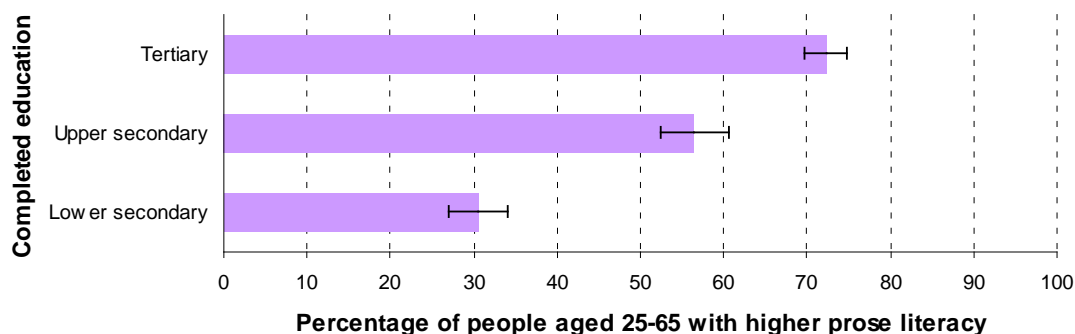


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figures 3 and 4 illustrate the variation in prose literacy and numeracy according to education level using aggregated educational categories. There were significant differences between these aggregated categories in the percentage of people with higher prose literacy or numeracy, and these figures help to make it clear that the greatest difference in percentages was between lower secondary (up to Year 11) and upper secondary (Year 12-13 or Level 1 to 3 certificates).

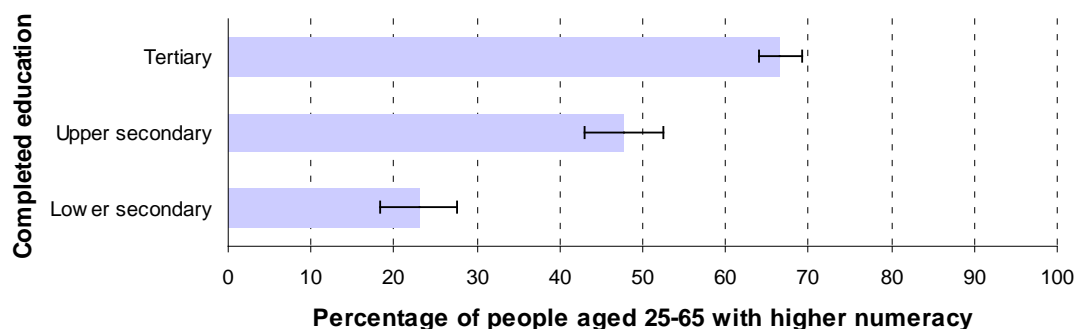
Figure 3
Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by aggregated level of education completed



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 4
Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by aggregated level of education completed



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

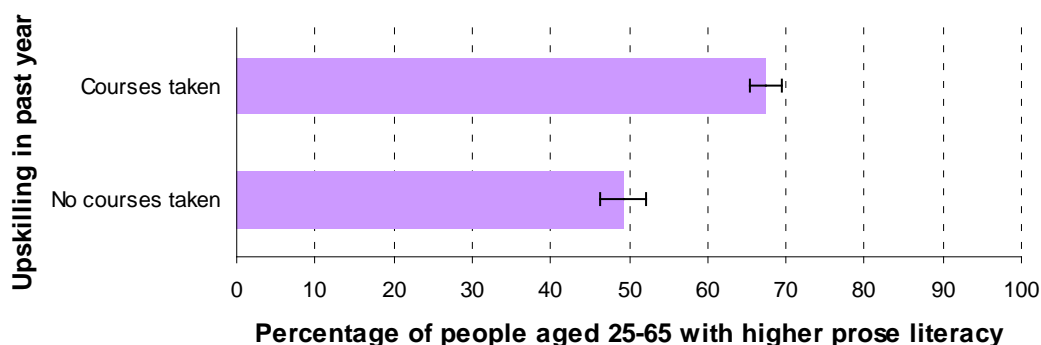
Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

2.2 Formal and non-formal upskilling

Upskilling refers to further education or training, including on-the-job training. Survey respondents were asked if they had undertaken any courses of study in the past year. Formal upskilling encompasses courses taken as part of a programme of study leading to a qualification, while non-formal upskilling here refers to courses which were taken but did not count towards a qualification. Figures 5 and 6 aggregate formal and non-formal upskilling and show the percentages of people aged 25-65 with higher prose literacy and numeracy according to whether they took formal or non-formal courses in the past year. There were significantly greater percentages of people with higher literacy or numeracy among those who had taken courses in the past year.

Figure 5

Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by formal or non-formal upskilling in the past year

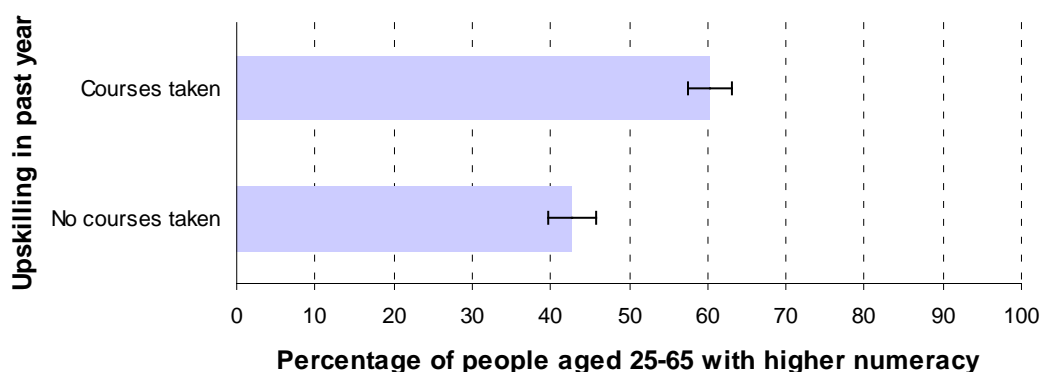


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 6

Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by formal or non-formal upskilling in the past year



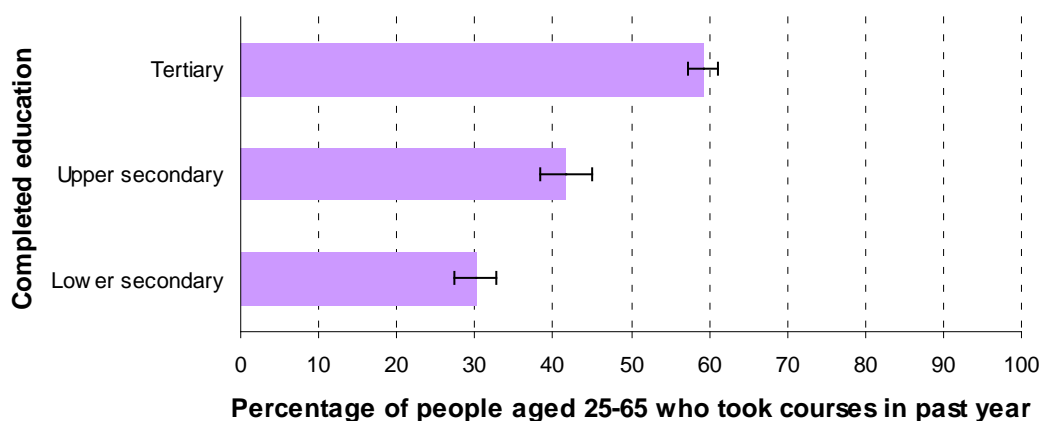
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 7 shows the percentage of people who had taken courses in the past year according to their levels of completed education. The differences between people who had completed lower secondary, upper secondary and tertiary education were significant, and clearly those who had completed higher levels of education were more likely to have undertaken formal or non-formal upskilling in the past year.

Figure 7

Percentage of people aged 25-65 upskilling in the past year by level of completed education



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Given the association of upskilling with completed education, one may wonder if the greater percentage of people with higher prose literacy or numeracy among those who had taken courses in the past year merely reflects the over-representation of the better educated among those taking courses. This turns out not to be the whole story, as indicated in Figures 8 and 9.

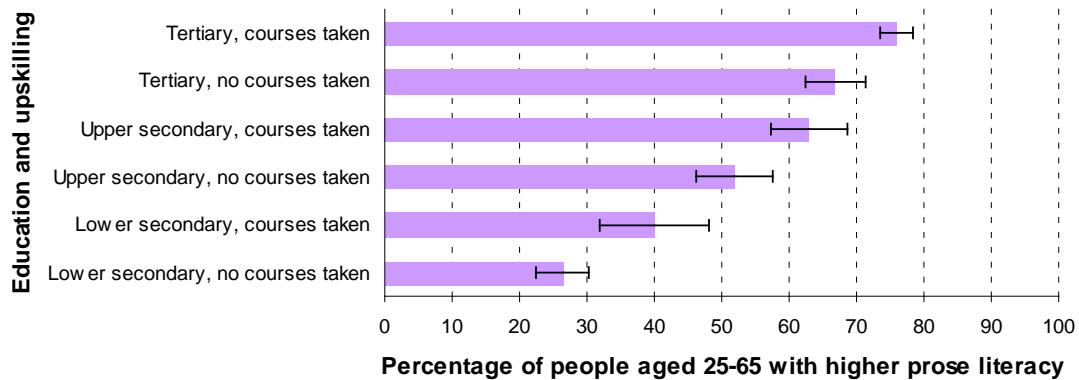
At each level of completed education, the percentage with higher prose literacy or numeracy was greater among those who took courses in the past year than among those who did not. For prose literacy, these differences were significant at all levels of completed education, while for numeracy the difference was only significant for those who had completed tertiary education.

People who had completed tertiary education and had taken courses in the past year were significantly more likely than all others to have both higher prose literacy and higher numeracy. People with lower secondary education who had not taken courses in the past year were significantly less likely to have higher prose literacy or higher numeracy than all others. People with lower secondary education who had taken courses were still significantly less likely to have higher numeracy than those with higher completed education.

Among people with lower or upper secondary education who had taken courses in the past year, the percentage with higher prose literacy was comparable with the percentage among those at the next highest level of completed education who had not taken courses. Similarly, among those with upper secondary education who had taken courses in the past year, the percentage with higher numeracy was comparable with tertiary-educated people who had not taken courses.

Figure 8

Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by completed education and upskilling in the past year

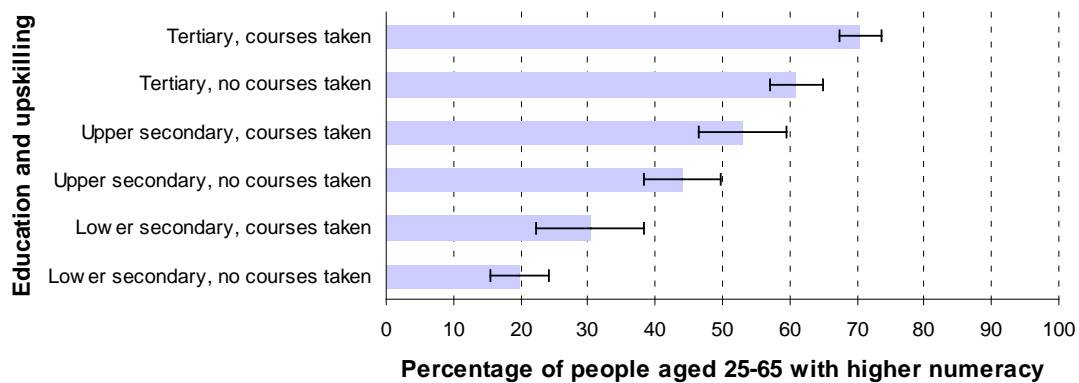


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 9

Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by completed education and upskilling in the past year



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

The associations between upskilling and prose literacy and numeracy could be due to courses providing a boost to people’s literacy and numeracy skills. On the other hand, it could be a selection effect, with people who have higher literacy and numeracy skills being more likely to take courses. In fact, the most appropriate interpretation is probably to consider that both the selection and the booster effects could be in play at the same time, since cross-sectional survey data does not provide evidence either way.

2.3 Summary

Education, literacy and numeracy

There was a strong association between level of education completed and the percentage of people with higher prose literacy or numeracy. People whose highest completed level was lower secondary (Year 11 or less) were much less likely to have higher prose literacy or numeracy (i.e. more likely to have low prose literacy or numeracy) compared with people who had completed upper secondary or tertiary education. People who had completed bachelors or postgraduate degrees were much more likely than those who had not to have higher prose literacy and especially higher numeracy.

Formal and non-formal upskilling

At every level of completed education, people who had completed formal or non-formal courses in the past year were more likely to have higher prose literacy and higher numeracy than people who had not taken courses. Given that people with higher levels of completed education were more likely to take courses, formal and non-formal upskilling effectively compounds the effect of completed education. At the other extreme, people with lower secondary education were less likely to take courses, and the combined effect is a low likelihood of having higher prose literacy and numeracy.

3 LABOUR FORCE STATUS AND COMPUTER USE

Use of a computer at work and computer use at home are both strong predictors of higher prose literacy and numeracy in the statistical models. Use of a computer at work is clearly dependent on being employed. Because computer use and employment are intertwined in this way, the two areas are explored together here. Accordingly, this chapter covers labour force status, work computer use and home computer use in terms of how these variables relate to higher prose literacy and numeracy.

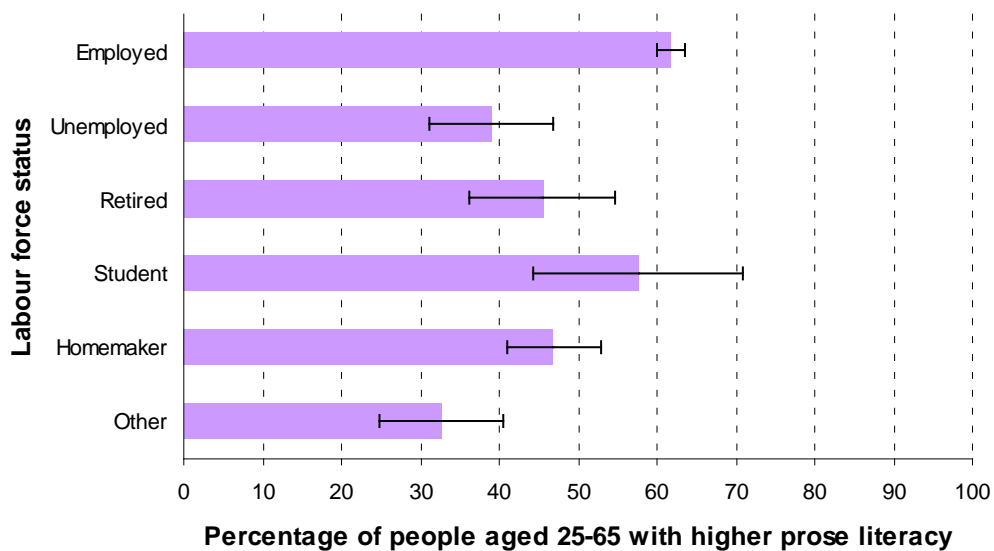
3.1 Labour force status

Labour force status, prose literacy and numeracy

Respondents were asked about their labour force status at the time of the survey. The percentage of people aged 25-65 with higher English prose literacy and higher numeracy (where higher means levels 3 to 5) in each category of current labour force status is displayed in Figures 10 and 11.

Figure 10

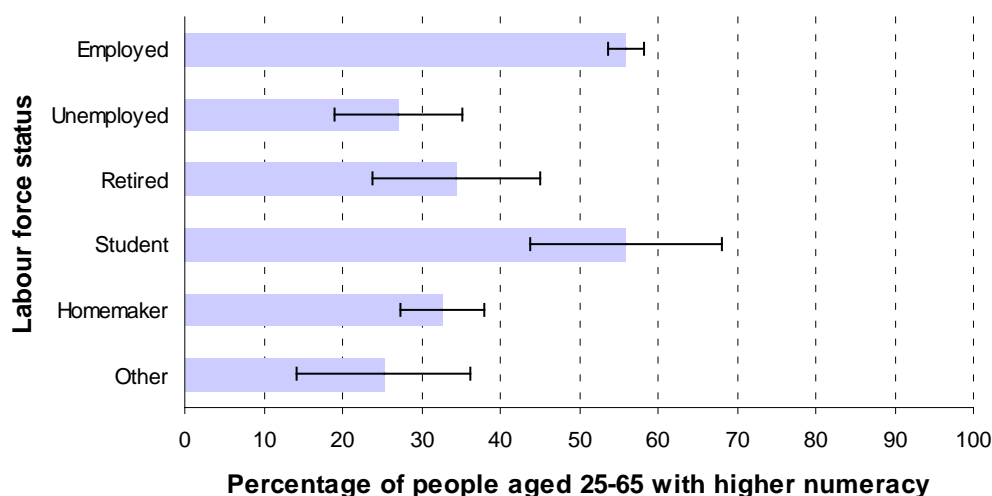
Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by current labour force status



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 11
Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by current labour force status



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Note: The estimate for the 'Other' category is of marginal reliability.

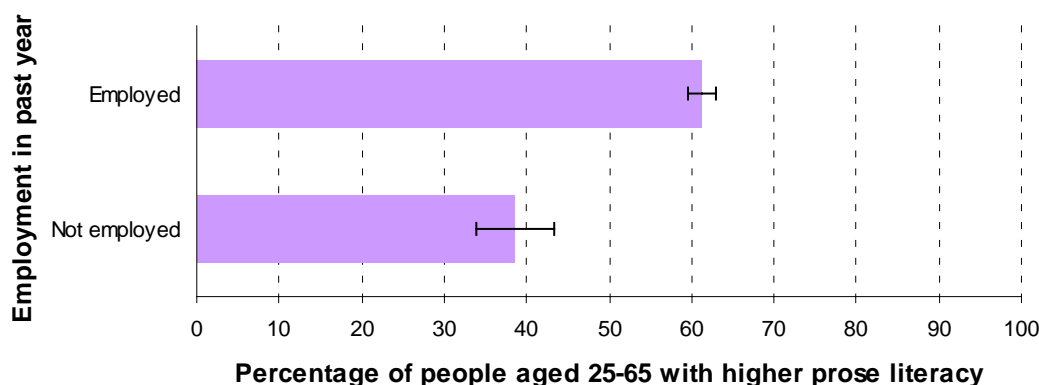
The two groups which had the greatest percentage of people with higher prose literacy and higher numeracy were the employed and students. The margin of error for students is large because there were few people 25 or over in the sample whose main labour force status was 'student', just as the margin of error for the retired is large because there were relatively few retired people 65 or under. The percentage of people with higher prose literacy and higher numeracy was significantly greater for employed people than for people who were not employed, apart from students.

Employment in past year, prose literacy and numeracy

Respondents were also asked if they had been employed in the past year or not. Some people who were not employed at the time of the interview had been employed during the previous year and hence count as part of the employed group on the basis of this question (see Chapter 10 for more detail). Figures 12 and 13 show the percentage of people with higher prose literacy and higher numeracy among those who were or were not employed in the past year. Clearly people who had been employed during the past year were significantly more likely to have higher prose literacy or numeracy than those who had not been employed.

Figure 12

Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by employment in past year

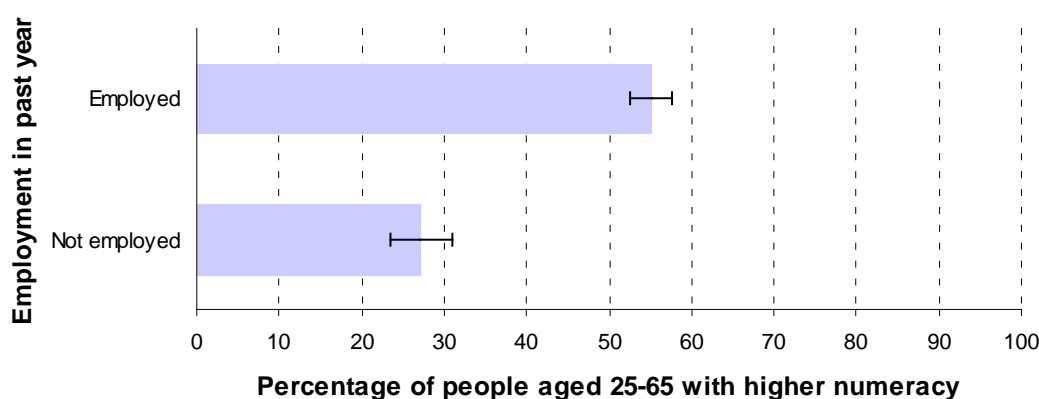


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 13

Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by employment in past year



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

3.2 Computer use

The ALL survey included a question about use of a computer at work and questions about access to and use of a computer at home. Because the question about computer use at work could only be asked of those who had been employed, this variable cannot be completely separated from that of labour force status and hence is dealt with in conjunction with the effects of labour force status.

Both use of a computer at work and at home are significant predictors of higher prose literacy and numeracy in the statistical models, after controlling for level of education completed, first language and main home language (and in the extended models, for other factors as well). Because the relationship between computer use and literacy or numeracy is probably not as obvious as those involving education and language, this report goes into that relationship in some depth in order to clarify what is behind the statistical results: see Chapter 4.

Computer use at work

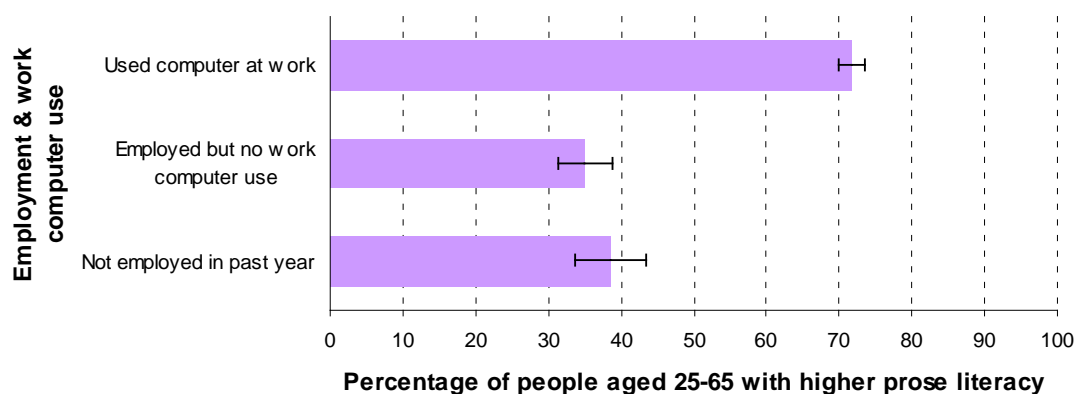
The survey question was only addressed to those who had ever used a computer and had been employed in the previous year, and asked “In the last 12 months, did you use a computer in your job?”⁵

Computer use at work, prose literacy and numeracy

Figures 14 and 15 indicate that those who had been employed in the past year and had used a computer at work were much more likely to have higher prose literacy or numeracy than those who were not employed, or those who were employed but did not use a work computer. In fact, the percentage with higher prose literacy and numeracy was comparable for the latter two groups.

Figure 14

Percentage of all people aged 25-65 with higher prose literacy (Levels 3-5) by employment and computer use at work

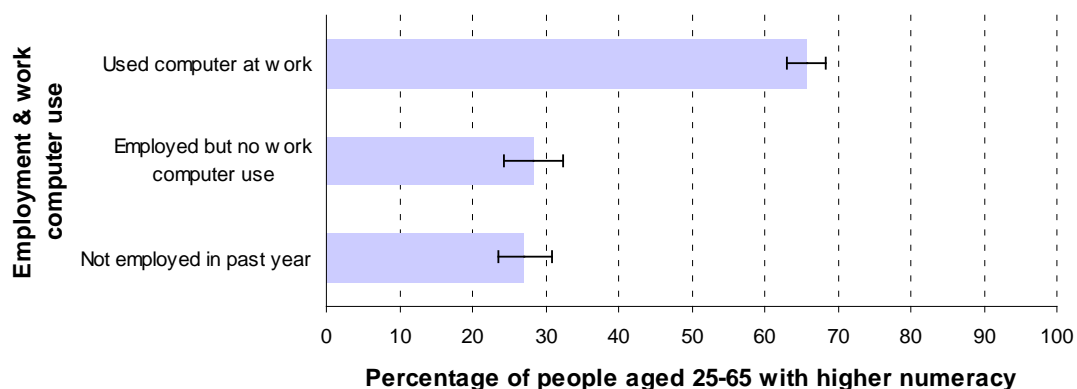


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 15

Percentage of all people aged 25-65 with higher numeracy (Levels 3-5) by employment and computer use at work



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

⁵ It is not possible to explore work computer use in further detail. The survey did not include such questions as to what extent or for what purposes people used computers at work.

Computer use at home

The initial survey question on this topic was addressed to those who had ever used a computer, and who also had access to a computer at home, and asked “In a typical month, how many hours did you use a computer at home?” To make sure that people actually used their home computers, home computer use was defined as using a home computer 5 or more hours per month (see Chapter 10 for more discussion of this variable).

Home computer use, prose literacy and numeracy

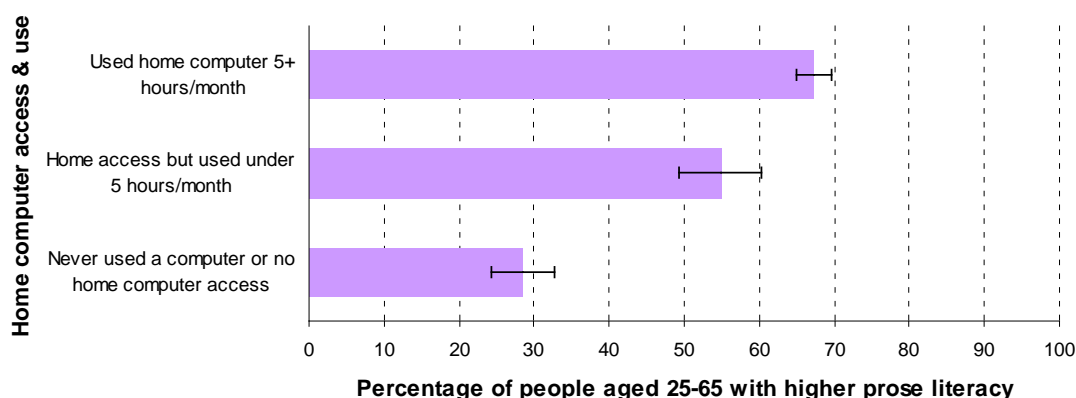
Statistics Canada and OECD (2005, p.184), summarising results from six countries which administered the ALL survey in 2003, and referring to people with home computer access as ‘computer users’, reported that

A comparison of computer users and non-users reveals a literacy gap in all countries. ... users consistently score higher on average by approximately 50 or more points.

Similarly, in the New Zealand ALL data, there was a large difference in the percentage of people aged 25-65 with higher prose literacy or numeracy, according to whether or not they had access to a computer at home, and whether they used the computer for 5 or more hours per month, as shown in Figures 16 and 17.

Figure 16

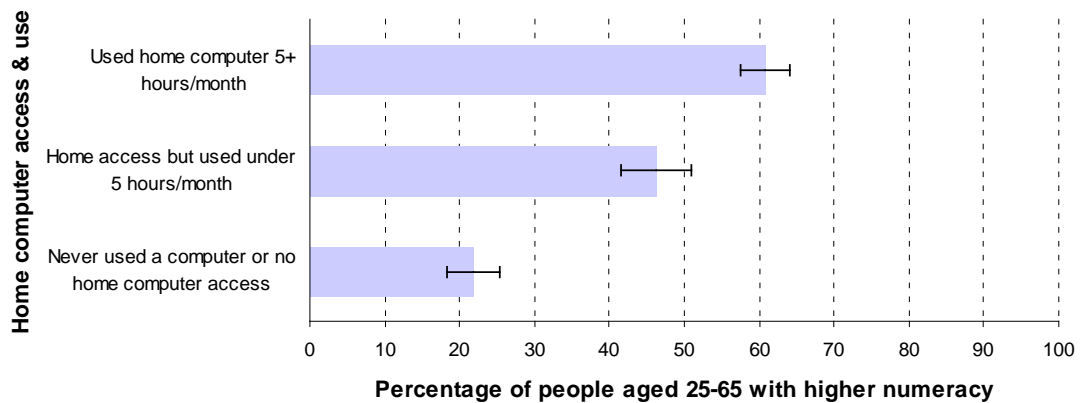
Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by computer access and use at home



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 17
Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by computer access and use at home



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

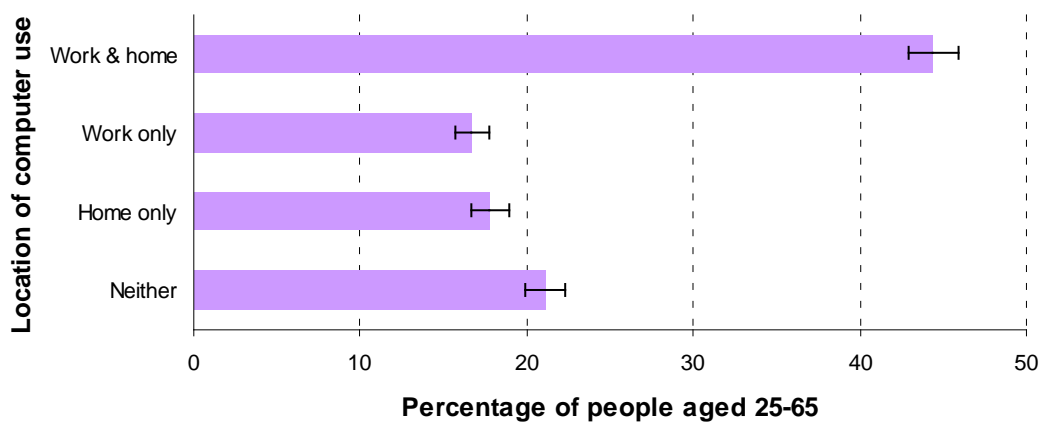
Combined effects of computer use at work and at home

Does home computer use make a difference only for those who do not use a computer at work, or does it also make a difference to those who use a computer at work? If we look at computer use at work and at home together, there are four possible combinations of computer use (where home computer use is defined as using a home computer for 5 or more hours per month): a person may

- use a computer at work as well as using a computer at home
- use a computer at work but not use a computer at home
- use a computer at home but not use a computer at work
- not use a computer at work or at home

The estimated percentages of people aged 25-65 in these four situations are displayed in Figure 18.

Figure 18
Percentage of people aged 25-65 with different combinations of work and home computer use



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

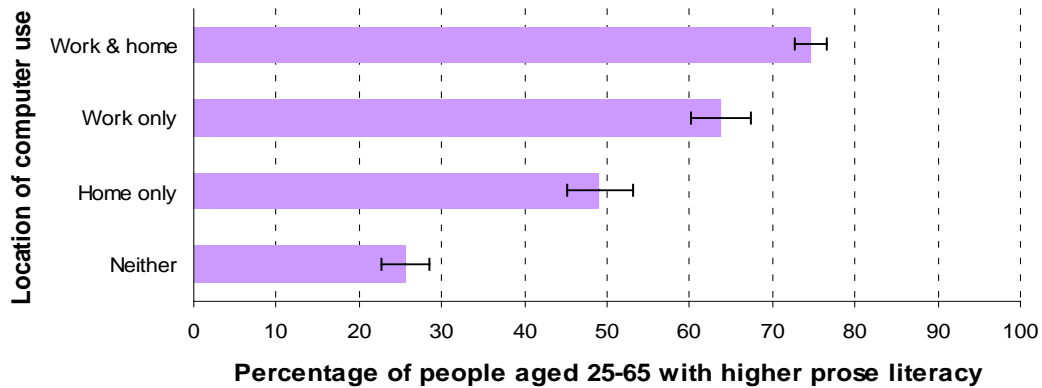
Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Work and home computer use, prose literacy and numeracy

Figures 19 and 20 show the percentage of people aged 25-65 with higher prose literacy and numeracy for each of the four different combinations of work and home computer use.

Figure 19

Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by work and home computer use

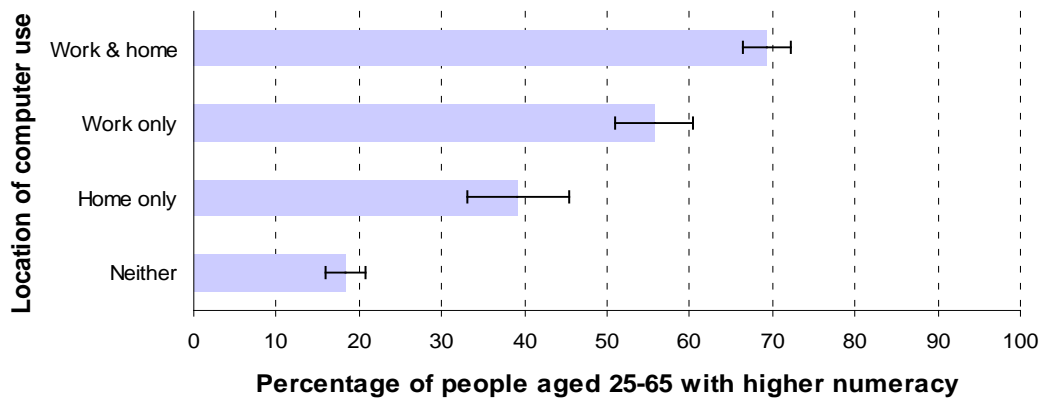


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 20

Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by work and home computer use



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

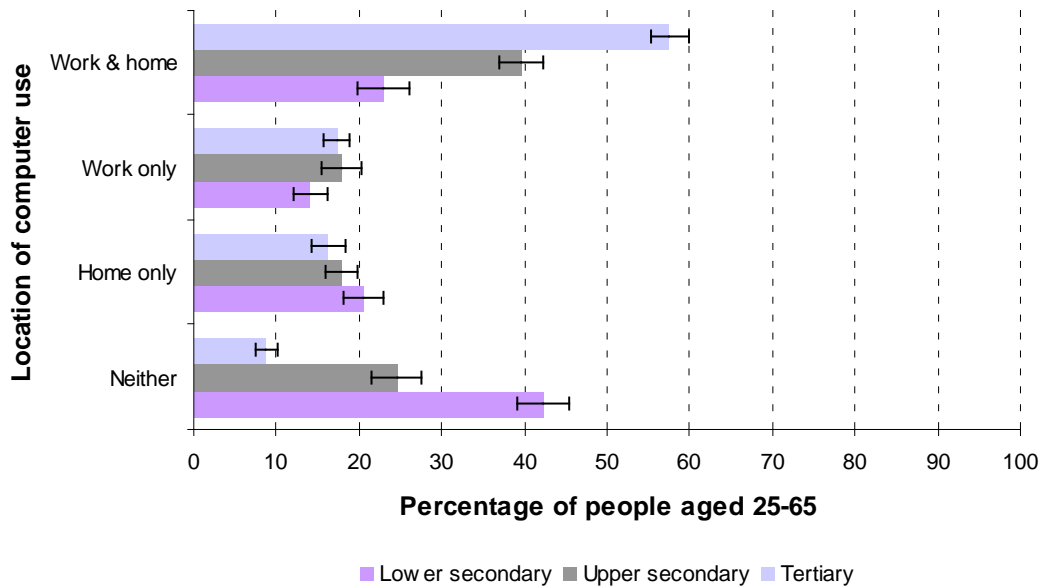
Clearly home computer use made a big difference even for people who also used a computer at work. Those using a computer both at work and at home were much more likely to have higher prose literacy or numeracy than those using a computer at work but not at home, who in turn were more likely to have higher prose literacy and numeracy than those who did not use a computer in either location.

Computer use and education

For the prose literacy and numeracy scores, and for personal reading activities, the combinations of work and home computer use form a four-step scale consisting of no computer use, use at home, use at work, and use in both locations (work and home). This four-step scale is used to explore the relationship between computer use and the level of education completed in Figure 21.

Those with tertiary qualifications almost all used a computer in at least one location, and a majority (58 per cent) used a computer in both locations. But for people with lower levels of education, there was less predictability about computer use; in particular, people whose highest completed education was lower secondary (Year 11 or less) were approximately as likely to use a computer in one location as to not use a computer in either location. It may be the case that computer use is a more important factor relating to literacy and numeracy among people with lower educational attainment than among people with higher educational attainment.

Figure 21
Locations of computer use by completed education for people aged 25-65



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

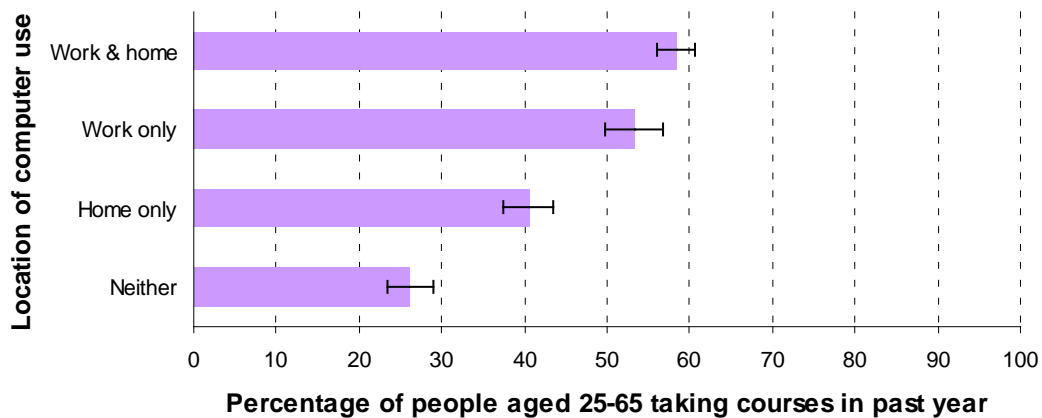
Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Computer use and upskilling

The combination of computer use at work and at home also shows a strong association with formal and non-formal upskilling. Figure 22 shows the variation in the percentage of people aged 25-65 who took formal or non-formal courses in the past year according to the combination of work and home computer use. Those who used a computer both at work and at home, or who had used a computer at work, were significantly more likely to have taken courses than those who used a computer at home but not at work, and these people were significantly more likely to have taken courses than people who did not use a computer at home or at work.

Figure 22

Percentage of people aged 25-65 taking formal or non-formal courses in the past year, by computer use at work and home



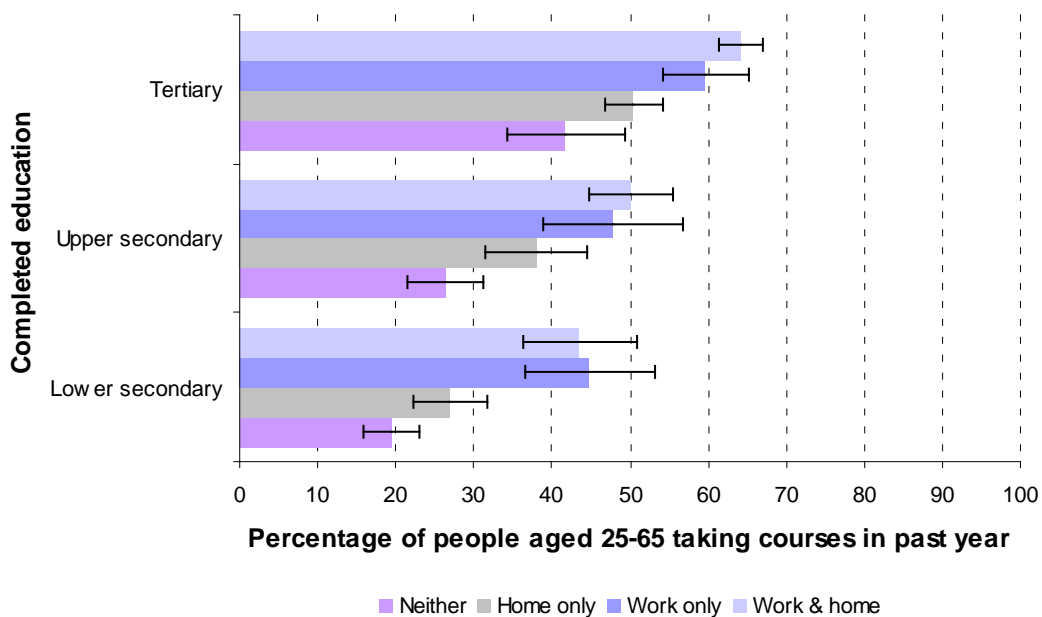
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

The association between computer use and upskilling is not confined to people with better education. Among those with lower secondary education (or less), and among those with upper secondary education (Year 12-13 or certificate levels 1-3), as well as among those with tertiary education, people who used a computer at work or both at work and at home were significantly more likely to have taken courses than those who did not use a computer in either location, as shown in Figure 23. Similarly, those who used a computer at work and at home were significantly more likely to take courses than those who used a computer only at home, for all levels of education. In fact, computer use, especially at work, made more of a difference for those with lower or upper secondary education than for those with tertiary education.

Figure 23

Formal and non-formal upskilling by completed education and location of computer use for people aged 25-65



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

3.3 Summary

Current labour force status

Among people aged 25-65, those who were employed and students were most likely to have higher prose literacy and higher numeracy, although there were very few people whose main labour force status was 'student' in this age range.

People who had been employed in the past year were significantly more likely to have higher prose literacy and numeracy than people who had not, although the advantage of being employed was confined mainly to people who had used a computer at work.

Computer use

See Chapter 4 for a more detailed coverage of the relationship between computer use and literacy or numeracy.

Computer use at work

Both work and home computer use are significant predictors of higher prose literacy and numeracy (after controlling for other factors).

People aged 25-65 who had been employed and used a computer at work in the past year were significantly more likely to have higher literacy and numeracy compared with people who had not been employed or who had been employed and not used a computer at work.

Home computer use

People aged 25-65 who used a computer at home for 5 or more hours per month were significantly more likely to have higher literacy and numeracy compared with people who did not.

Combined effect of work and home computer use

Work and home computer use were moderately correlated but had separate and cumulative effects on prose literacy and numeracy.

People aged 25-65 who used a computer at work and at home were significantly more likely to have higher literacy and numeracy than people who used a computer only at work, who were significantly more likely to have higher literacy and numeracy than those who used a computer only at home, and in turn these people were significantly more likely to have higher literacy and numeracy than people who did not use a computer at work or at home.

Computer use both at work and at home was significantly greater among tertiary-qualified people (58 per cent), while use in neither location was significantly greater among those without tertiary qualifications.

Those who had used a computer at work were significantly more likely to have taken formal or non-formal courses in the past year than those who had used a computer at home but not at work, and these people were significantly more likely to have taken courses than people who did not use a computer at home or at work.

The association between computer use and upskilling held across all levels of completed education, but was particularly strong for people with lower or upper secondary education but not tertiary.

Adding formal and non-formal upskilling to the statistical models does not substantially improve the explanatory power of the models. The positive effect of upskilling on prose

literacy and numeracy appears to be covered by the completed education and computer use variables.

Variables associated with higher or lower literacy and numeracy

To summarise, the following variables were associated with greater percentages of people aged 25-65 having **higher** prose literacy and numeracy (Levels 3, 4 and 5):

- Labour force status of employed or student
- Being employed and using a computer at work
- Using a computer at home
- Especially, the combination of using a computer at work AND at home

Conversely, the following variables were associated with smaller percentages of people aged 25-65 having higher prose literacy and numeracy, that is, with a greater percentage of people having **low** prose literacy and numeracy (Levels 1 and 2):

- Labour force status of unemployed, retired, homemaker or other
- Being employed but not using a computer at work
- Not using a computer at home
- Especially, the combination of not using a computer at work AND not using a computer at home

The strong relationships between work and home computer use and prose literacy and numeracy require further explanation, and accordingly the next chapter explores this issue in greater depth.

4 COMPUTER USE, LITERACY AND NUMERACY

This chapter explores in some detail the relationships between literacy and numeracy on the one hand and computer use on the other, in order to clarify why computer use is such a strong predictor of literacy and numeracy in the statistical models.

Statistics Canada and OECD (2005) note strong associations between literacy and numeracy and use of information and communications technology, and summarise some of the reasons which have been put forward in the research literature for the association between literacy skills and ICT use (p.184):

... ICT use is linked to literacy skills in a number of ways. Some studies suggest that literacy skills are essential to the development of ICT literacy ... While ICT skills may depend on technological proficiency to a certain extent, it [*sic*] also requires cognitive skills, such as those underlying literacy, numeracy and problem solving, which are critical for using ICTs effectively ... Most ICT content, notably the Internet, remains text-based ..., and the format and content of web pages often demand skills similar in nature to those assessed by the document literacy domain in ALL, namely unstructured and non-continuous texts such as tables and documents. In general, literacy is becoming increasingly important as more information is transmitted and shared through ICTs than ever before ...

This chapter takes a somewhat different angle, using data from the ALL survey to analyse the relationships between computer use, jobs, and literacy and numeracy activities at work and at home.

4.1 Work computer use

Why does having used a computer at work make such a difference to literacy and numeracy?

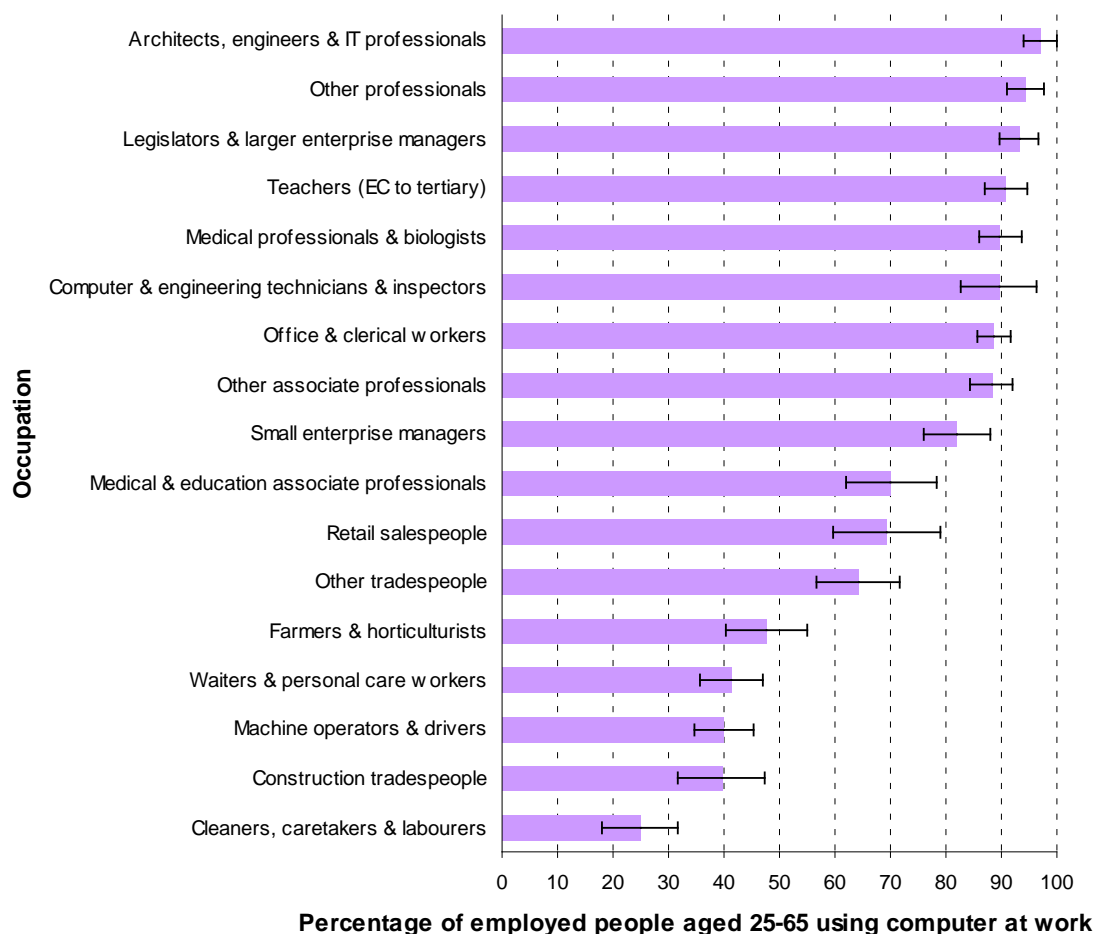
Work computer use and occupation

A partial answer is that use of a computer at work is particularly associated with occupations that can be expected to require or foster higher literacy and numeracy. Figure 24 shows the extent of computer use at work among people in different detailed occupational categories⁶. The occupations are ranked according to the percentage in each occupational category who used a computer at work.

⁶ 'Other professionals' includes accountants and other business professionals, lawyers, librarians, social workers, journalists, artists and priests; 'Medical and education associate professionals' includes laboratory technicians, physiotherapists, speech therapists and teacher aides; 'Other associate professionals' includes sales representatives, real estate agents, law clerks, designers, performers and athletes; 'Farmers and horticulturists' also includes foresters, hunters and fishers; 'Construction tradespeople' includes builders, carpenters, plumbers, electricians and painters; 'Other tradespeople' includes welders, mechanics, fitters, jewellers, butchers, bakers, cabinet makers and tailors.

Figure 24

Percentage of employed people aged 25-65 who had used a computer at work in the past year, by detailed occupational classification



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

It can be seen from Figure 24 that computer use was spread across all occupational categories. It was virtually a standard feature of managerial, professional, technical and clerical occupations, although not so much in the category ‘Medical and education associate professionals’. Computers were used by a majority of retail salespeople and ‘other’ tradespeople. Even where computers were used by half or less than half the people in an occupational category, the proportion was around 40 to 50 per cent for all but the lowest ranked group. So although there was a connection between occupation and computer use, it was a fairly diffuse one.

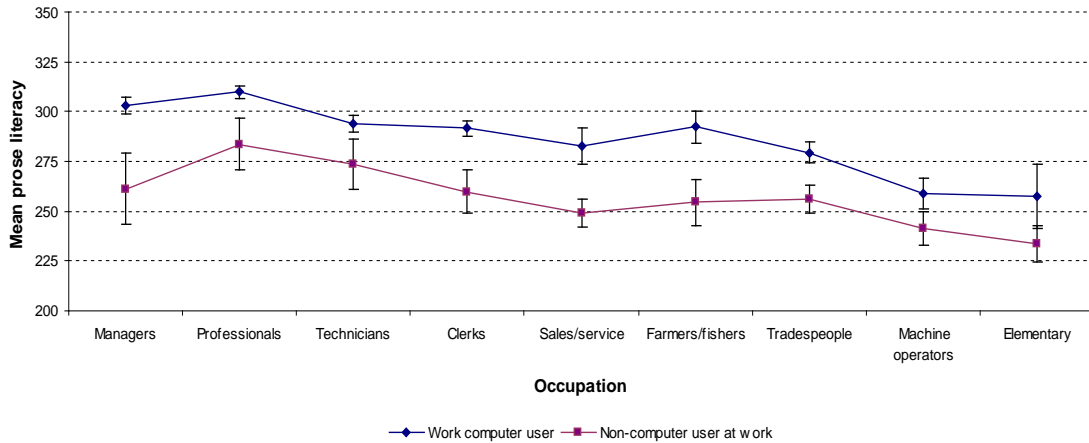
There were considerable differences within occupations between employed people who used a computer at work and those who did not, in both prose literacy and numeracy, as shown in Figures 25 and 26. Computer users had significantly higher mean prose literacy in all occupations except elementary workers, and significantly higher mean numeracy in all occupations other than machine operators and drivers.

For occupations other than machine operators and drivers and elementary workers, the mean prose literacy of work computer users was in Level 3 (275-325), while the mean prose literacy of non-computer users was in Level 2 (225-275) for all occupations except professionals.

For occupations other than machine operators and drivers and elementary workers, the mean numeracy of work computer users was in Level 3 (275-325), while the mean numeracy of non-computer users was in Level 2 (225-275) for all occupations except elementary workers, whose mean numeracy was in Level 1 (less than 225).

Figure 25

Mean English prose literacy by occupation and computer use at work, for people aged 25-65 who were employed in the past year

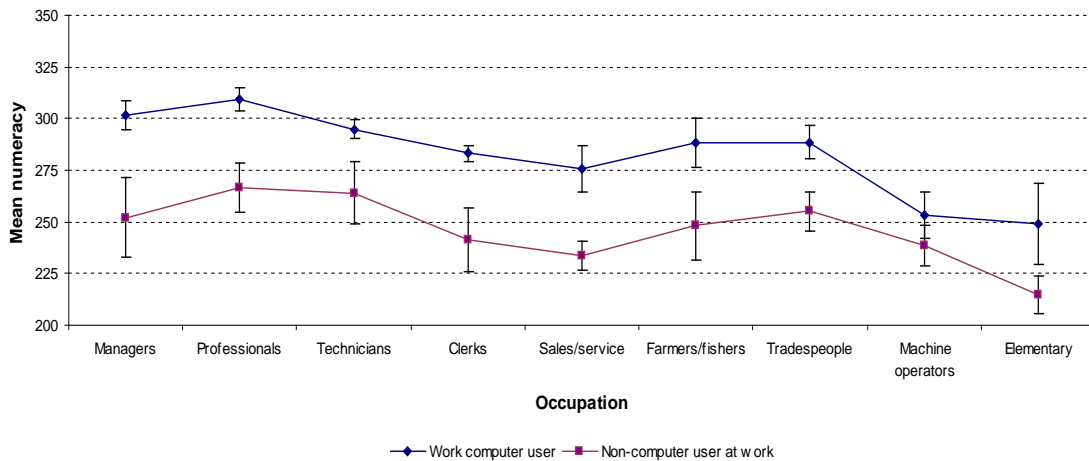


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 26

Mean numeracy by occupation and work computer use, for people aged 25-65 who were employed in the past year



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Thus work computer users were over-represented in the occupational categories which tended to have greater percentages of people with higher prose literacy and numeracy (managers, professionals and technicians: see Chapter 5), while non-computer users were over-represented in the occupations with smaller percentages of people with higher prose literacy and numeracy. In addition there were marked differences in prose literacy and numeracy between computer users and non-users within occupations. This suggests that work computer use may be a somewhat better indicator than occupation of jobs which are occupied by people with higher prose literacy and numeracy.

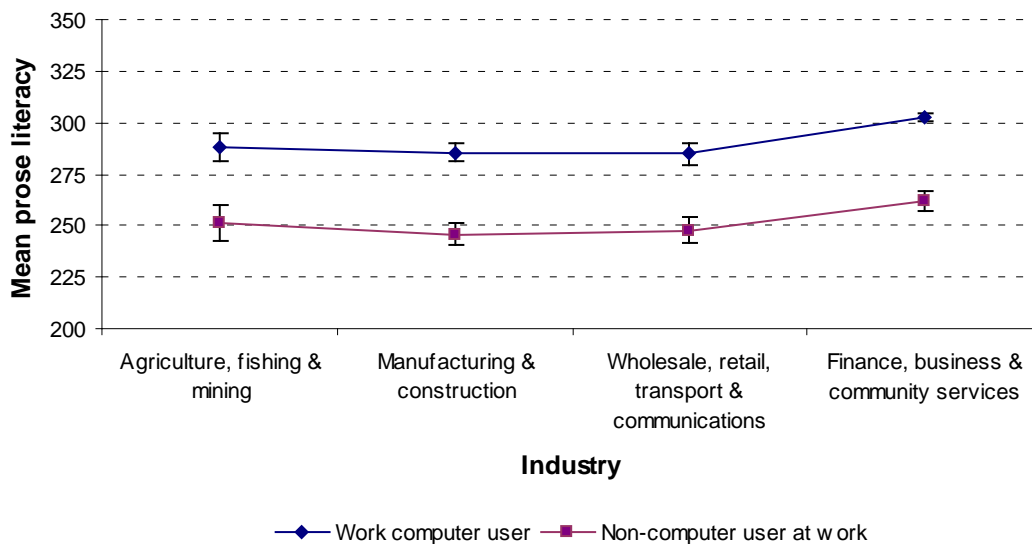
Work computer use and industry

Figures 27 and 28 show the mean prose literacy and numeracy scores for people aged 25-65 who used or did not use a computer at work by industry. The main difference between industries was that the prose literacy mean was significantly higher for computer users in the industry grouping ‘finance, business and community services’ than in the other industry categories, while the numeracy mean for ‘finance, business and community services’ was significantly higher than for ‘manufacturing and construction’ and ‘wholesale, retail, transport and communications’. For non-computer users, those in ‘finance, business and community services’ had a significantly higher mean prose literacy than those in ‘manufacturing and construction’ and in ‘wholesale, retail, transport and communications’, but there were no significant differences among the numeracy means.

However the striking feature of Figures 27 and 28 is that the differences within industries between the means for computer users and non-users were much greater than the differences between industries within the computer use or non-use group. The prose literacy and numeracy means for computer users were all in Level 3 across industries, while the means for non-users were all in Level 2.

Figure 27

Mean prose literacy by industry and work computer use, for people aged 25-65 who were employed in the past year

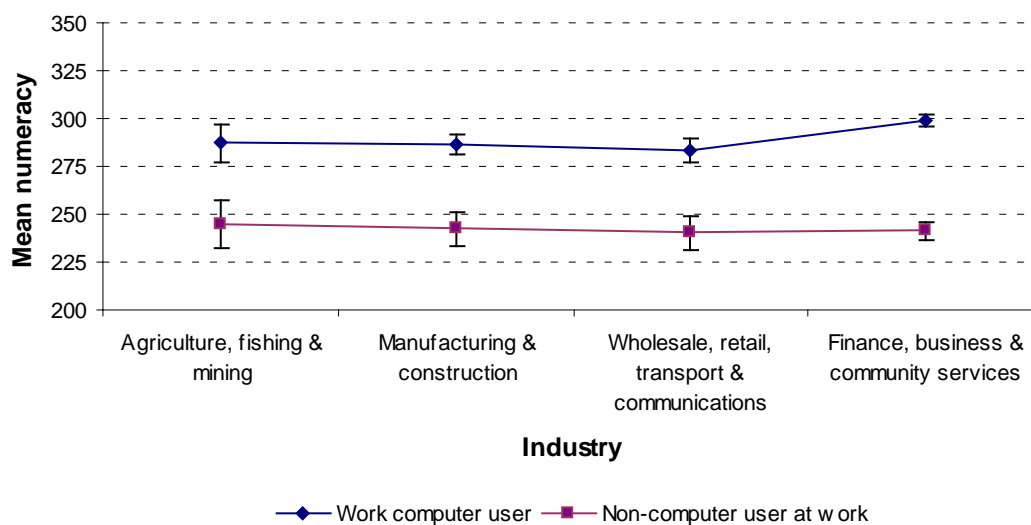


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 28

Mean numeracy by industry and work computer use, for people aged 25-65 who were employed in the past year



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Work computer use and literacy and numeracy activities at work

The diffuseness of the association between computer use and occupational categories suggests that computer use may be related to the literacy and numeracy demands of particular jobs, rather than to the broader occupational categories they fall into. This impression is reinforced by the marked differences between computer users and non-users within occupations and within industries.

The survey included a series of questions (E1 to E3) on reading and writing activities, and activities related to document literacy and numeracy, undertaken at work. The three questions each included a series of sub-questions as shown in Table 2.

Table 2

ALL survey questions on literacy and numeracy activities at work

- E1** The next questions are about your reading, writing and mathematics activities at your main job – whether these activities are done on paper or on computer. How often <do/did> you read or use information from each of the following as part of your main job? Would you say at least once a week, less than once a week, rarely or never.
- Letters, memos or e-mails
 - Reports, articles, magazines or journals
 - Manuals or reference books including catalogues
 - Diagrams or schematics
 - Directions or instructions
 - Bills, invoices, spreadsheets or budget tables
- E2** How often <do/did> you write or fill in each of the following as part of your main job? Would you say at least once a week, less than once a week, rarely or never.
- Letters, memos or e-mails
 - Reports, articles, magazines or journals
 - Manuals or reference books including catalogues
 - Directions or instructions
 - Bills, invoices, spreadsheets or budget tables

- E3** How often <do/did> you do each of the following as part of your main job? Would you say at least once a week, less than once a week, rarely or never.
- a) Measure or estimate the size or weight of objects
 - b) Calculate prices, costs or budgets
 - c) Count or read numbers to keep track or things
 - d) Manage time or prepare timetables
 - e) Give or follow directions or use maps or street directories
 - f) Use statistical data to reach conclusions

Note that questions were only asked of those currently employed or employed in the past year.

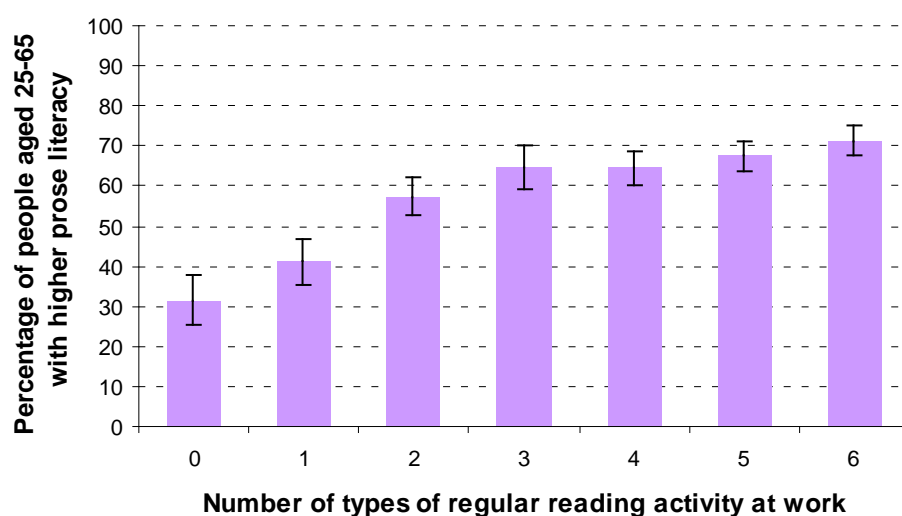
Variables were constructed from the responses to these questions as follows: responses to the sub-questions were simplified as indicating ‘regular’ activity (ie at least weekly) or not, and the number of ‘regular’ responses was totalled for each question. The variables constructed are then:

- number of types of regular reading activities at work (from question E1), with range from 0 to 6
- number of types of regular writing activities at work (from question E2), with range from 0 to 5
- number of types of activity related to document literacy or numeracy (from question E3), with range from 0 to 6

Figures 29 and 30 show how the number of types of regular reading activities at work was related to the extent of higher prose literacy and numeracy. The percentage with higher prose literacy and numeracy increased with the number of types of reading activity up to three, but above three types there was no statistically significant difference in the percentages. For prose literacy there was a large and statistically significant gap between one and two regular activities, while for numeracy the largest gap (also significant) was between no regular reading activities and one or more.

Figure 29

Percentage of people aged 25-65 with higher prose literacy (Levels 3-5), by number of types of regular reading activity at work

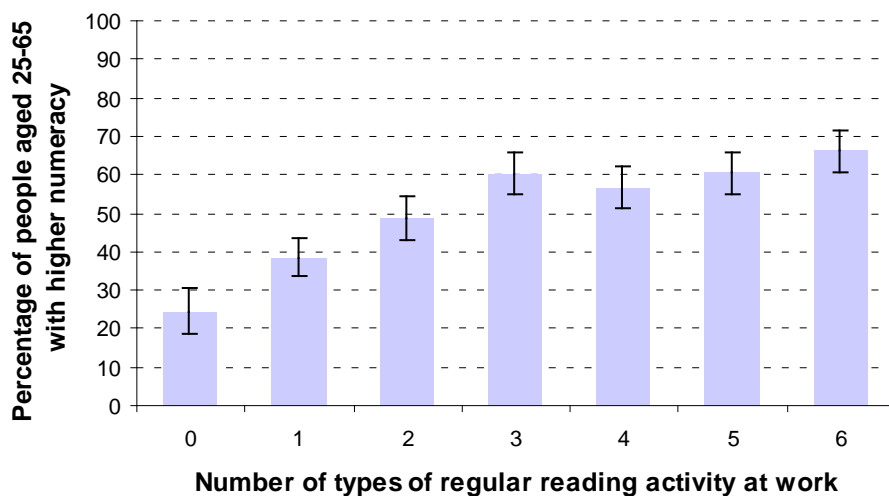


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 30

Percentage of people aged 25-65 with higher numeracy (Levels 3-5), by number of types of regular reading activity at work



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

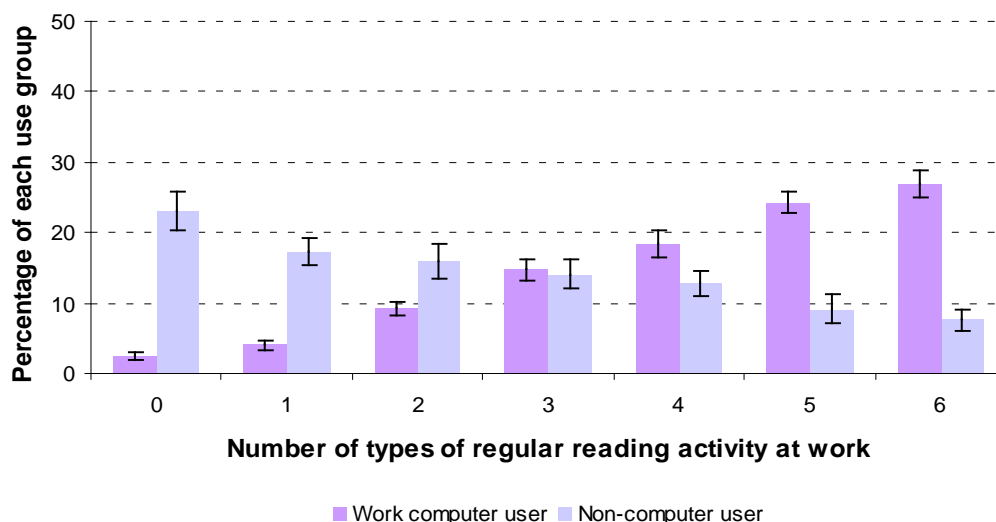
Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 31 shows the comparison (among employed people aged 25-65) between computer users and non-computer users at work, in terms of the number of types of regular reading activity at work. Computer users were significantly more likely to regularly engage in 4-6 types of reading activity, while non-computer users were significantly more likely to regularly engage in only 0-2 types of reading activity. The percentage of computer users engaged in three or more regular reading activities at work is estimated at 84 per cent, while the percentage for non-computer users is 44 per cent.

Thus having used a computer at work is a variable which is indicative of jobs that involve regular (at least weekly) reading of a wide range of types of material (which in turn is associated with an increased chance of having higher prose literacy and numeracy), while not having used a computer at work is indicative of jobs without regular reading requirements or with a narrower range of types of regular reading activity.

This pattern makes sense if we view the computer as the primary literacy and numeracy tool in the modern workplace: people whose work requires regular involvement in literacy and/or numeracy activities are very likely to use a computer in carrying out at least some of those activities.

Figure 31
Number of types of regular reading activity at work by computer use at work



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

When we look at the number of types of regular writing activities at work, the estimated percentage of people with higher prose literacy or numeracy increased with the number of types up to two, but the statistically significant difference was between those who engaged in one or more regular writing activities and those who did not undertake regular writing activities at all.

Computer users were significantly more likely to undertake two or more regular writing activities, while non-computer users were significantly more likely to undertake no regular writing activities or only one. The percentage of computer users engaged in two or more regular writing activities at work is estimated at 75 per cent, while the percentage for non-computer users is 34 per cent.

The relationship between prose literacy and the number of types of activities related to document literacy and numeracy (from question E3) is not as clear cut as it is with reading and writing activities. Nevertheless, there was still a statistically significant difference in the percentage with higher prose literacy between 0-1 regular activity types and 3-6 types. The percentage with higher numeracy increased up to four types of regular activity, although the clearest statistical difference was between no regular activities and two or more type of regular activity.

Work computer users were significantly more likely to engage in 4-6 regular types of activities related to document literacy or numeracy than non-computer users, while non-computer users were significantly more likely to be involved in one type or none. The percentage of computer users engaged in three or more regular activities related to document literacy and numeracy at work is estimated at 68 per cent, while the percentage for non-computer users is 49 per cent.

Thus across reading and writing activities and activities related to document literacy and numeracy, computer users at work were much more likely to be engaged in a wide range of types of activity on a regular basis. For each set of types, the percentage of people with higher prose literacy or numeracy reached a maximum at either two or more or three or more types of regular activity, and the great majority of computer users were in this upper range of types of regular activity, while a majority of non-computer users fell below this threshold, with 0-1 or 0-2 types of regular activity. The overall picture is that people who had used a computer at work

were regularly engaged in a wide range of regular literacy and numeracy related activities, which correlates with being more likely to have a higher prose literacy or numeracy score.

These observations are consistent with the analysis by Statistics Canada and OECD (2005, p.141) of the results from six countries which carried the ALL survey in 2003: they reported that literacy and numeracy scores increased with increasing engagement in literacy and numeracy practices at work, using an index of engagement which was standardised for education and language.

4.2 Use of a computer at home

Home computer use has a separate but similar effect in the statistical models to use of a computer at work.

Can home computer use be related to literacy or numeracy activities in a similar way to use of a computer at work?

Some information on this question can be obtained from survey question G3, which asks about personal reading habits, that is, reading which is not done for work or study purposes. (There were no comparable questions on personal writing or activities related to document literacy or numeracy.) Question G3 has four sub-questions as shown in Table 3.

Table 3

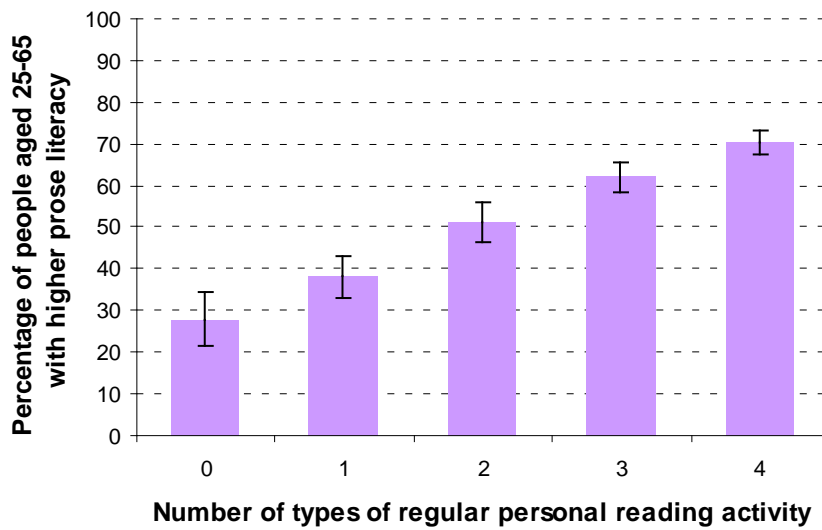
ALL survey question on personal reading activities

- G3** How often do you read or use information from each of the following sources as part of your daily life? Please don't include time spent as part of your job or schooling. Would you say at least once a week, less than once a week, rarely or never.
- a) How often do you read or use information from newspapers?
 - b) How often do you read or use information from magazines or articles?
 - c) How often do you read or use information from books – fiction or non-fiction?
 - d) How often do you read or use information from letters, notes, e-mails?

As with literacy and numeracy related activities at work, we can construct a scale of the number of types of personal reading activity done on a regular basis, i.e. at least weekly. Figures 32 and 33 show the relationships between this scale and higher prose literacy and numeracy.

Figure 32

Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by number of types of regular personal reading

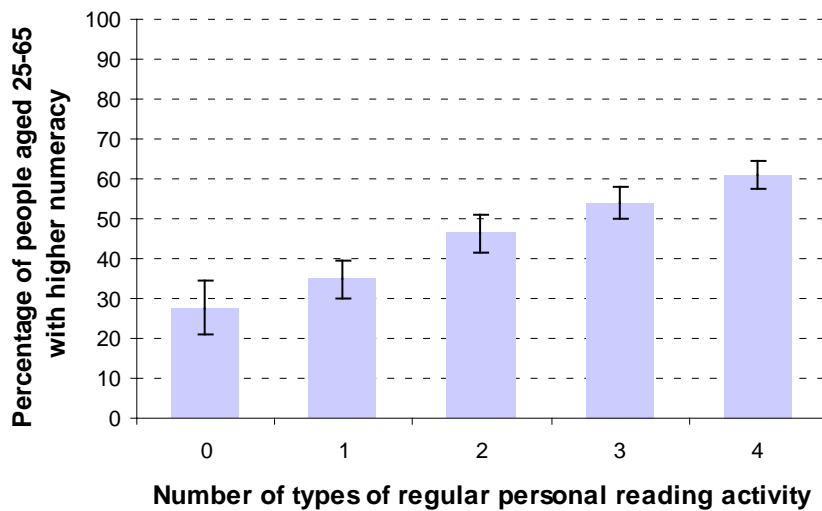


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 33

Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by number of types of regular personal reading



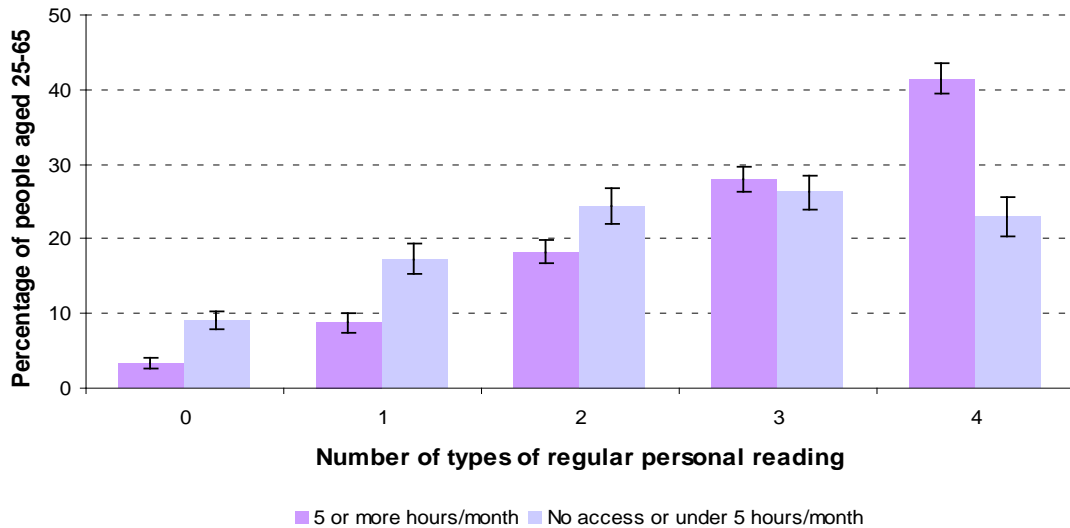
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

There was a remarkably consistent relationship between the number of types of regular personal reading and the percentage of people with higher prose literacy or numeracy. For prose literacy there was a statistically significant difference between all the steps on the scale except between no types of regular personal reading and one type. For numeracy there was a statistically significant difference between any pair of steps separated by two or more types of regular personal reading.

Figure 34 shows the comparison between those who used a home computer for 5 or more hours per month and those who did not in terms of the number of types of regular personal reading.

Figure 34
Number of types of regular personal reading activities, by home computer use



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

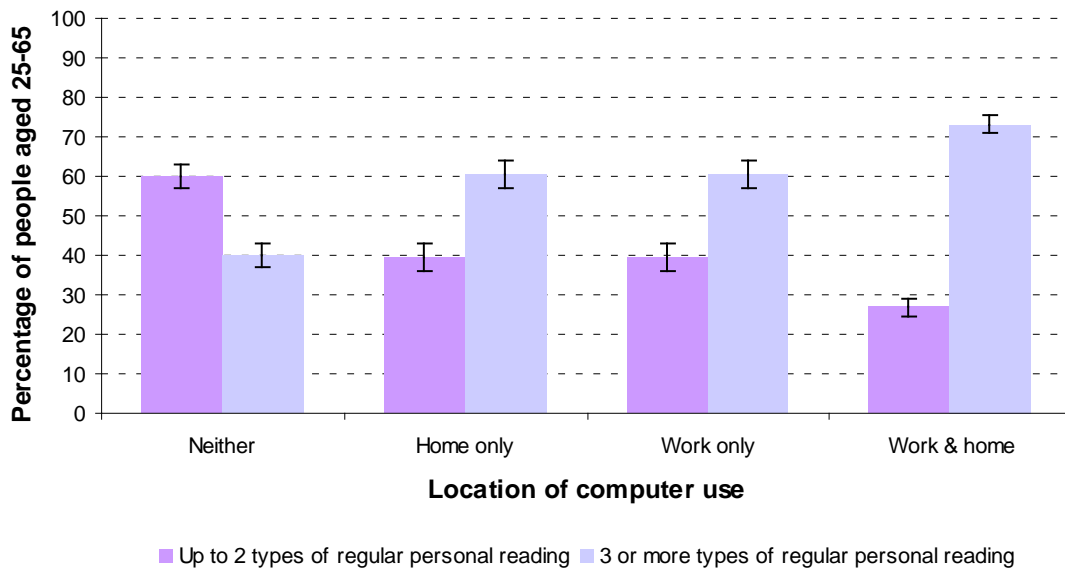
People who used a computer at home were significantly more likely to engage in all four types of personal reading on a regular basis, while those who did not were significantly more likely to engage in none or up to two types. The percentage of home computer users engaged in three or more regular personal reading activities is estimated at 70 per cent, while the percentage for those without access or who used a home computer less than 5 hours per month is 49 per cent. Just as using a computer at work is indicative of work involving a wide range of regular reading activities, using a computer at home is indicative of engaging in a wider range of regular personal reading activities.

4.3 Combined effects of computer use at work and at home

We have seen in section 3.2 how the combinations of work computer use or non-use and home computer use or non-use were strongly related to the percentage of people with higher prose literacy and numeracy. Can these combinations also be related to regular personal reading and regular reading activities at work?

Figures 35 and 36 show the relationships between the four different combinations of work and home computer use, and the number of types of regular personal and work reading activities. The number of types of regular reading activities are aggregated into two categories, namely up to two types, and three or more types.

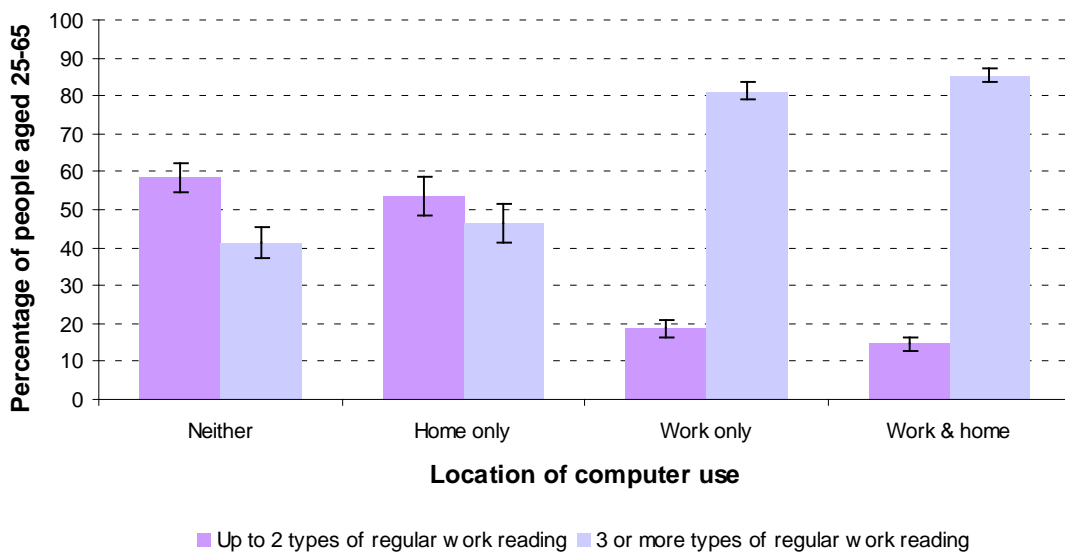
Figure 35
Number of types of regular personal reading activity, by work and home computer use



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 36
Number of types of regular work reading activity, by work and computer use



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

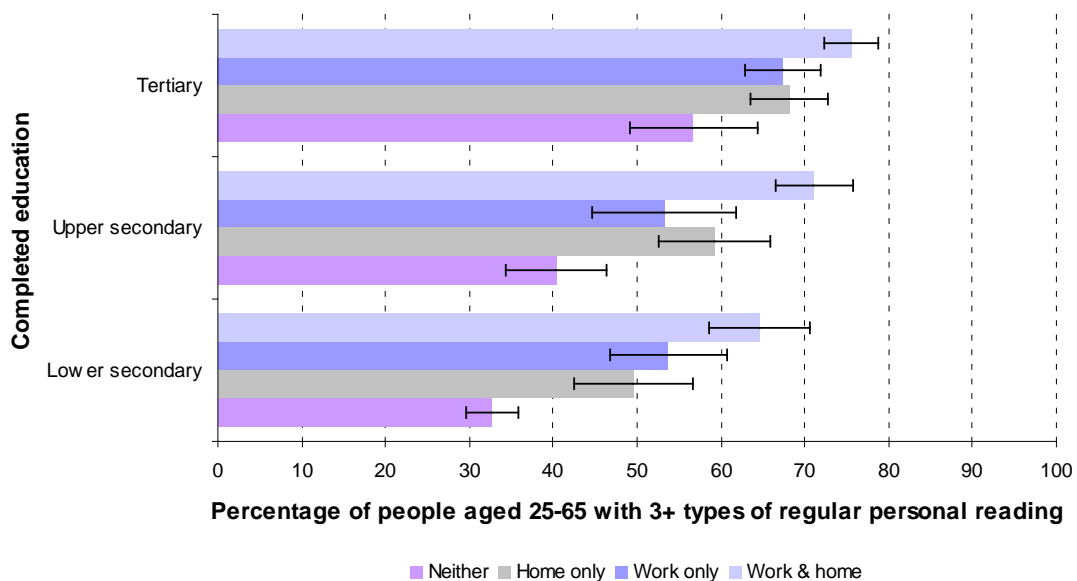
As with prose literacy and numeracy scores, the pattern of regular personal reading activities was similar for those using a computer only at work or only at home, but there was a greater percentage of people with three or more regular personal reading activities among those using a computer both at work and at home, and a smaller percentage among those who did not use a computer either at work or at home.

For regular reading activities at work, the relationship was different. Those who used a computer at work were much more likely than those who did not to engage in three or more regular work reading activities. For those using a computer at work, there was a small additional effect of using a computer at home, but for those not using a computer at work, there was no statistically significant effect of using a computer at home.

How does involvement in personal reading vary by work and home computer use for people who had completed different levels of education? Figure 37 shows the percentage of people aged 25-65 with high personal reading involvement (three or more types of regular personal reading) according to completed education. Work and home computer use made a clear difference for people with lower or upper secondary education: those who used a computer both at work and at home were more likely to have high personal reading involvement than those who used a computer in only one location, who in turn were significantly more likely to have high personal reading involvement than those who did not use a computer in either location.

On the other hand, for each category of computer use, there was a significant difference between people with tertiary education and people with lower secondary or less, but people with upper secondary education were not clearly distinct from the other two groups.

Figure 37
Percentage of people with extensive regular personal reading by completed education and locations of computer use

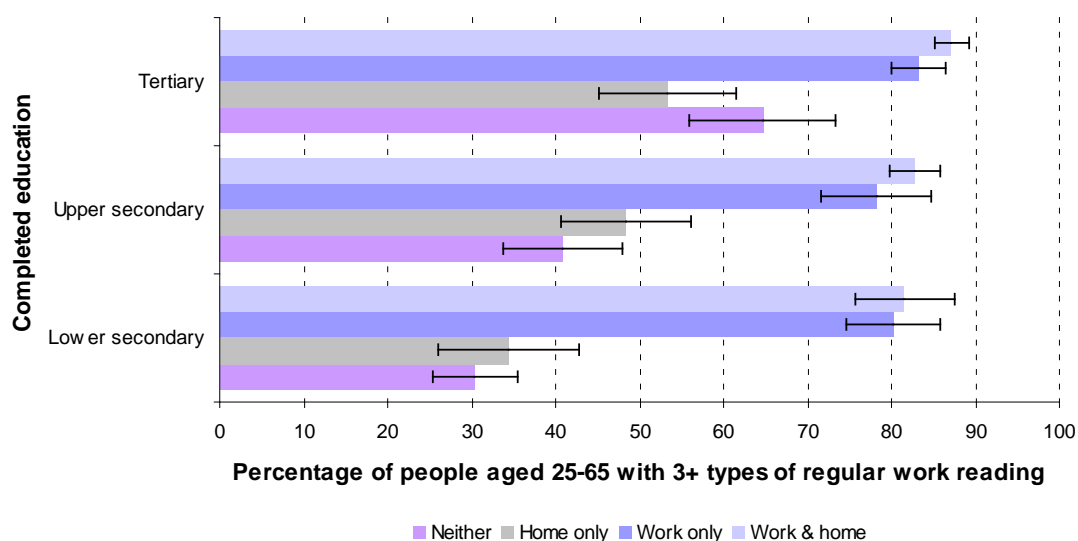


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Different observations apply for the variation of high work reading involvement (3 or more types of regular work reading) according to computer use and education, as shown in Figure 38. The most striking feature is that the percentage of people with high work reading involvement was similarly large among those who used a computer at work, whatever their level of completed education and whether or not they also used a computer at home. The percentage of people with high work reading involvement was significantly less among those who did not use a computer at work, and here there was no significant difference between those using or not using a computer at home, although there was a significant difference between those with tertiary and those with lower secondary education. Thus the overriding factor related to high work reading involvement was computer use at work.

Figure 38
Percentage of people with extensive regular work reading by completed education and locations of computer use



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

4.4 Summary

Both work computer use and home computer use are significant predictors of higher prose literacy and numeracy (after controlling for other factors).

Computer use at work

A substantial proportion of people in almost all occupations used computers at work, but computers were used by a considerably higher proportion of people in managerial, professional, technical and clerical occupations than in manual occupations.

Computer use at work was strongly associated with engaging in a wide range of regular reading and writing activities at work, and regular activities related to document literacy and numeracy. In turn, engaging regularly in a wide range of such activities was strongly associated with higher prose literacy and numeracy.

Thus computer use at work is a powerful indicator of the kind of work which involves a higher intensity of involvement in literacy- and numeracy-related tasks, that is, the kind of work which requires and/or fosters higher literacy and numeracy.

Home computer use

People aged 25-65 who used a computer at home for 5 or more hours per month were significantly more likely to have higher literacy and numeracy compared with people who did not.

Computer use at home was strongly associated with engaging in a wide range of regular personal reading activities, which in turn was strongly associated with higher prose literacy and numeracy.

Combined effect of work computer use and home computer use

Work and home computer use were moderately correlated but had separate and cumulative effects on prose literacy and numeracy.

People aged 25-65 who used a computer both at work and at home were significantly more likely to have higher literacy and numeracy than people who used a computer only at work or only at home, and these people were significantly more likely to have higher literacy and numeracy than people who did not use a computer at work or at home. The percentage of people with higher literacy and numeracy descended in four significant steps in the order: those who used a computer both at work and at home, those who used a computer at work only, those who used a computer at home only, and those who did not use a computer in either location.

There was a similar gradation in involvement with regular personal reading activities, with people who used a computer at work and at home having the highest involvement, and people who did not use a computer in either location having the least, but there was no significant difference in personal reading involvement between those using a computer only at work and only at home.

Those who used a computer at work had high involvement in work reading, irrespective of completed education and home computer use.

5 FACTORS RELATED TO EMPLOYMENT

This chapter covers the relationships between prose literacy and numeracy on the one hand and occupation, industry and income on the other, as well as the relationships among these employment-related variables and between these variables and education and computer use.

Occupation and industry in the ALL survey data were assigned not necessarily on the basis of current employment, or even employment in the past year, but on the basis of the last job held within the previous five years.

5.1 Occupation

Occupation is aggregated into four broad categories⁷, following Pool at al. (2005), but dividing their ‘manual workers’ into two categories:

- Managers, professionals and technicians/associate professionals
- Clerks and service workers
- Farmers, fishers and tradespeople
- Machine operators and elementary workers

The first category corresponds to what Pool at al. refer to simply as ‘Professionals’.

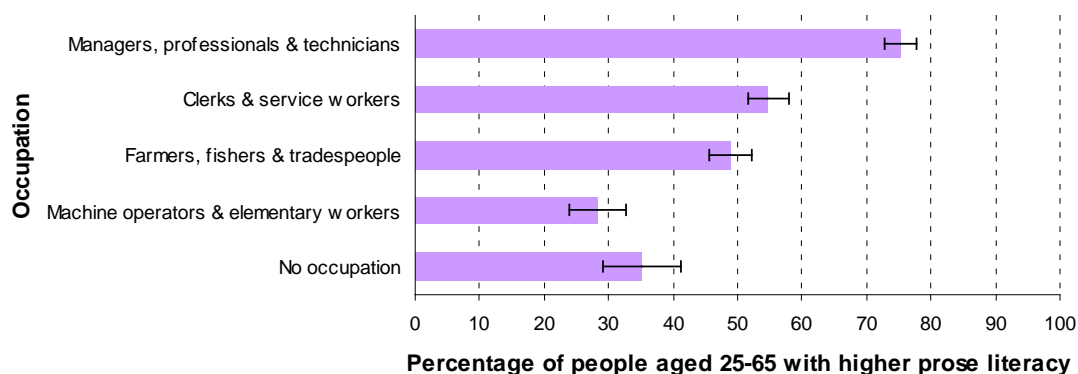
Occupation, prose literacy and numeracy

Figures 39 and 40 show the percentages of people in each of these broad occupational categories with higher prose literacy and higher numeracy.

There is a clear clustering and ordering of broad occupational categories by percentage of people with higher prose literacy and numeracy: managers, professionals and technicians had the greatest percentage; clerks and service workers, and farmers, fishers and tradespeople were comparable and had an intermediate percentage; machine operators and elementary workers, and people with no assigned occupation were comparable and had a low percentage. The differences between the three occupational clusters were all statistically significant.

⁷ See Chapter 10 for a more detailed explanation of the occupational categories. Note that five respondents with military occupations have been excluded from the analyses in this section.

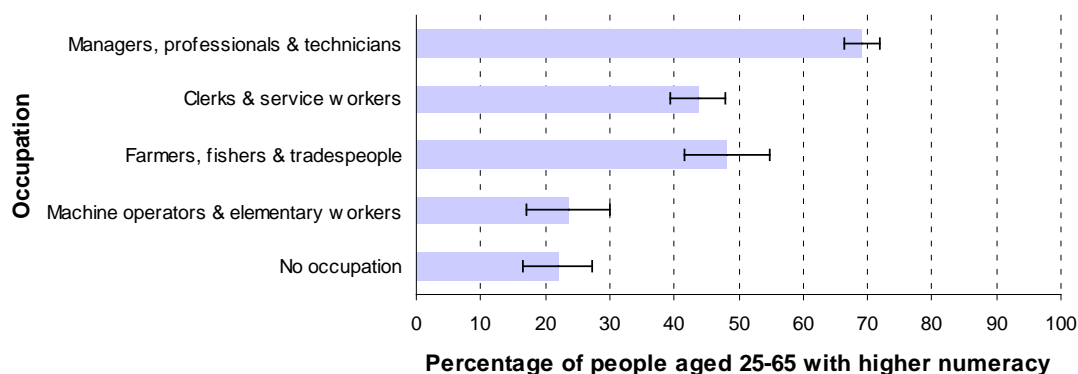
Figure 39
Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by aggregated occupation



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 40
Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by aggregated occupation



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

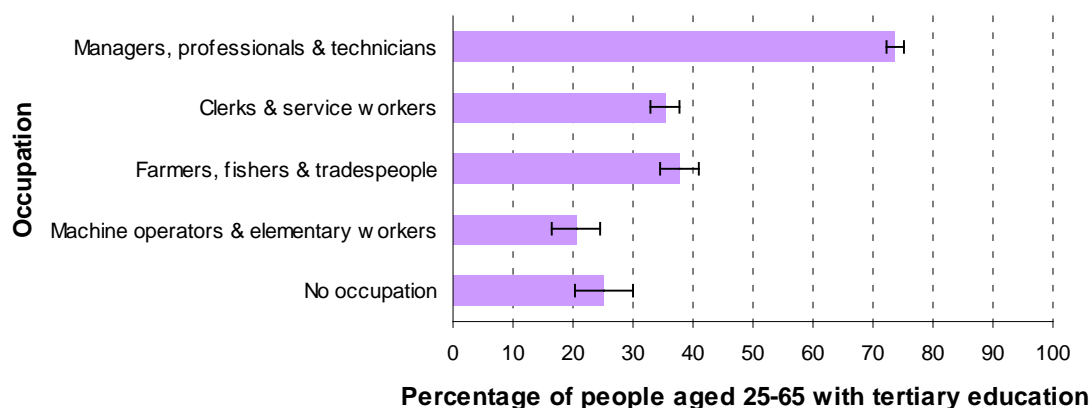
Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Associations between occupation and other variables

Much of the difference in prose literacy and numeracy between the occupational groups is captured by the differences in educational attainment and in computer use.

To illustrate the educational differences, Figure 41 shows the percentage of people with tertiary education (Level 4 and above) in each of the broad occupational groups. This level of educational attainment (tertiary or not) distinguishes sharply between managers, professionals and technicians, and people in other occupational groups. Figure 41 also shows the same clustering and ordering as Figures 39 and 40: managers, professionals and technicians had the greatest percentage with a tertiary education; clerks and service workers, and farmers, fishers and tradespeople had an intermediate percentage; and machine operators and elementary workers, and people with no assigned occupation had a low percentage.

Figure 41
Percentage of people aged 25-65 with a tertiary education by aggregated occupation

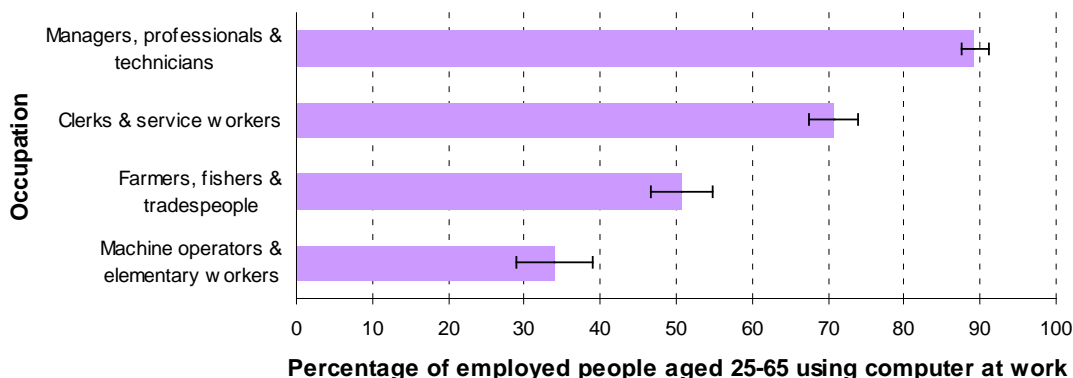


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 42 shows the differences between occupational groups in the percentage of employed people (who all have assigned occupations) using a computer at work. Again there is a clear ordering, with managers, professionals and technicians having the highest percentage of computer use and machine operators and elementary workers the least, and all differences being statistically significant. Note that this clarity is more evident after aggregating the occupations: compare Figure 24. The feature that is different from the preceding Figures is the fact that clerical and service workers were considerably more likely to use a computer at work than farmers, fishers and tradespeople.

Figure 42
Percentage of employed people aged 25-65 who had used a computer at work in the past year, by aggregated occupation



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

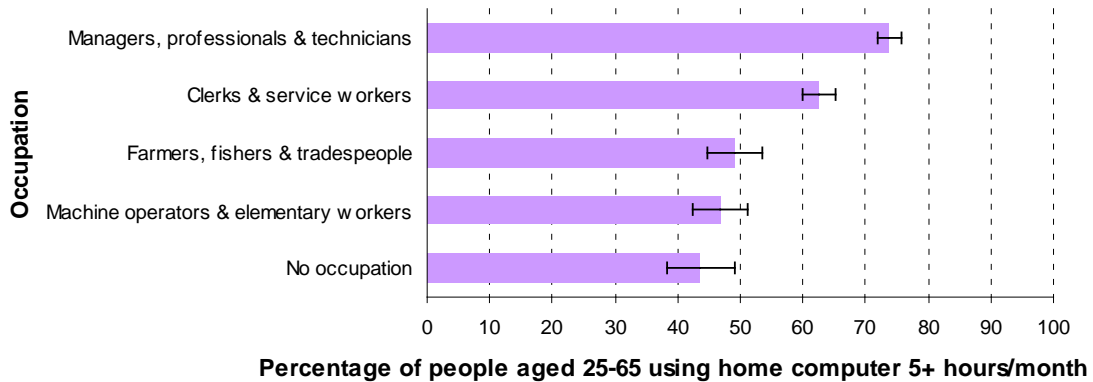
Note: The above graph is only for people employed in the past year, because the computer use at work question was only asked of people employed in the past year.

A somewhat different pattern is evident for use of a computer at home, as shown in Figure 43. There was no significant difference between farmers, fishers and tradespeople, machine operators and elementary workers, and people with no assigned occupation. However, managers, professionals and technicians were significantly more likely to use a computer at

home than clerks and service workers, who were significantly more likely to use a home computer than the other occupational groups.

Figure 43

Percentage of people aged 25-65 using a home computer for 5 or more hours per month, by aggregated occupation



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Educational attainment and computer use account for much of variation between occupations, hence occupation is not a variable in the basic statistical models, although occupation has a small but significant additional effect in the extended models (positive for the managerial, professional or technical group, negative for machine operators and elementary workers).

5.2 Industry

Respondents to the ALL survey were assigned to an industry if they had been employed at any time in the previous five years.

Following Pool et al. (2005), industry is aggregated into four broad sector groupings (the corresponding terms used by Pool et al. are in parentheses⁸):

- Finance, business and community services (More skilled tertiary)
- Wholesale and retail trade, transport and communications (Less skilled tertiary)
- Manufacturing and construction (Secondary)
- Agriculture, forestry, fishing and mining (Primary)

The last two categories are further aggregated into ‘Agriculture, manufacturing and construction’ in order to obtain statistically reliable results for some analyses.

‘Finance, business and community services’ covers a wide range of services including finance, insurance, real estate, professional and technical services, public administration, education, health, arts and recreation.

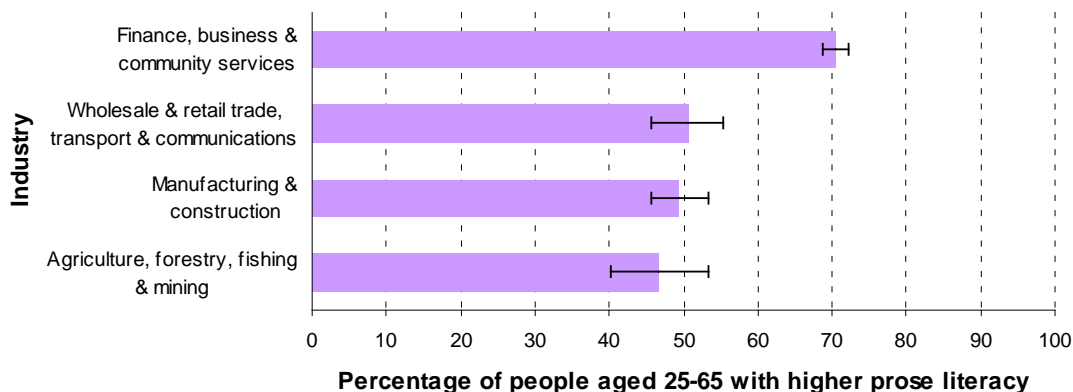
⁸ Because of the way the ALL data was coded, it was not possible to precisely replicate the categorisation used by Pool et al. In particular, personal services are included in ‘Finance, business and community services’ here but were allocated to ‘Less skilled tertiary’ by Pool et al. See Chapter 10 for a detailed explanation of the industry categories used in this report.

Industry, prose literacy and numeracy

Figures 44 and 45 show the percentages of people in each of these broad industry categories with higher prose literacy and higher numeracy.

Figure 44

Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by industry

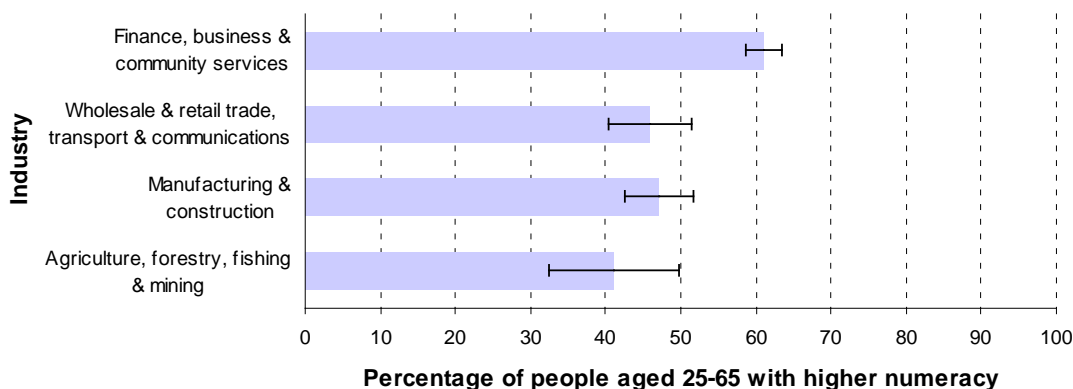


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 45

Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by industry



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Clearly, there was a significantly greater percentage of people with higher prose literacy and numeracy in ‘Finance, business and community services’ than in the other industry groups, which were not significantly different from each other.

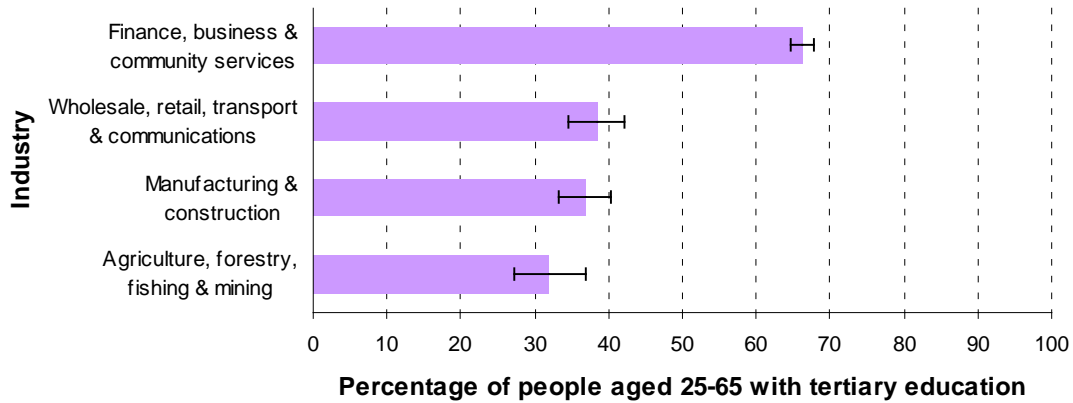
Associations of industry with other variables

The associations between industry and prose literacy and numeracy are largely accounted for by the education, computer use and occupation variables, to the extent that if an industry variable is added to either of the extended statistical models it is not a significant predictor and does not improve the explanatory power of the model.

Figure 46 shows the percentage of people aged 25-65 with tertiary qualifications in each industry group, and here there was a clear distinction between ‘Finance, business and

community services’ in which a clear majority of workers had tertiary qualifications, and the other industry groups, in which people with tertiary qualifications were in a clear minority.⁹

Figure 46
Percentage of people aged 25-65 with a tertiary education by industry

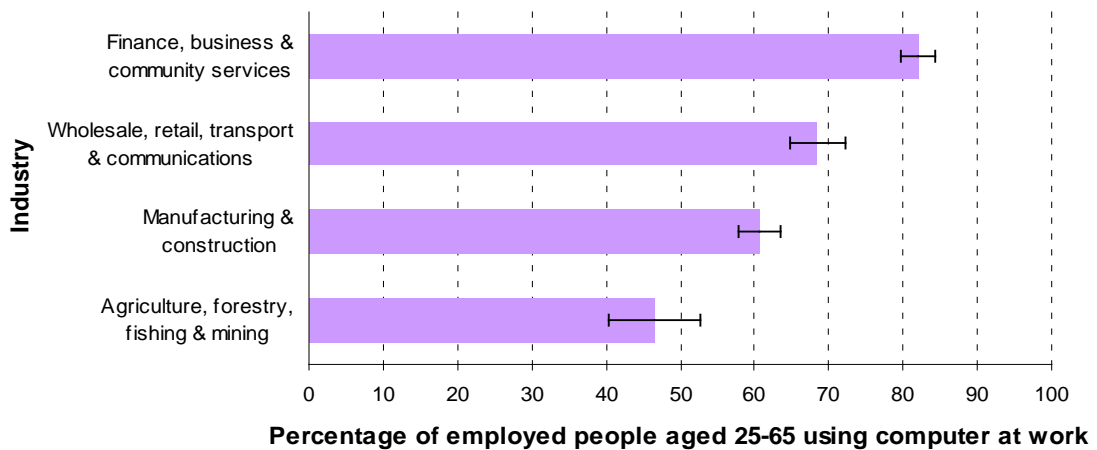


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 47 shows the percentage of people using a computer at work in each industry group. There were significant differences between all groups, with ‘Finance, business and community services’ well out in front, and with ‘Agriculture, forestry, fishing and mining’ showing the smallest percentage.¹⁰

Figure 47
Percentage of employed people aged 25-65 who had used a computer at work in the past year, by industry



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

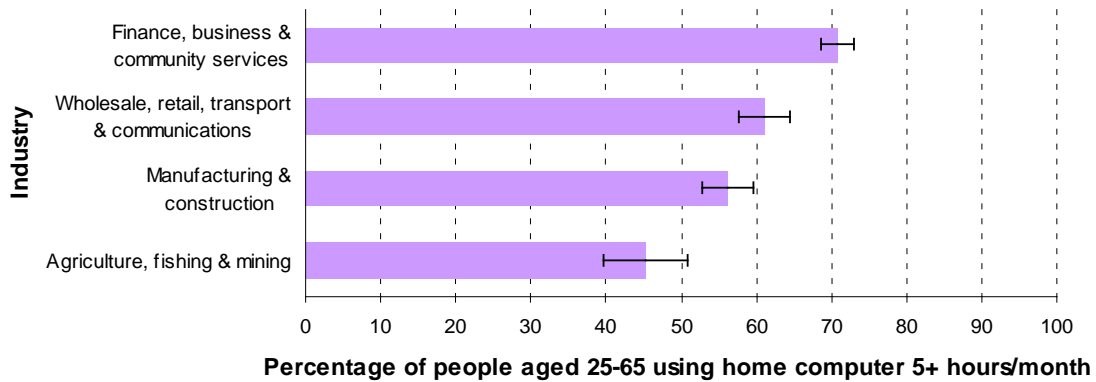
Note: The above graph is only for people employed in the past year, because the computer use at work question was only asked of people employed in the past year.

⁹ The correlation between having a tertiary qualification and being in ‘Finance, business and community services’ was 0.29.

¹⁰ Among people employed in the past year, the correlation between using a computer at work and being in ‘Finance, business and community services’ was 0.22.

Home computer use by industry group, as displayed in Figure 48, shows a similar pattern, although the differences between industry groups were not quite as great. Nevertheless, the percentage of people using a home computer in ‘Finance, business and community services’ was significantly greater than in any of the other industry groups, and the percentage in ‘Agriculture, fishing and mining’ significantly less.

Figure 48
Percentage of people aged 25-65 using a home computer 5 or more hours per month, by industry

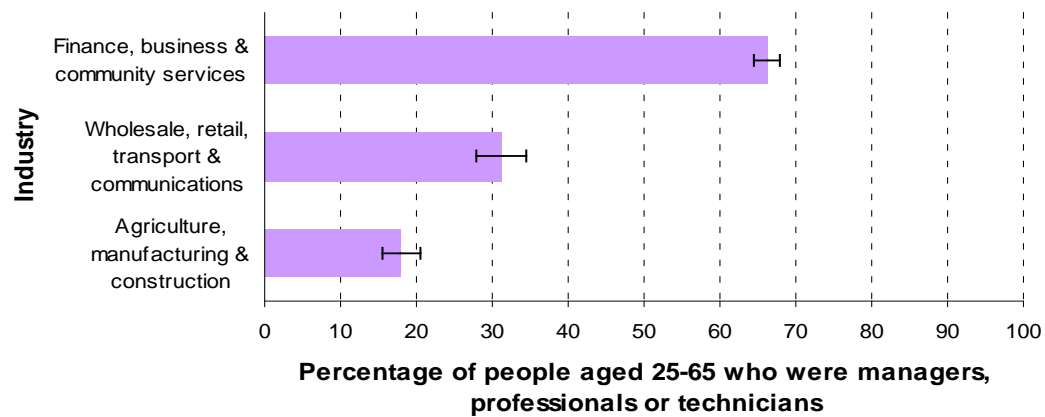


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 49 shows the percentage of people in each industry who were managers, professionals or technicians. This occupational group accounted for the majority of workers in ‘Finance, business and community services’ but a clear minority of workers in the other industry groups.¹¹

Figure 49
Percentage of people aged 25-65 who were managers, professionals or technicians, by industry



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

¹¹ The correlation between being a manager, professional or technician and working in ‘Finance, business and community services’ was 0.42.

5.3 Income

Respondents to the ALL survey were asked to provide estimates of their annual gross personal incomes, and over 80 per cent did so. Those who were unable or unwilling to provide an estimate were asked if the incomes fell in particular ranges, and these ranges are used below in reporting the income data. However, personal income remained unspecified for over 4 per cent of respondents (see Chapter 10).

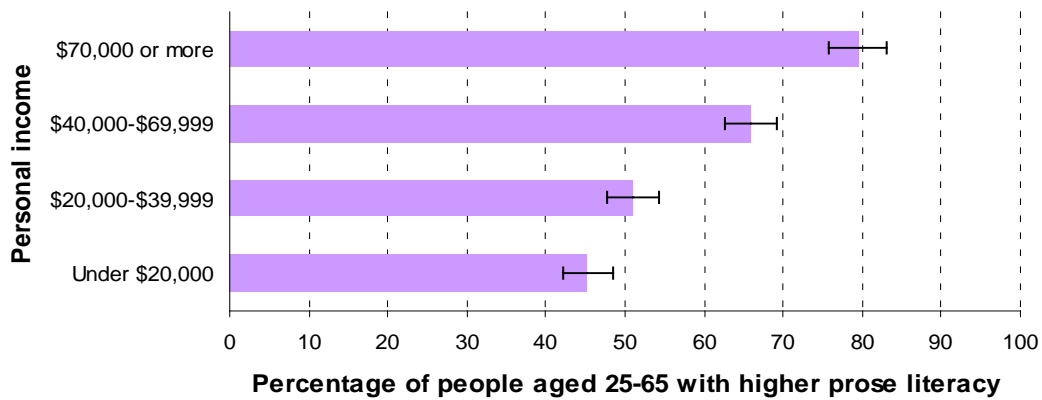
Income, prose literacy and numeracy

People with higher incomes were more likely to have higher prose literacy and numeracy, as indicated in Figures 50 and 51, which show the percentage of people aged 25-65 with higher prose literacy and numeracy by annual gross personal income.

The increase in the percentage of people with higher prose literacy or numeracy was significant for each step up in income range, with the exception of the two lowest ranges for prose literacy.

Figure 50

Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by gross annual personal income

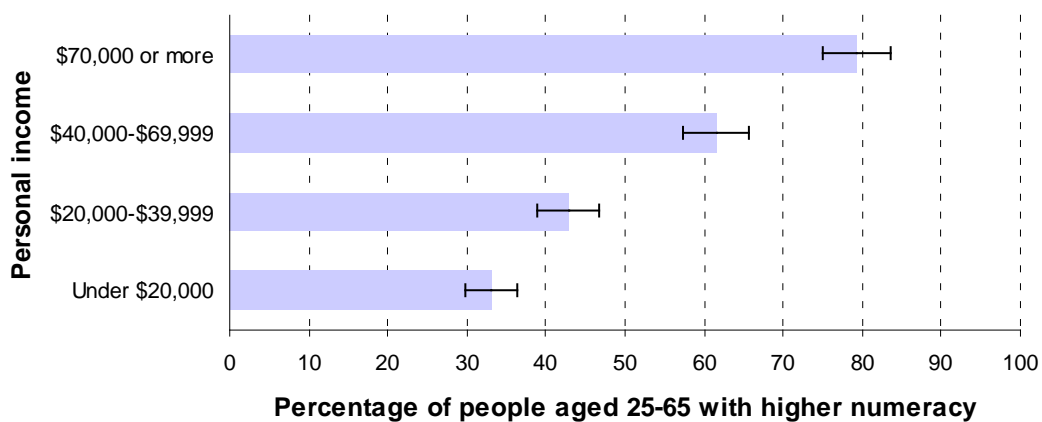


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 51

Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by gross annual personal income



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

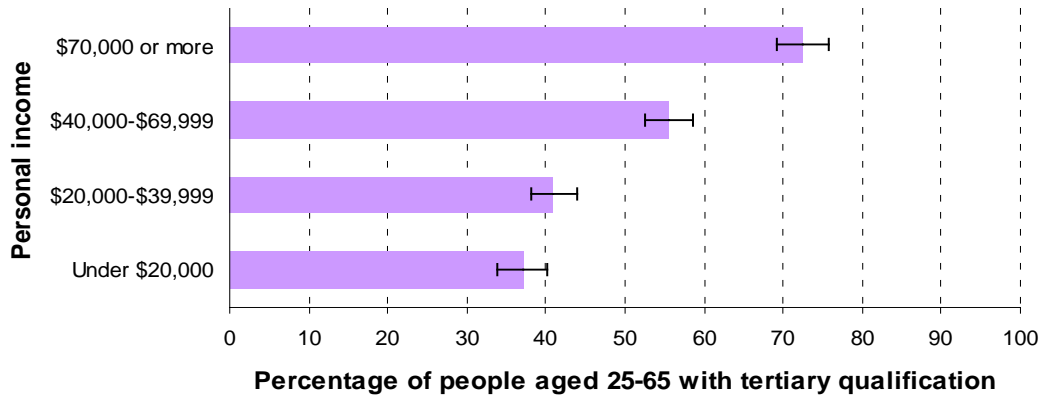
Associations of income with other variables

Income displays strong associations with completed education, computer use and higher-skilled occupations (managerial, professional and technical).

The association of income with completed education is illustrated in Figure 52 which shows the percentage of people with tertiary education in each personal income range. People with incomes above \$40,000 were much more likely to have a tertiary education.¹²

Figure 52

Percentage of people aged 25-65 with a tertiary education, by gross annual personal income



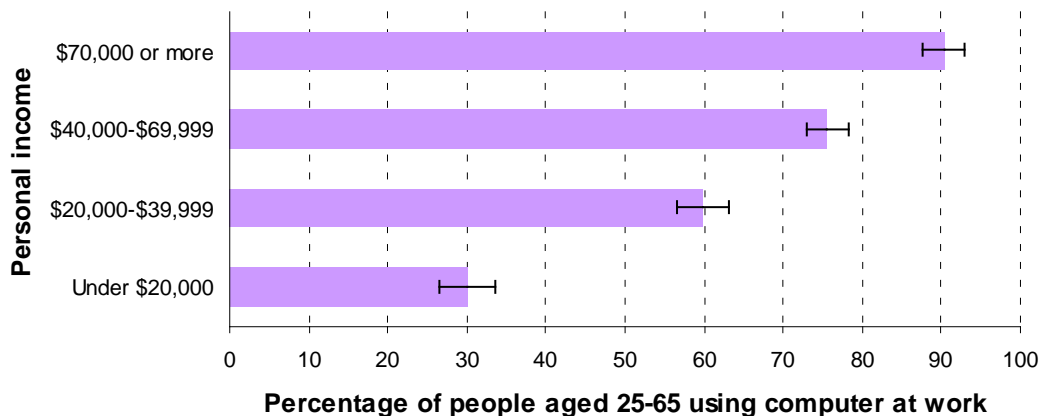
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

There was a strong association between higher income and using a computer at work. Figure 53 shows the percentage of all people aged 25-65 in each range of personal income who were employed in the past year and used a computer at work.¹³

Figure 53

Percentage of people aged 25-65 who had used a computer at work in the past year, by gross annual personal income



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

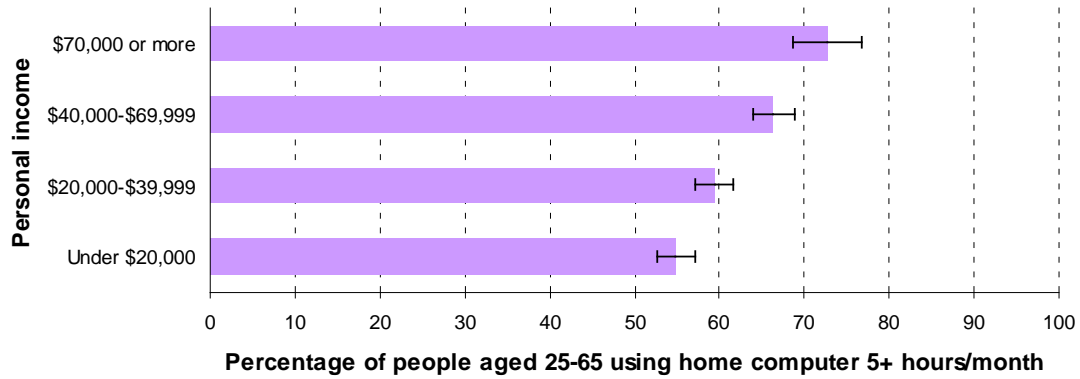
¹² The correlation between having a tertiary education and having an income of \$40,000 or more was 0.22.

¹³ The correlation between using a computer at work and having an income of \$40,000 or more was 0.36.

Figure 54 shows the percentages of people using a computer at home in each range of personal income. Although the differences between the three lower ranges were statistically significant, the variation was not nearly as great as for computer use at work.¹⁴

Figure 54

Percentage of people aged 25-65 using a home computer 5 or more hours per month, by gross annual personal income



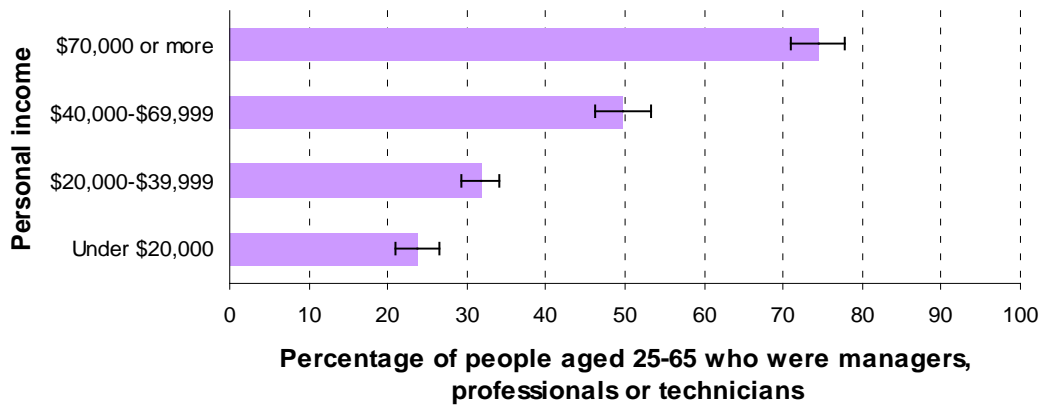
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 55 shows the percentage of people aged 25-65 who were managers, professionals or technicians in each range of personal income. The percentage is clearly greater with higher personal income, to the point that an estimated 74 per cent of those with incomes of \$70,000 or more belonged to this occupational grouping.¹⁵

Figure 55

Percentage of people aged 25-65 who were managers, professionals or technicians, by gross annual personal income



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Given the strong associations between personal income and the other variables covered in this section, personal income is redundant in the statistical models once other variables (completed education, computer use, occupation) are included.

¹⁴ The correlation between using a home computer for 5 or more hours per month and having a personal income of \$40,000 or more was 0.12.

¹⁵ The correlation between having an income of \$40,000 or more and being a manager, professional or technician was 0.30.

5.4 Summary of labour force status, computer use and employment-related factors

This is a convenient point to not only summarise the relationships of prose literacy and numeracy to occupation, industry and income, but also to reconsider these variables in relation to the labour force and computer use variables covered in the previous chapters.

Variables associated with higher or lower literacy and numeracy

The following variables were associated with greater percentages of people aged 25-65 having **higher** prose literacy and numeracy (Levels 3, 4 and 5):

- Labour force status of employed or student
- Being employed and using a computer at work
- Using a computer at home
- Especially, the combination of using a computer at work AND using a computer at home
- Being a manager, professional or technician
- Working in finance, business or community services (which include education and health)
- Having an annual gross personal income of \$40,000 or more

Conversely, the following variables were associated with smaller percentages of people aged 25-65 having higher prose literacy and numeracy, that is, with a greater percentage of people having **low** prose literacy and numeracy (Levels 1 and 2):

- Labour force statuses of unemployed, retired, homemaker or other
- Being employed but not using a computer at work
- Not using a computer at home
- Especially, the combination of not using a computer at work AND not using a computer at home
- Being a machine operator or elementary worker
- Working in any of the following industries:
 - Wholesale and retail trade, transport and communications
 - Manufacturing and construction
 - Agriculture, forestry, fishing and mining
- Having an annual gross personal income of less than \$40,000

Of these variables, industry and personal income are redundant in the statistical models for prose literacy and numeracy once other factors (including labour force status, computer use and occupation) are taken account of, because of the correlations that industry and income have with those other variables; and the computer use variables have somewhat stronger predictive value in the statistical models than the occupation, industry and income variables.

Use of a computer at work is strongly associated with being employed in managerial, professional, technical or clerical occupations, although a significant proportion of workers in other occupational groups also used computers. People who had used a computer at work in the past year were likely to be involved in a much wider range of regular work activities related to literacy and numeracy than those who had not, and those who were involved in a greater number of types of regular literacy or numeracy activities were more likely to have higher literacy or numeracy. Computer use at work appears to pinpoint, more effectively than occupational categories, those jobs which require or encourage regular literacy and numeracy

activities, and this probably reflects the importance of the computer as a tool for literacy and numeracy activities.

Similarly, people who used a computer at home were more likely to engage in a wide range of regular personal reading activities. There was a straightforward relationship between increase in the number of types of regular personal reading and higher literacy and numeracy scores.

Work computer use and home computer use are only moderately correlated with each other, and have separate and cumulative effects in the statistical models. Taken together they form a scale, such that people who used a computer at work and also used a computer at home were much more likely to have higher prose literacy or numeracy than those who used a computer in only one location (either work or home), who in turn were much more likely to have higher prose literacy or numeracy than those who did not use a computer in either location.

There is a small but significant additional effect (incorporated in the extended statistical models) of occupation, with managers, professionals and technicians having higher prose literacy and numeracy than clerks and service workers and farmers, fishers and tradespeople, who in turn have higher prose literacy and numeracy than machine operators and elementary workers.

Literacy, numeracy and computer use

This report has also explored a factor which has not previously been explored extensively in the New Zealand ALL data, namely computer use. On the basis of previous research it could be expected that there would be a relationship between the variables of work and home computer use and the measures of prose literacy and numeracy. How it would compare with employment-related factors such as occupation and industry was not clear.

It is therefore remarkable to find that the computer use variables are such strong predictors of prose literacy and numeracy, and that they work better than occupation and industry as predictors (when education is controlled for). Computer use at work in fact accounts for some of the variation between different occupations and industries.

Work computer use turns out to be a good indicator of the extent to which people's work involved regular reading, writing and/or numeracy-related activities, and home computer use is a good indicator of the range of personal reading activities people were involved in. The range of people's literacy and numeracy-related activities shows a strong relationship with prose literacy and numeracy scores. This helps to explain why there is such a strong relationship between literacy and numeracy and computer use.

6 LANGUAGE AND RELATED FACTORS

Respondents to the ALL survey were asked two questions about their language backgrounds.

The first asked “What is the language that you first learned at home in childhood and still understand?” Up to two first languages could be specified, but 99 per cent of people aged 25-65 had only one first language.

The second question asked “What language do you speak most often at home?”¹⁶ Only one such ‘main home language’ could be specified in response to this question.

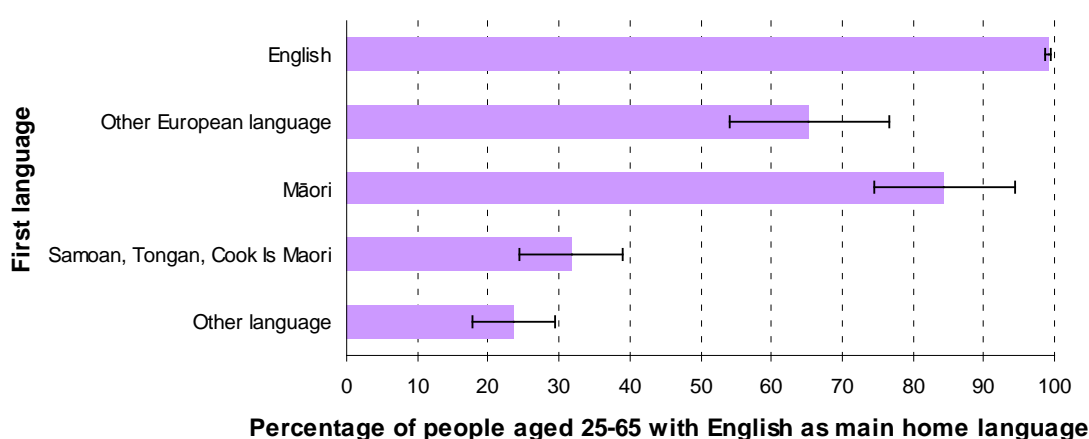
6.1 First language and main home language

The relationship between first language and main home language

For 94 per cent of people aged 25-65, the main home language was the same as the first language, where one first language was specified, or was the same as one of the two first languages specified. However, 6 per cent of people aged 25-65 reported a main home language that was different from their first language(s). In most of these cases, the main home language was English, while the first language(s) was/were not English, indicating a shift in language usage in the life history of the respondent. There were a very small number of cases where the first language was English and the main home language was not, but there were too few such cases to obtain a reliable estimate of the number of people in the population in that situation.

Figure 56 represents the extent to which people aged 25-65 with different first languages had English as their main home language. Note that virtually everyone with English as their first language (99 per cent) had English as their main home language. Most people who had Māori (84 per cent) or a European language other than English (65 per cent) as a first language had English as their main home language. Only a minority of people who had a major Pacific language – Samoan, Tongan or Cook Islands Maori – (32 per cent) or any Other language (24 per cent) as a first language had English as the main home language.

Figure 56
Percentage of people aged 25-65 with English as the main home language, by first language



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

¹⁶ Note that the wording of the two questions is different from that of the 2006 Census question, which (in the English-language questionnaire) asked “In which language(s) could you have a conversation about a lot of everyday things?”

Since the literacy and numeracy skills measured in the ALL survey are English-based and the test materials are in English, the key language factor is the extent to which English is part of people’s language backgrounds. On this basis the population in the 25-65 age group (2,122,000 people) can be divided into three groups:

- People with English as a first language, almost all of whom had English as their main home language as well (1,793,000 people, or 84 per cent)
- People without English as a first language, but with English as their main home language (107,000 people, or 5 per cent)
- People without English as a first language, whose main home language was not English (222,000 people, or 10 per cent)

The last two of these categories correspond to the two language variables used in the statistical models (see Appendix A).

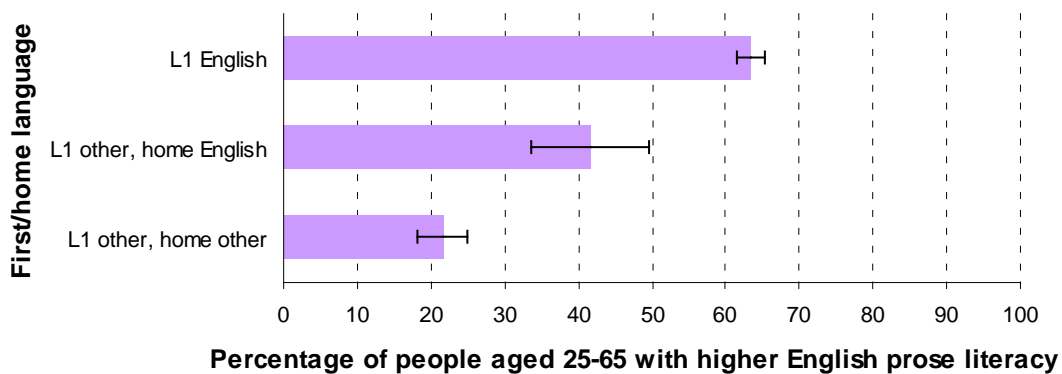
Language, literacy and numeracy

Figures 57 and 58 show the percentages of people with higher English prose literacy and higher numeracy in these three language-based groupings.

For higher prose literacy the estimated percentages are 63 per cent for people with English as a first language (L1 English), 42 per cent for people without English as a first language but with English as main home language (L1 other, home English), and 22 per cent for people whose first and home languages were not English (L1 other, home other). The differences between the three groups were clearly statistically significant.

Figure 57

Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by first language and home language

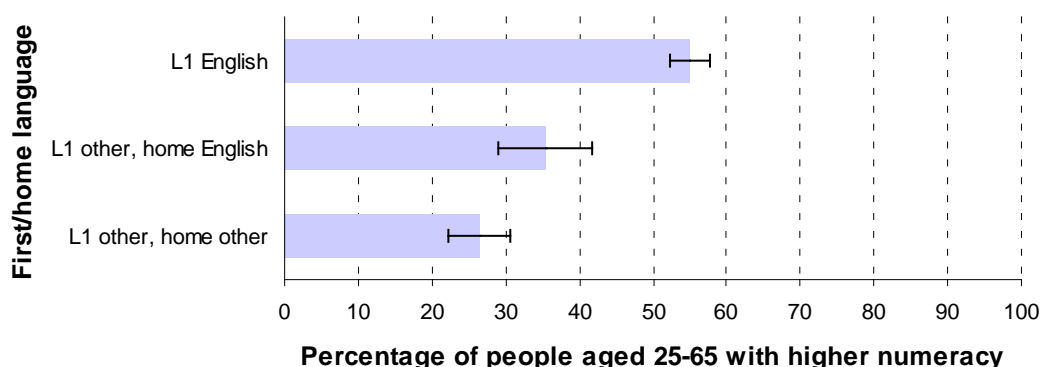


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

The percentages of people aged 25-65 with higher numeracy for the three groups were 55 per cent, 35 per cent and 27 per cent, but the difference between the two groups without English as a first language was not statistically significant.

Figure 58
Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by first language and home language



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

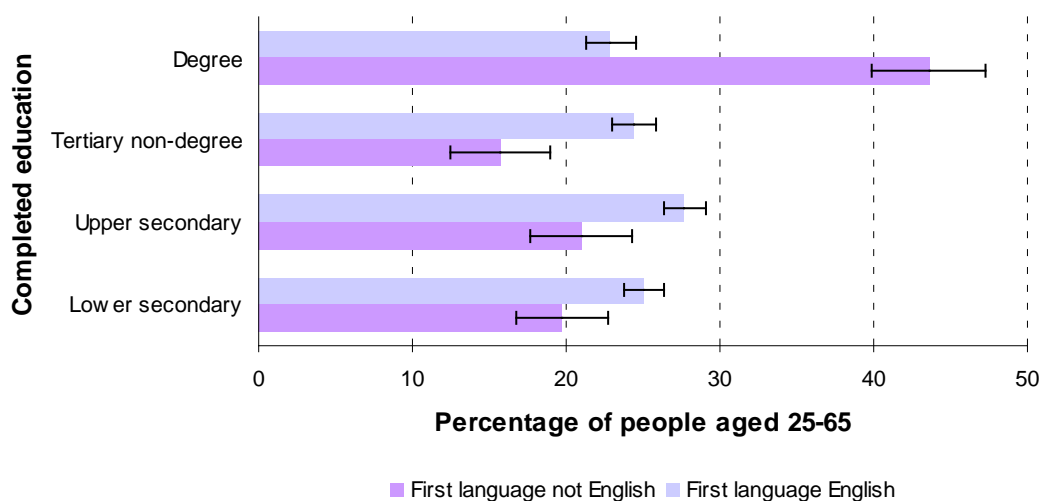
Thus not having English as a first language means being less likely to have higher prose literacy or numeracy, even when English is the main home language. First language is therefore a better guide than main home language to those whose English-based literacy or numeracy may be affected by their language background. The remaining analyses in this chapter which deal with the relationships between language and non-language factors will use first language as the sole language variable.

First language, education and computer use

The majority of people whose first language was not English were born outside New Zealand (see section 6.2 below), hence the relationships between first language and education, and first language and computer use, reflect largely the circumstances of migrants.

Figure 59 shows the highest level of education completed for people aged 25-65 with and without English as a first language. The percentage of people with a degree (bachelors or postgraduate) was considerably greater among those whose first language was not English (44 per cent) than among native English speakers (23 per cent), reflecting immigration policies with an emphasis on selecting highly-skilled migrants. The percentages of people who had completed lower levels of education were, correspondingly, significantly smaller among those whose first language was not English than among native English speakers.

Figure 59
Completed education by first language for people aged 25-65

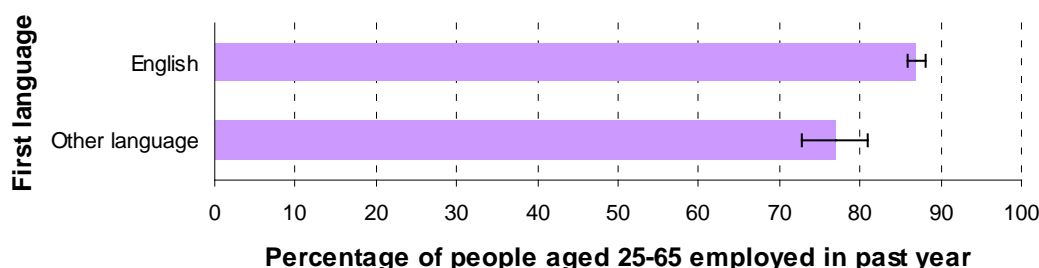


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

People whose first language was not English were significantly less likely to have been employed in the past year than native English speakers, as shown in Figure 60.

Figure 60
Percentage of people aged 25-65 employed in the past year by first language

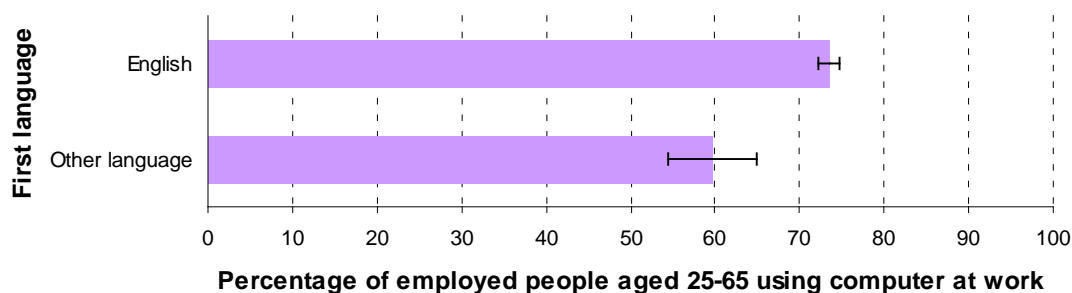


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Even though people with non-English first language were much more likely to have a degree than native English speakers, and even if they were employed, they were significantly less likely to have used a computer at work in the past year, as shown in Figure 61. This is a contrary pattern to the overall relationship between education and work computer use, and reflects in part the experience of many migrants in having difficulty finding employment that matches their level of qualification, particularly in their first years in New Zealand (see Smyth and Lane, 2009; Earle, 2009b; Earle, 2009c for more detailed discussion). Since computer use at work is an indicator of work that requires or fosters regular and intensive literacy and numeracy practices, the implication is that a substantial number of highly-qualified people whose first language was not English were missing out on employment that could help to maintain or develop literacy and numeracy skills in English.

Figure 61
Percentage of employed people aged 25-65 who had used a computer at work in the past year, by first language

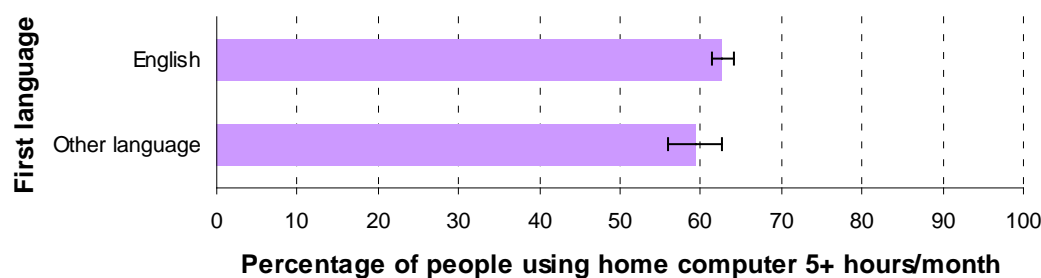


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

There was no significant difference in home computer use between those with and without English as a first language, as shown in Figure 62.¹⁷

Figure 62
Percentage of people aged 25-65 using a computer at home for 5 or more hours per month, by first language



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

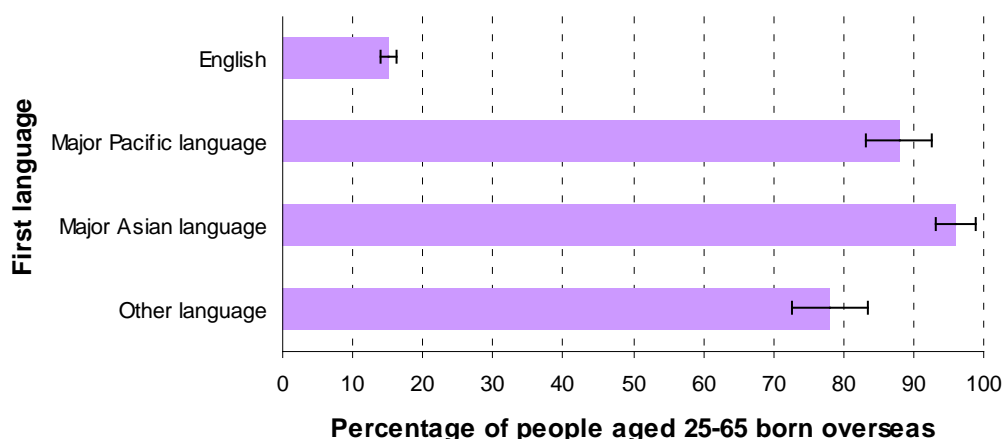
6.2 Language and birthplace

Figure 63 shows the percentage of people aged 25-65 born overseas according to their first language. The 'Major Pacific language' category refers to Samoan, Tongan and Cook Islands Maori; other Pacific languages were not specifically identified in the coding of the survey responses and are grouped in the 'Other language' category. The 'Major Asian language' category covers Chinese, Korean, Japanese, Vietnamese, Malay, Indonesian, Hindi, Punjabi, Tamil and 'Other Indian language'; other Asian languages were not specifically identified and so are also grouped in the 'Other language' category.

Clearly the majority of native speakers of languages other than English were born overseas, but the percentage born overseas varies somewhat by language category. Almost all (96 per cent) of the native speakers of major Asian languages were born overseas, 88 per cent of native speakers of major Pacific languages, and 78 per cent of native speakers of other languages, compared with 15 per cent of native English speakers.

¹⁷ Home computer use is an indicator of more regular and intensive personal literacy activities, but the survey data is not specific as to the language of those activities. Nevertheless, for people whose first language was not English, there were strong correlations between home computer use and English prose literacy ($r = 0.46$) and numeracy ($r = 0.50$); stronger in fact than for native English speakers (prose $r = 0.28$, numeracy $r = 0.29$), and also stronger than the correlations for people with first language other than English between work computer use and prose literacy ($r = 0.42$) and numeracy ($r = 0.45$).

Figure 63
Percentage of people aged 25-65 who were born overseas, by first language



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

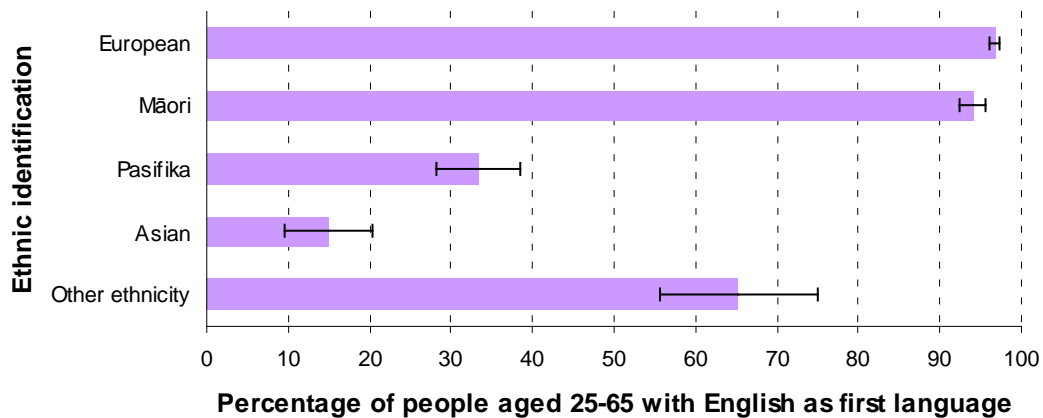
Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

6.3 Language and ethnic identification

Language and ethnic identification are closely related. Language rather than ethnicity variables are used as independent variables in the basic statistical models because they have greater predictive value, and because there is clearly a direct relationship between English language proficiency and the ability to interpret English text which was a necessary part of the testing of literacy and numeracy in the survey.

Figure 64 shows the relationship between broad ethnic identification and having English as a first language. All differences between ethnic groups are statistically significant. What stands out is the relatively small percentages of the Pasifika (33 per cent) and especially the Asian group (15 per cent) with English as a first language, compared with the relatively large percentages of Europeans (97 per cent), Māori (94 per cent) and Other (65 per cent) with English as a first language.

Figure 64
Percentage of people aged 25-65 with English as a first language, by ethnic identification (total response)



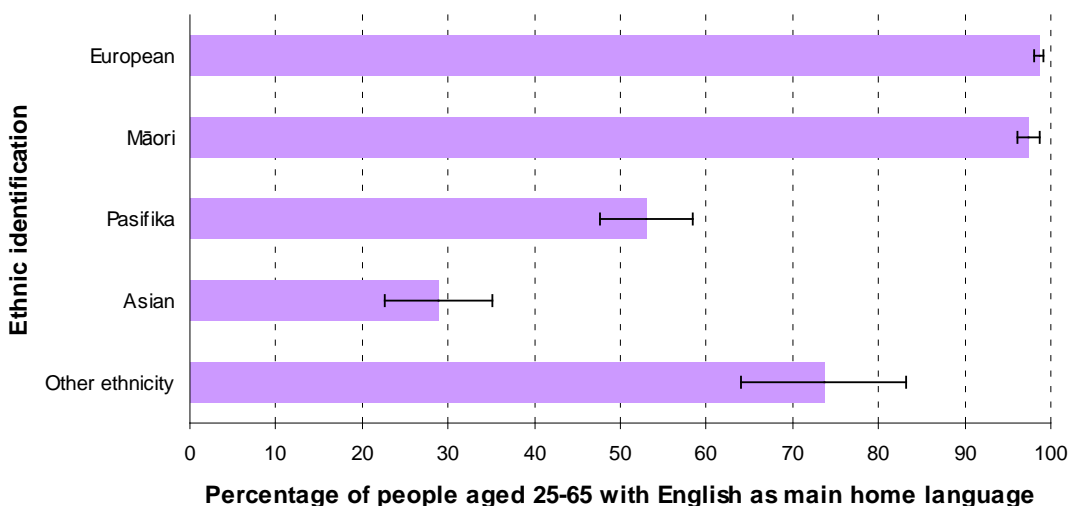
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Note: This graph is based on 'total response' ethnic identification: people with multiple ethnic responses are represented in more than one ethnic category. The estimate in this graph for the Asian category is of marginal reliability

When we look at the percentage of each ethnic group who had English as their main home language (Figure 65), there is a considerable difference from the first language percentage for the Pasifika (53 per cent) and Asian (29 per cent) groups. For the other groups, the percentages with English as the main home language (99 per cent for European, 97 per cent for Māori, 74 per cent for Other) are not greatly different from the percentages with English as first language.

Figure 65
Percentage of people aged 25-65 with English as the main home language, by ethnic identification (total response)



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

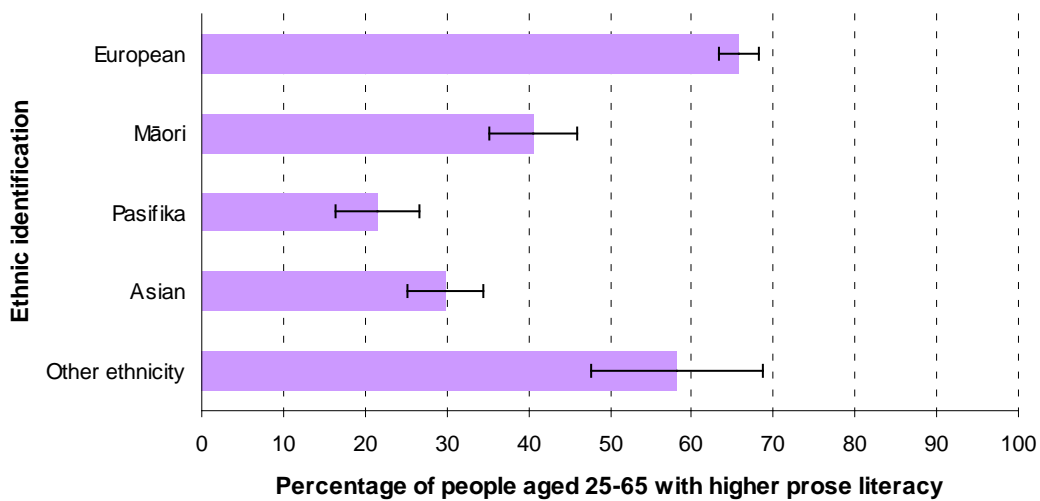
Note: This graph is based on 'total response' ethnic identification: people with multiple ethnic responses are represented in more than one ethnic category.

6.4 Ethnic identification

There were clear ethnic differences in prose literacy and numeracy, as illustrated in Figures 66 and 67. The percentage of people aged 25-65 with higher prose literacy was greatest for people in the European (66 per cent) and Other (58 per cent) ethnic categories (these two groups were not significantly different); Māori had a significantly smaller percentage (41 per cent); while the percentages for Asian (30 per cent) and Pasifika (22 per cent) were significantly smaller again (and not significantly different from each other). The pattern was somewhat different for numeracy: the percentage with higher numeracy was greatest for European (58 per cent) and Other (54 per cent); significantly less for Māori (28 per cent) and Asian (33 per cent); and significantly less again for Pasifika (14 per cent).

Figure 66

Percentage of people aged 25-65 with higher prose literacy (Levels 3-5) by ethnic identification (total response)



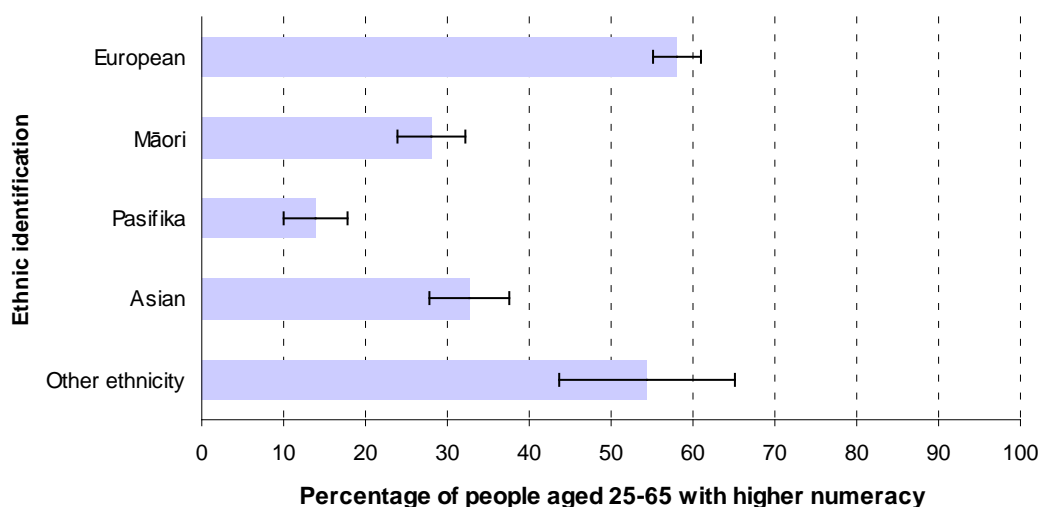
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Note: This graph is based on 'total response' ethnic identification: people with multiple ethnic responses are represented in more than one ethnic category.

Figure 67

Percentage of people aged 25-65 with higher numeracy (Levels 3-5) by ethnic identification (total response)



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

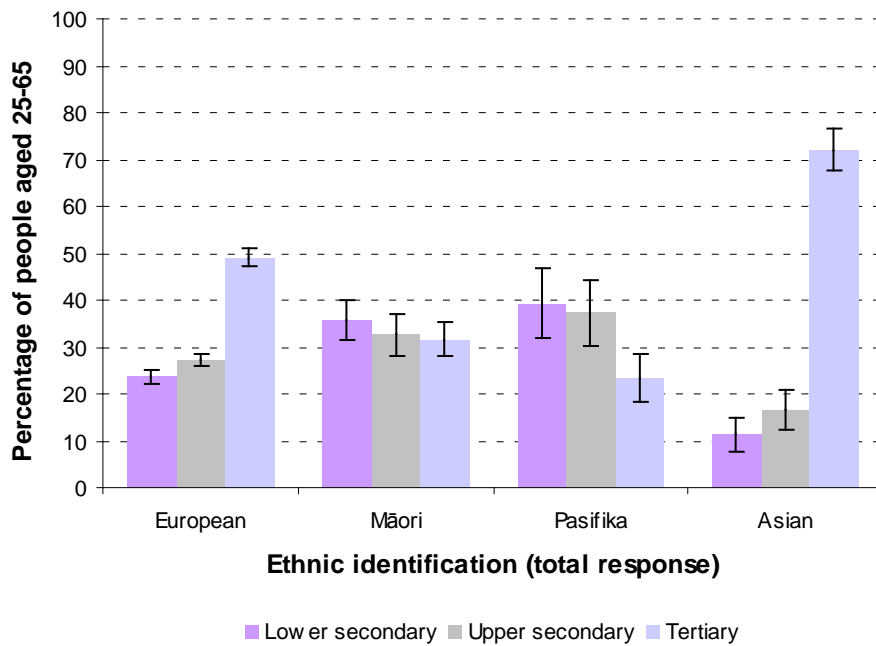
Note: This graph is based on 'total response' ethnic identification: people with multiple ethnic responses are represented in more than one ethnic category.

Figure 68 shows the percentages of people with each ethnic identification who had completed different levels of education, Figure 69 shows the percentages who were employed in the past year, and Figure 70 shows the percentages of employed people who had used a computer at work in the past year. Differences in prose literacy and numeracy between European, Māori and Pasifika follow the pattern of the percentages with tertiary education, but this is not the case for Asians. The large percentage of Asians with tertiary qualifications is strongly offset by their lower rate of employment and work computer use¹⁸ and especially their much smaller percentage of native English speakers (see section 6.3). On the other hand the ethnic differences in prose literacy and especially numeracy do correspond approximately to the pattern in work computer use.

Note that the percentage of people with European identification who were employed was significantly greater than for those with Māori, Pasifika and Asian identification, and similarly, among those who were employed, the percentage with European identification who used a work computer was significantly greater than for those with Māori, Pasifika and Asian identification.

¹⁸ This is an indication that a considerable proportion of Asians had jobs which were not commensurate with their qualifications: see Smyth and Lane (2009) and Earle (2009a, 2009b, 2009c) for analyses relevant to this point.

Figure 68
Completed education by ethnic identification (total response) for people aged 25-65

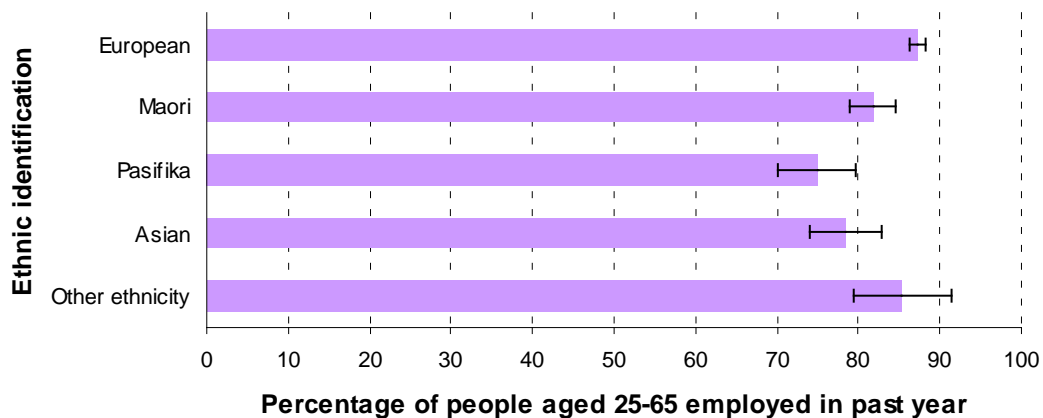


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Note: This graph is based on 'total response' ethnic identification: people with multiple ethnic responses are represented in more than one ethnic category. The number of respondents with 'Other' ethnic identification was too small to allow a reliable analysis by completed education.

Figure 69
Percentage of people aged 25-65 who were employed in the past year, by ethnic identification (total response)



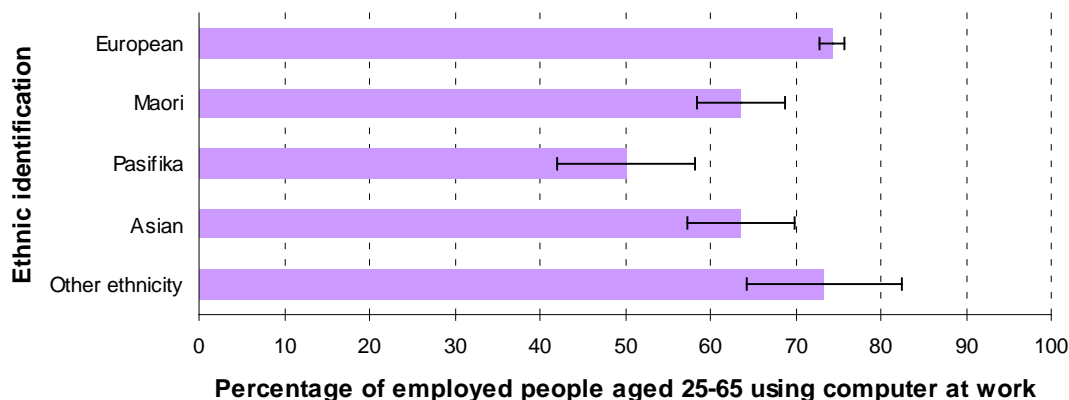
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Note: This graph is based on 'total response' ethnic identification: people with multiple ethnic responses are represented in more than one ethnic category.

Figure 70

Percentage of employed people aged 25-65 who had used a computer at work in the past year, by ethnic identification (total response)



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Note: This graph is based on 'total response' ethnic identification: people with multiple ethnic responses are represented in more than one ethnic category.

The literacy and numeracy skills of adults identifying as Māori and as Pasifika have been analysed comprehensively and in depth by Satherley and Lawes (2009a, 2009b) and Lawes (2009a, 2009b). The relative distributions of higher prose literacy and numeracy among Māori and Pasifika when subdivided by age, labour force status, education, income, occupation and industry were broadly similar to the corresponding distributions among the population as a whole. However, although there was a significant gender difference in the distribution of higher numeracy in the population as a whole, this gender difference was not evident among Māori and Pasifika.

Satherley and Lawes (2009b) discuss statistical models for Māori document literacy, and Lawes (2009b) discusses statistical models of Pasifika prose literacy and document literacy. These models are based on somewhat different sets of independent variables from those used in the models in this report; in particular, they do not include computer use variables. However, the strongest predictor of Māori document literacy was found to be time spent in formal education (Satherley and Lawes, 2009b). The strongest predictors of prose literacy and document literacy for Pasifika were time spent in formal education and main language spoken in the home (Lawes, 2009b). These findings are consistent with the statistical modelling used in this report.

6.5 Summary

Language

Of all people aged 25-65, 84 per cent had English as a first language, and 99 per cent of these had English as their main home language. Five per cent did not have English as a first language but had English as their main home language, while 10 per cent did not have English either as a first language or as their main home language.

There was a strong association between these language categories and higher prose literacy and numeracy. Of people aged 25-65 with English as a first language, 63 per cent had higher English prose literacy (Levels 3 to 5) and 55 per cent had higher numeracy. Of people with non-English first language but English home language, 42 per cent had higher English prose literacy and 35 per cent had higher numeracy. Of people with non-English first language and home language, 22 per cent had higher English prose literacy (in other words, 78 per cent had

low English prose literacy) and 27 per cent had higher numeracy (i.e. 73 per cent had low numeracy). For those whose first language was not English, having English as the main home language made a significant difference to English prose literacy, but not to numeracy.

People whose first language was not English were much more likely to have a degree than native English speakers. Of people aged 25-65 with non-English first language, 44 per cent had a degree, compared with 23 per cent of native English speakers.

However, people with non-English first language were significantly less likely to have been employed in the past year, and if employed, were also significantly less likely to have used a computer at work.

There was a close relationship (though not an exact match) between language variables and ethnic identification. A minority of people aged 25-65 who identified as Asian (15 per cent) and Pasifika (33 per cent) had English as a first language, while a majority of people who identified as European (97 per cent), Māori (94 per cent) and Other (65 per cent) were native English speakers.

Ethnic identification

People with European or Other ethnic identification were most likely to have higher prose literacy, while Asian and Pasifika were least likely, with Māori intermediate between the European/Other and the Asian/Pasifika clusters. The Asian group clustered differently for numeracy. People with European or Other ethnic identification were most likely to have higher numeracy, Pasifika were the least likely, and Asian and Māori clustered together in an intermediate position.

The percentage of people with upper secondary or tertiary education was greatest among people with Asian identification (whose tertiary completion in particular was considerably higher than other groups), followed in order by European, Māori and Pasifika.¹⁹

The percentage of people who were employed in the past year, and of those, the percentage using a computer at work was significantly greater for people with European ethnic identification than for Māori, Pasifika and Asian.

As summarised above, the majority of people with European, Māori or Other ethnic identification had English as a first language, while only a minority of Pasifika and Asian people had English as a first language.

Taking each of the four main ethnic categories in turn:

- People with European identification had the second largest percentage with upper secondary or tertiary education, the greatest percentage using a computer at work, and 97 per cent had English as a first language. They had the greatest percentage with higher English prose literacy and the greatest percentage with higher numeracy.
- People with Māori identification had the second smallest percentage with upper secondary or tertiary education, an intermediate percentage using a computer at work, and 94 per cent had English as a first language. They were in an intermediate position compared with other ethnic identifications in terms of both prose literacy and numeracy.
- People with Pasifika identification had the smallest percentage with upper secondary or tertiary education, the smallest percentage using a computer at work, and the second smallest

¹⁹ Because of the small number of respondents with Other ethnic identification, they could not be included in this comparison

percentage with English as a first language. They had the smallest percentage with higher prose literacy and the smallest percentage with higher numeracy (in other words, the greatest percentages with low prose literacy and low numeracy).

- People with Asian identification had the greatest percentage with upper secondary or tertiary education, an intermediate percentage using a computer at work, and the smallest percentage with English as a first language (15 per cent). With Pasifika they had the smallest percentage with higher prose literacy, but an intermediate percentage with higher numeracy. It seems clear that the language factor had a particularly strong negative effect on prose literacy, and not such a strong effect on numeracy.

Ethnicity is closely related to language, and in the statistical models, the language variables account for a large part of the relative advantage in prose literacy and numeracy of Europeans, and a large part of the relative disadvantage of Pasifika and Asian people.

In addition, the extended models include two variables combining English as a first language with ethnic identification (Māori and Pasifika). These variables have a significant but relatively small negative effect for prose literacy (relative to other native English speakers) and a significant and relatively large negative effect for numeracy, after controlling for other variables including education, computer use, occupation and deprivation.

The inclusion of these variables in the models is parallel to that of the gender variable (see next chapter), in that both the combined language/ethnicity variables and the gender variable help to differentiate numeracy from prose literacy for particular groups (women compared with men, native English-speaking Māori and Pasifika compared with other native English speakers). As with gender, the language/ethnicity variables may represent different educational pathways available to different groups of people in past periods, but the survey does not provide detail which could confirm this.

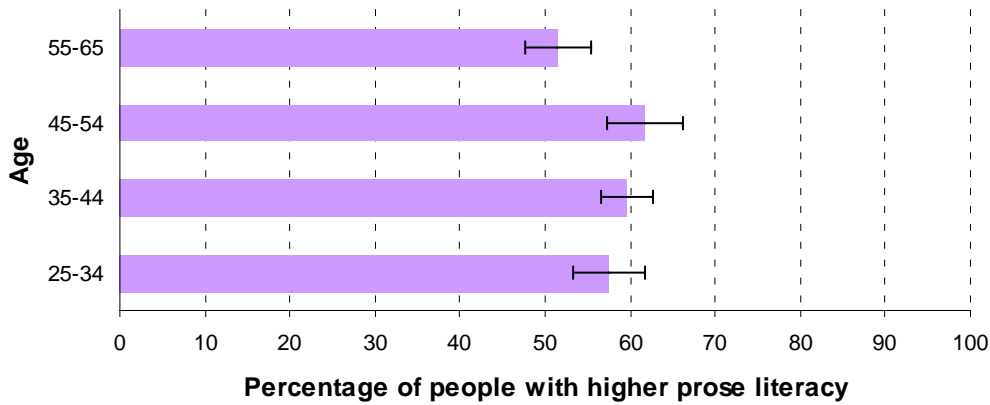
7 AGE AND GENDER

The demographic factors considered in this chapter are age, gender, and the interaction of age and gender.

7.1 Age

Looking at age in ten-year bands, the main effect in general is that the percentage of people aged 55-65 with higher prose literacy and with higher numeracy was significantly less than for younger age groups, as shown in Figures 71 and 72. To be more precise, the percentage of people aged 55-65 with higher prose literacy was significantly less than that for people age 45-54 or 35-44, but not significantly different from that for people aged 25-34. The percentage of people aged 55-65 with higher numeracy was significantly less than that for each of the younger age groups (45-54, 35-44 and 25-34).

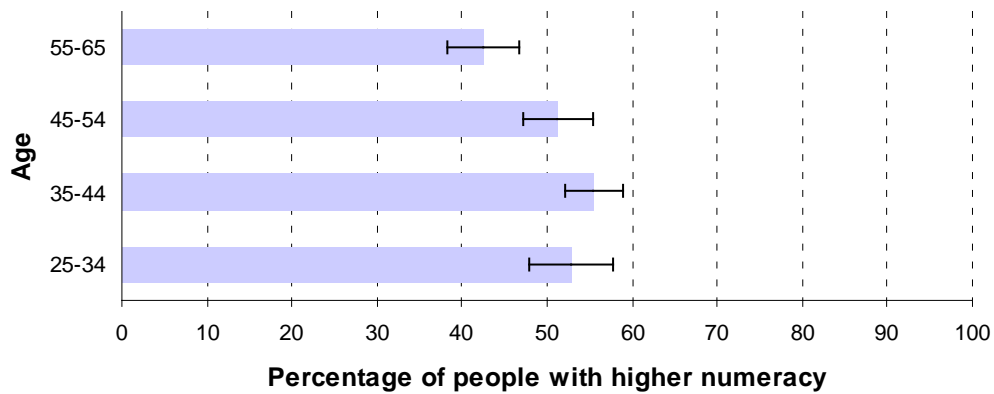
Figure 71
Percentage of people with higher prose literacy (Levels 3-5) by age



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 72
Percentage of people with higher numeracy (Levels 3-5) by age



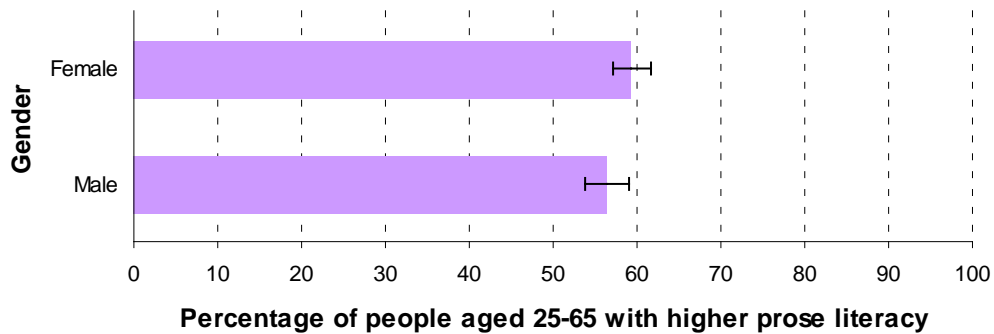
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

7.2 Gender

There was no significant gender difference in the percentage of people aged 25-65 with higher prose literacy, but there was a significantly greater percentage of men (57 per cent) with higher numeracy than of women (46 per cent), as shown in Figures 73 and 74.

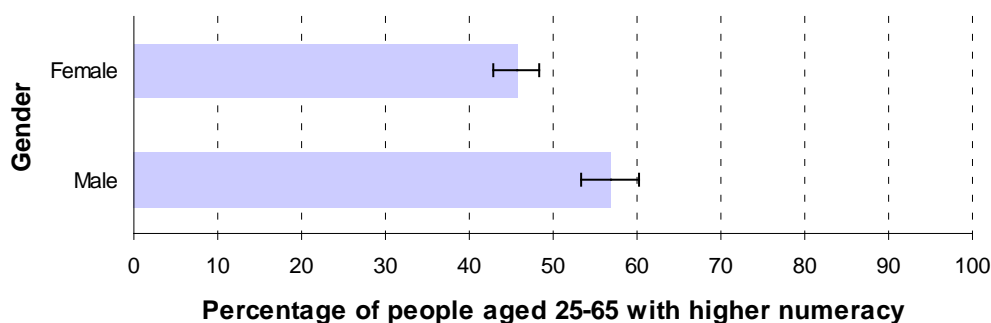
Figure 73
Percentage of people aged 25-65 with higher prose literacy by gender



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 74
Percentage of people aged 25-65 with higher numeracy by gender



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

When other factors are not controlled for, men are significantly more likely to have higher numeracy than women, but there is no significant gender difference in prose literacy. In the extended statistical models, where other factors *are* controlled for, there is a significant positive effect for men in numeracy, and also a significant positive effect for women in prose literacy, which counteracts men’s advantages in other factors including education, employment and computer use.

7.3 Age and gender

These are considered together because the two demographic variables interact in interesting ways.

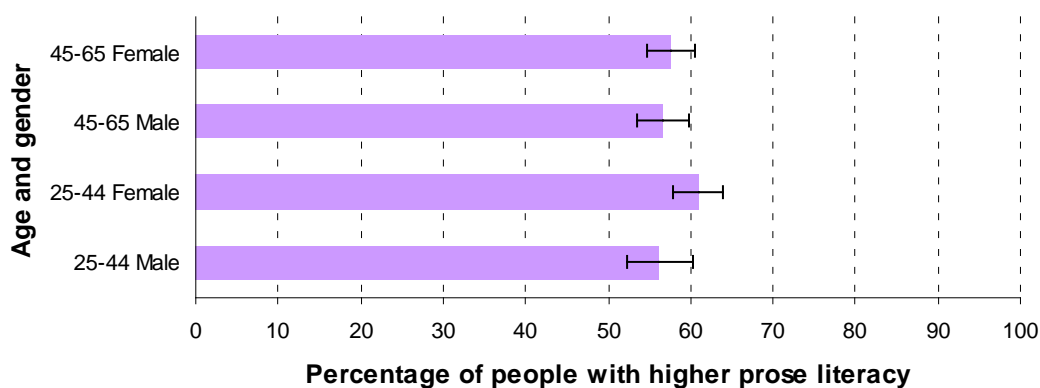
Four categories combining age and gender²⁰ will be compared:

- Age: 25-44; Gender: Male
- Age: 25-44; Gender: Female
- Age: 45-65; Gender: Male
- Age: 45-65; Gender: Female

There were no significant differences among the four categories in terms of prose literacy, but there were marked differences in numeracy, as shown in Figures 75 and 76. The percentage of people with higher numeracy was less for women than men within both age bands, and the percentage was significantly less for older women than for the other three groups. There was no significant difference between older and younger men, but the percentage was significantly greater for younger women than for older women.

²⁰ It is necessary to use 20-year age bands in order to obtain statistically robust results for each age/gender category.

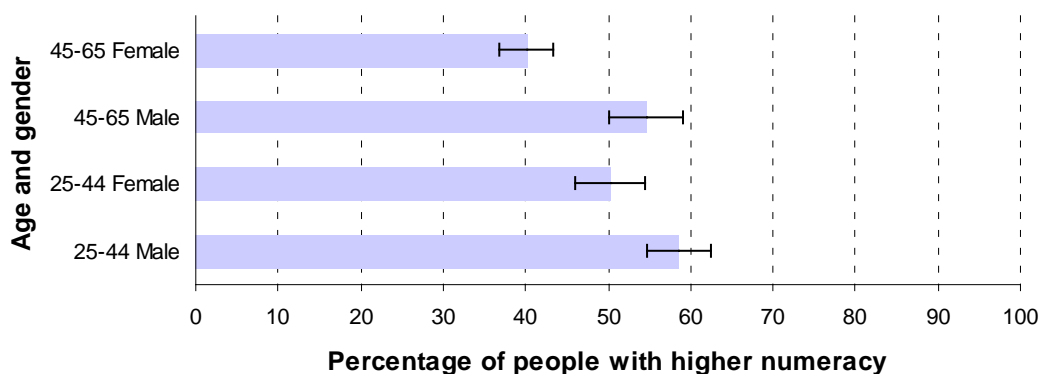
Figure 75
Percentage of people with higher prose literacy, by age and gender



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 76
Percentage of people with higher numeracy, by age and gender



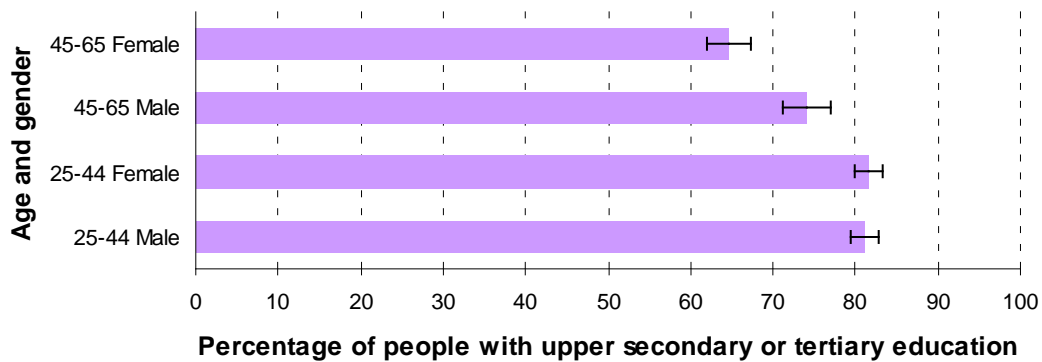
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

These age and gender patterns for prose literacy and numeracy are only partly explained by the basic factors of education, computer use and language.

Figure 77 shows the percentage of people in each age/gender category with upper secondary or tertiary education. A significantly smaller percentage of people in the older age group had reached these levels of education compared with the younger age group, and a significantly smaller percentage of older women had reached these levels compared with older men.

Figure 77
 Percentage of people with upper secondary or tertiary education, by age and gender

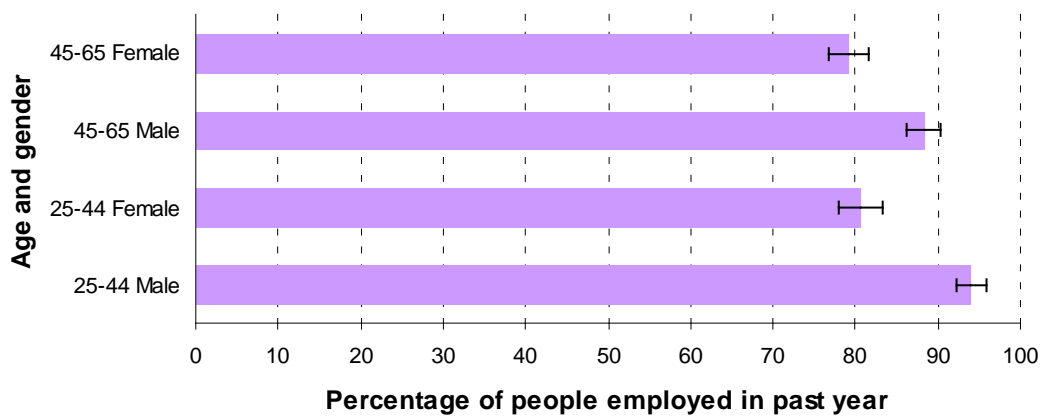


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Before considering computer use at work, it is important to note that there is a marked gender difference in the percentage of people employed. Figure 78 shows the percentage of people employed in the past year in each age/gender group. A significantly greater percentage of men than women were employed in the past year, and a significantly greater percentage of younger than older men.

Figure 78
 Percentage of people employed in the past year, by age and gender



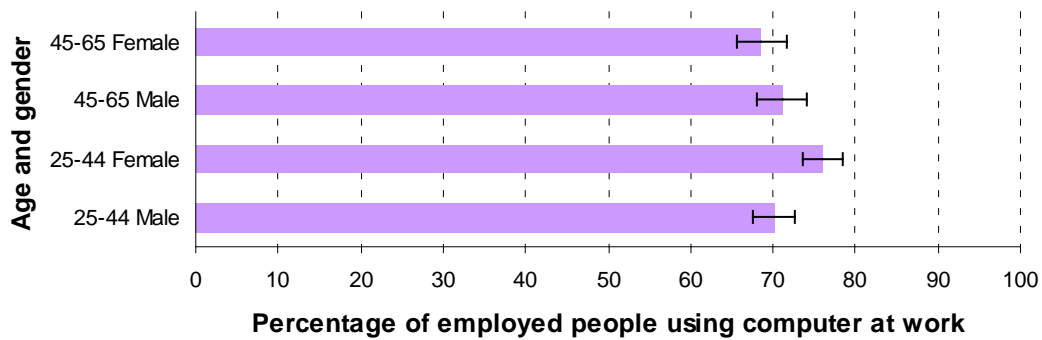
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

In terms of computer use, if we restrict attention to people employed in the past year, younger women were most likely to use a computer at work, and were significantly more likely to do so than younger men, while older women were comparable with older and younger men, as shown in Figure 79.

Figure 79

Percentage of employed people who had used a computer at work in the past year, by age and gender



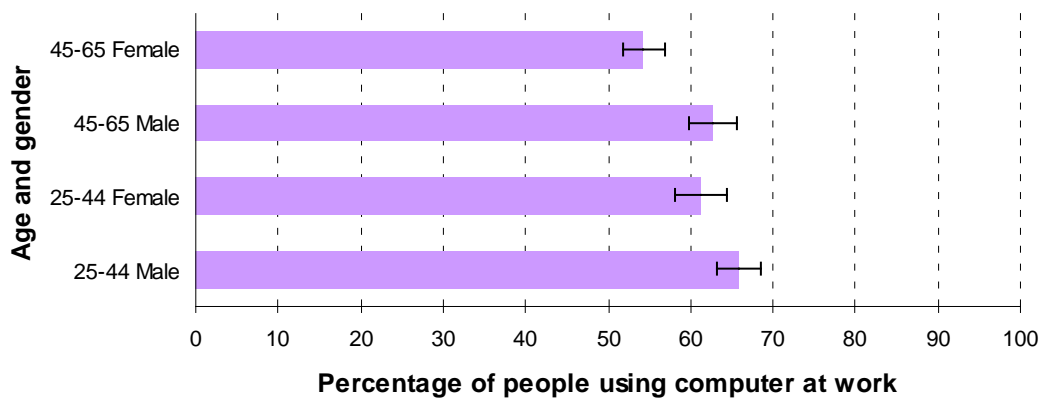
Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

However, men were significantly more likely than women to be employed, so when we look at work computer use across the whole population aged 25-65, older women were significantly less likely to have used a computer at work and younger women were comparable with men, as shown in Figure 80.

Figure 80

Percentage of people who had used a computer at work in the past year, by age and gender

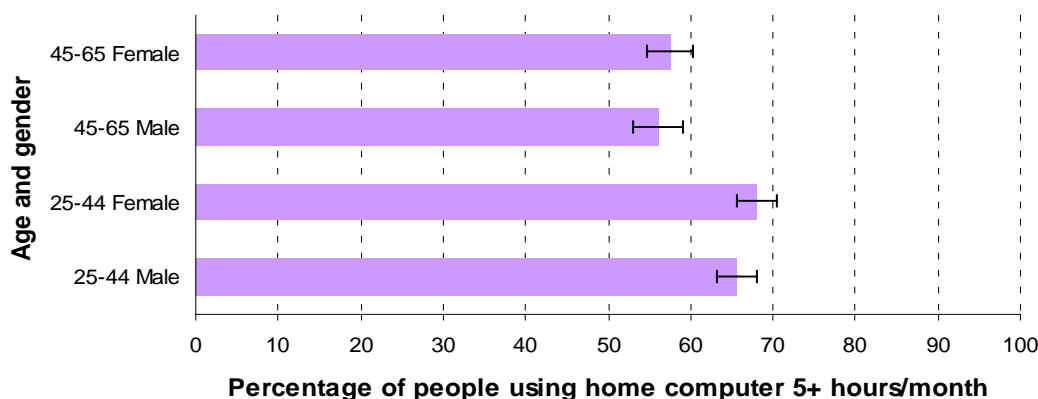


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 81 shows the percentage of people using a home computer for 5 or more hours per month by age and gender. Here there was no significant gender difference, but younger people were significantly more likely to use a home computer to that extent than older people.

Figure 81
Percentage of people using a computer at home for 5 or more hours per month, by age and gender

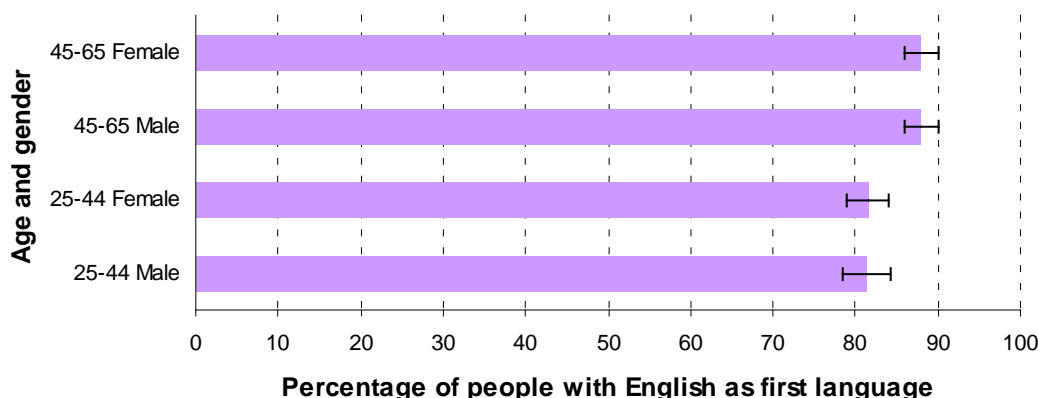


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

However, the older men and women were more likely to be native English speakers, as shown in Figure 82.

Figure 82
Percentage of people with English as a first language, by age and gender



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Older women clearly had less education and were less likely to use a computer at work (because they were less likely to be employed): this partly explains their lower numeracy, but these factors do not appear to have such an effect on prose literacy.

Because the basic factors of education, computer use and language do not fully account for the age and gender distribution of higher prose literacy and numeracy, it helps to have age and gender factors in the extended models.

In the extended statistical models, being aged 45-65 is a significant negative predictor for numeracy but not a significant predictor for prose literacy, while being male is a positive predictor for numeracy but a negative predictor for prose literacy.

The gender differences may reflect different educational paths for men and women but it is not possible to explore this using the ALL survey because respondents were not asked about their

educational history in detail, and so there is no information on such topics as the subjects they studied or for how long they pursued mathematics or other quantitative studies.

7.4 Summary

Age

People aged 55-65 were significantly less likely to have higher prose literacy than people aged 45-54 or 35-44, but not significantly less likely than people aged 25-34. People aged 55-65 were significantly less likely to have higher numeracy than people aged 45-54, 35-44 or 25-34.

Gender

The percentage of men and women aged 25-65 with higher prose literacy was not significantly different, but there was a significantly greater percentage of men (57 per cent) with higher numeracy than women (47 per cent).

Age and gender

Age and gender were considered together, with age divided into two bands (25-44 and 45-65) for statistical robustness.

There were no significant differences among the age/gender categories in the percentage with higher prose literacy, but there were significant differences in numeracy. Within each age band, men were significantly more likely to have higher numeracy than women, but younger women were on a par with older men. The percentage of younger and older men with higher numeracy was not significantly different, but younger women were significantly more likely to have higher numeracy than older women. In fact, the percentage of older women with higher numeracy was significantly less than that for each of the other three age/gender groups.

These age/gender patterns were partly accounted for by education, employment, computer use, and first language. The percentages of younger men and women who had completed upper secondary or tertiary education was significantly greater than the percentage of older men, which in turn was significantly greater than the percentage of older women. Men (both older and younger) were significantly more likely to have been employed in the past year than women (both older and younger). Among those who had been employed, younger women were significantly more likely to have used a computer at work than younger men, while older women's and older men's work computer use was not significantly different. Among people aged 25-65 as a whole though, because of women's lower employment rate, older women were significantly less likely to have used a computer at work than any of the other three age/gender groups. Younger women and men were significantly more likely to use a computer at home than both older women and older men. On the other hand, older men and women were significantly more likely to be native speakers of English.

In particular, these factors would appear to account for the relatively small percentage of older women with higher numeracy, but not for the fact that the percentage of older women with higher prose literacy is comparable with that of the other age/gender groups. Similarly, these factors account satisfactorily for the percentage of younger men and women with higher prose literacy being comparable, but not for the fact that younger men were significantly more likely to have higher numeracy than younger women.

These anomalies are dealt with in the extended statistical models by including age and gender variables, with being older a negative predictor of higher numeracy, and being male a negative predictor of higher prose literacy but a positive predictor of higher numeracy.

These age and gender variables may be proxies for other factors which were not explored in the survey. One possible explanation is that younger and older men and women have had different

educational histories, not just in the educational levels they reached, but also in their opportunities and choices to study different subjects at the different levels and to learn different skills, such as mathematical skills. The survey does not go into this kind of detail of educational history.

8 KEY FACTORS IN COMBINATION

The key factors associated with higher prose literacy and numeracy, as identified in this report, were higher levels of education (upper secondary, tertiary non-degree or degree), computer use at work and/or at home, and English as first and main home language. Taken together, these factors account for a considerable amount of the variation among people aged 25-65 in prose literacy and numeracy, as indicated in the discussion of statistical models in Appendix A. The statistical models provide one method of analysing the interplay of these factors.

This chapter takes a more straightforward descriptive approach to the way these three factors interact, and begins by simplifying the picture by choosing one variable to represent each of the three factors.

8.1 Combined effects of education, computer use and language

To represent the combined effects of these three key factors, completed education can be simplified to lower secondary (Year 11 or less) as opposed to upper secondary or tertiary, computer use to use of a computer at work or not, and language to English as first language or not. When used in a simplified statistical model, these three variables can account for 32 to 33 per cent of variation in prose literacy or numeracy (see Appendix A).

There are two distinct alternatives to using a computer at work, namely not being employed, or being employed but not using a computer at work. Consequently we can define 12 categories which combine education (2 alternatives), computer use (3 alternatives) and language (2 alternatives).

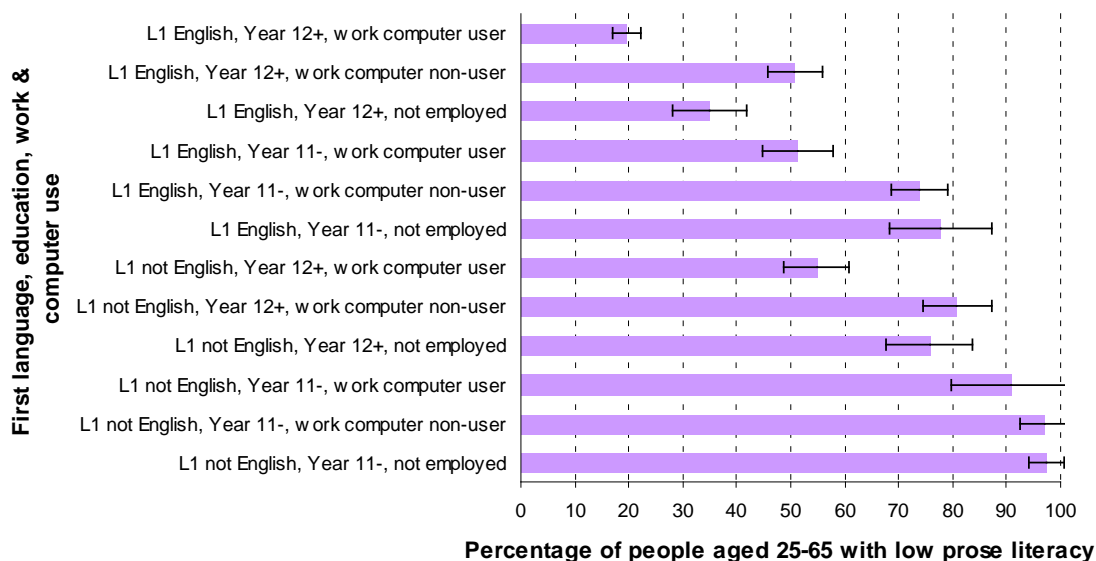
Rates of low prose literacy and numeracy

Figures 83 and 84 show the percentages of people aged 25-65 with *low* prose literacy and numeracy (Levels 1-2)²¹ in each of the 12 combined categories. The patterns for prose literacy and numeracy were very similar, and in both cases the twelve categories can be clustered into four groups.

²¹ In this case the estimates of percentages with low prose literacy and numeracy are more reliable than those for higher prose literacy and numeracy.

Figure 83

Percentage of people aged 25-65 with low prose literacy (Levels 1-2) by combined effect of language, education, employment and work computer use

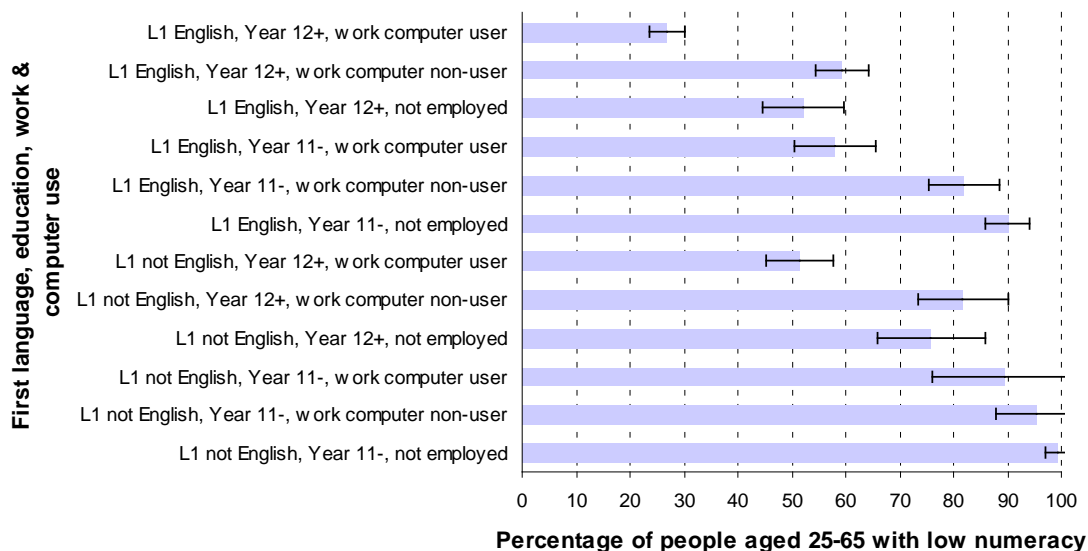


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

Figure 84

Percentage of people aged 25-65 with low numeracy (Levels 1-2) by combined effect of language, education, employment and work computer use



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: For an explanation of the categories see Chapter 10. The bars represent the margins of error (at the 95% confidence level).

At one extreme, almost all of those whose first language was not English and whose highest completed education was lower secondary or less had low prose literacy and low numeracy. It was not clear whether using a computer at work made a difference within this group. Only a small proportion did so, and so the margin of error for the computer users was large.

The second group, of whom approximately 70 to 90 per cent had low literacy or low numeracy, comprised firstly people whose first language was not English, who had upper secondary or tertiary education, who either were not employed or were employed but did not use a computer at work, and secondly people whose first language was English, who had a lower secondary education or less, who were either not employed or employed but did not use a computer at work. Also possibly belonging to this group was the small category of people whose first language was not English, who had lower secondary education or less but did use a computer at work.

Another way of describing these first two groups is to say that they consist of those categories where at most one of the characteristics (English as first language, upper secondary or tertiary, work computer use) favoured higher literacy and numeracy.

Of the third group, 30 to 70 per cent had low prose literacy or numeracy. There were three categories in this group:

- people who did not have English as a first language, who had upper secondary or tertiary education and used a computer at work
- people whose first language was English, who had lower secondary education or less, who used a computer at work
- people whose first language was English, who had upper secondary or tertiary education, who either were not employed or were employed but did not use a computer at work

Another way of describing this third group is to say that it consists of those categories where two of the characteristics (English as first language, upper secondary or tertiary, work computer use) favoured higher literacy and numeracy.

Of the remaining group, approximately 20 to 30 per cent had low prose literacy or numeracy (in other words, about 70 to 80 per cent had higher prose literacy or numeracy). This group consisted of the single category of people whose first language was English, who had an upper secondary or tertiary education and who used a computer at work. In other words, this group had all three of the key characteristics favouring higher literacy and numeracy.

There was one small difference between the patterns for prose literacy and numeracy. For prose literacy, the category of people who had English as a first language, who had upper secondary or tertiary education, and who were not employed, was distinct from all other categories. The percentage of this category with low prose literacy was significantly greater than for the corresponding category who used a computer at work, but was also significantly smaller than among the next three categories, namely:

- those with English as a first language, and with upper secondary or tertiary education, who were employed but did not use a computer at work
- those with English as a first language and with lower secondary education or less, who used a computer at work
- those whose first language was not English, who had upper secondary or tertiary education, who used a computer at work

For numeracy, this category (English as first language, upper secondary or tertiary, not employed) was not significantly different from the three bulleted categories.

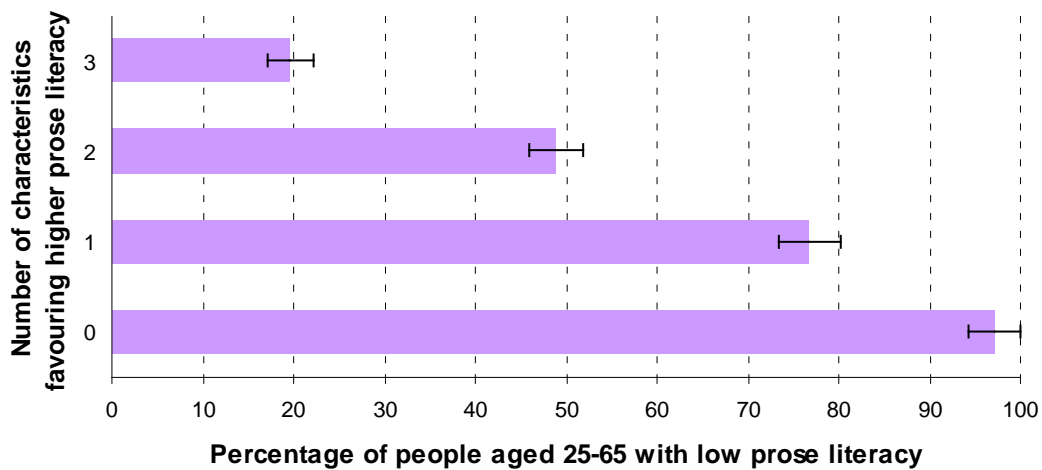
On the basis of the broad pattern of the clustering of these results (overlooking the minor difference between prose literacy and numeracy), there is a simpler way of representing them, using the number of major characteristics favouring higher prose literacy or numeracy, namely:

- English as first language
- upper secondary or tertiary education
- using a computer at work

The number of characteristics can range from zero (which corresponds to the category of people without English as first language, with lower secondary or less education, and no work computer use) to three (which corresponds to the category of people with English as a first language, with upper secondary or tertiary education, and using a computer at work). This number of characteristics favouring higher prose literacy and numeracy will be referred to as the **key factor scale**. Figures 85 and 86 show the percentages of people aged 25-65 with low prose literacy and low numeracy according to this key factor scale. There are clear and significant differences between each group defined by the key factor scale.

Figure 85

Percentage of people aged 25-65 with low prose literacy according to the key factor scale

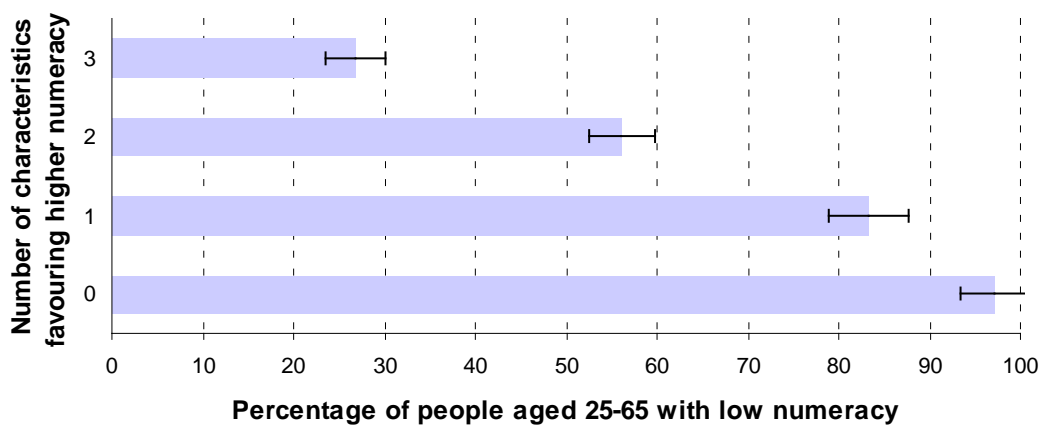


Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: The bars represent the margins of error (at the 95% confidence level).

Figure 86

Percentage of people aged 25-65 with low numeracy according to the key factor scale



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: The bars represent the margins of error (at the 95% confidence level).

Of the people who had none of the three key characteristics favouring higher literacy or numeracy, an estimated 97 per cent had low prose literacy, and 97 per cent also had low numeracy. Of those with one key characteristic favouring higher literacy or numeracy, 77 per cent had low prose literacy and 83 per cent had low numeracy. Of those with a key factor scale value of 2, 49 per cent had low prose literacy and 56 per cent had low numeracy, while among those with all three characteristics favouring higher prose literacy or numeracy, 20 per cent had low prose literacy and 27 per cent had low numeracy.

Breakdowns of low prose literacy and numeracy groups

Another way to look at low prose literacy and numeracy is in terms of the composition of the groups of people with low prose literacy and numeracy.

Among the estimated 893,000 people aged 25-65 with low prose literacy (Levels 1-2), 704,000 (79 per cent) had at least one of the characteristics of non-English first language, lower secondary education or less, not being employed in the past year, or being employed but not using a computer at work. 237,000 (27 per cent) had non-English first language, 358,000 (40 per cent) had lower secondary education or less, 190,000 (21 per cent) were not employed, and 335,000 (38 per cent) were employed but did not use a computer at work.

However there was considerable overlap between these categories. Of those with low prose literacy, 63,000 (7 per cent) had both non-English first language and lower secondary education or less. 63,000 (7 per cent) had non-English first language and were not employed. 87,000 (10 per cent) had non-English first language and were employed but did not use a work computer. 107,000 (12 per cent) had lower secondary education or less and were also not employed. 149,000 (17 per cent) had lower secondary education or less and were employed but did not use a computer at work.

Finally, 26,000 (3 per cent) of those with low prose literacy had the combination of non-English first language, lower secondary education or less and not being employed. Similarly, 29,000 (3 per cent) had the combination of non-English first language, lower secondary or less, and being employed but not using a work computer.

Among the estimated 1,040,000 people aged 25-65 with low numeracy (Levels 1-2), 781,000 (75 per cent) had at least one of the characteristics of non-English first language, lower secondary education or less, not being employed in the past year, or being employed but not using a computer at work. 233,000 (22 per cent) had non-English first language, 396,000 (38 per cent) had lower secondary education or less, 225,000 (22 per cent) were not employed, and 370,000 (36 per cent) were employed but did not use a computer at work.

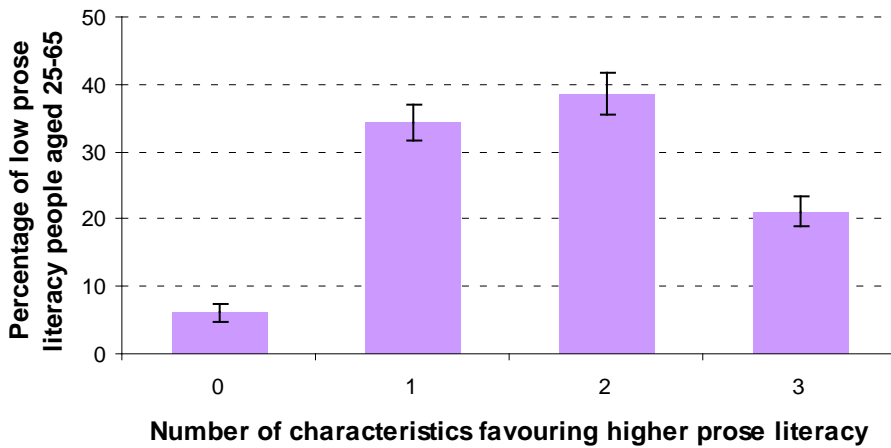
There was a similar degree of overlap between these numeracy categories as between prose literacy categories. Of those with low numeracy, 63,000 (6 per cent) had both non-English first language and lower secondary education or less. 64,000 (6 per cent) had non-English first language and were not employed. 88,000 (8 per cent) had non-English first language and were employed but did not use a work computer. 120,000 (12 per cent) had lower secondary education or less and were also not employed. 162,000 (16 per cent) had lower secondary education or less and were employed but did not use a computer at work.

Finally, 26,000 (3 per cent) of those with low numeracy had the combination of non-English first language, lower secondary or less and not being employed. Similarly, 28,000 (3 per cent) had the combination of non-English first language, lower secondary or less, and being employed but not using a work computer.

Figures 87 and 88 show breakdowns of the low prose literacy and low numeracy groups according to the key factor scale. The bulk (approximately 70 per cent) of people with low

prose literacy or with low numeracy had one or two characteristics favouring higher prose literacy or numeracy. Even though almost all people with none of the characteristics (first language not English, low education, no work computer use) had low prose literacy or numeracy, they represented a small proportion of the low prose literacy group (6 per cent) and of the low numeracy group (5 per cent). And even though a small minority of people with all three characteristics (i.e. people with English as a first language, upper secondary or tertiary education, and work computer use) had low prose literacy or numeracy, these people represented about a quarter of all those with low prose literacy (21 per cent) or numeracy (25 per cent).

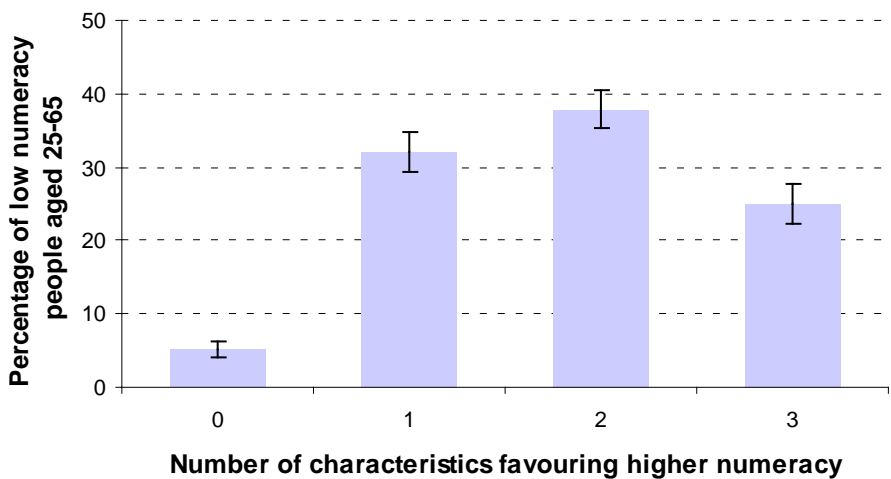
Figure 87
Breakdown of group of low prose literacy people aged 25-65 by key factor scale



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: The bars represent the margins of error (at the 95% confidence level).

Figure 88
Breakdown of group of low numeracy people aged 25-65 by key factor scale



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: The bars represent the margins of error (at the 95% confidence level).

A salient feature of the groups with low prose literacy and low numeracy was the relatively large percentages that did not use a computer at work (59 per cent of those with low prose literacy, and 57 per cent of those with low numeracy). There was in fact a large overlap between the groups of people with low prose literacy or numeracy and the group of people who did not use a computer at work (i.e. were not employed or were employed but did not use a computer use at work). A majority of people who did not use a computer at work had low prose literacy or numeracy, and a majority of those with low prose literacy and numeracy did not use a computer at work.

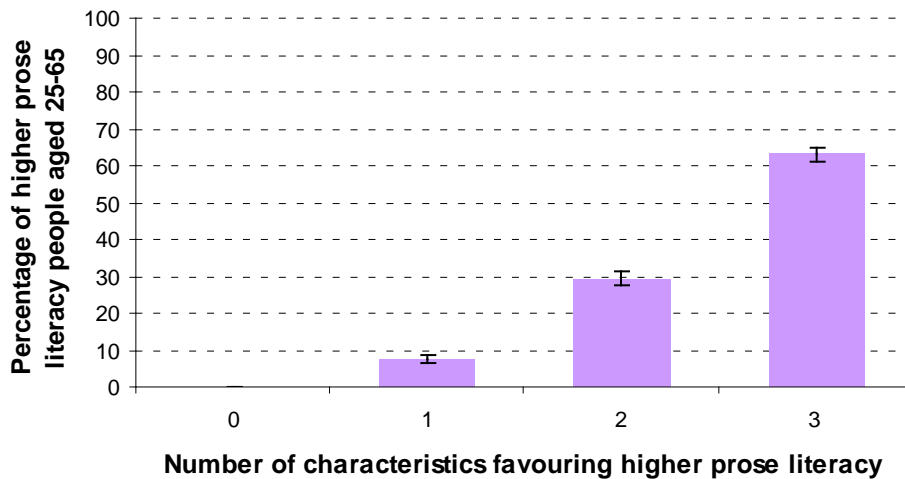
Breakdowns of higher prose literacy and numeracy groups

Of the estimated 1,230,000 people with higher prose literacy, 1,137,000 (92 per cent) had English as a first language, 1,073,000 had upper secondary or tertiary education (87 per cent) and 930,000 (76 per cent) used a computer at work. There was a great deal of overlap between these groups: 1,136,000 (92 per cent) had at least two of these characteristics, and 776,000 (63 per cent) had all three characteristics.

Of the estimated 1,083,000 people with higher numeracy, 986,000 (91 per cent) had English as a first language, 964,000 had upper secondary or tertiary education (89 per cent) and 852,000 (79 per cent) used a computer at work. As with prose literacy, there was a great deal of overlap between these higher numeracy groups: 1,015,000 (94 per cent) had at least two of these characteristics, and 706,000 (65 per cent) had all three characteristics.

Figures 89 and 90 show the breakdowns of the groups with higher prose literacy and higher numeracy according to the key factor scale.

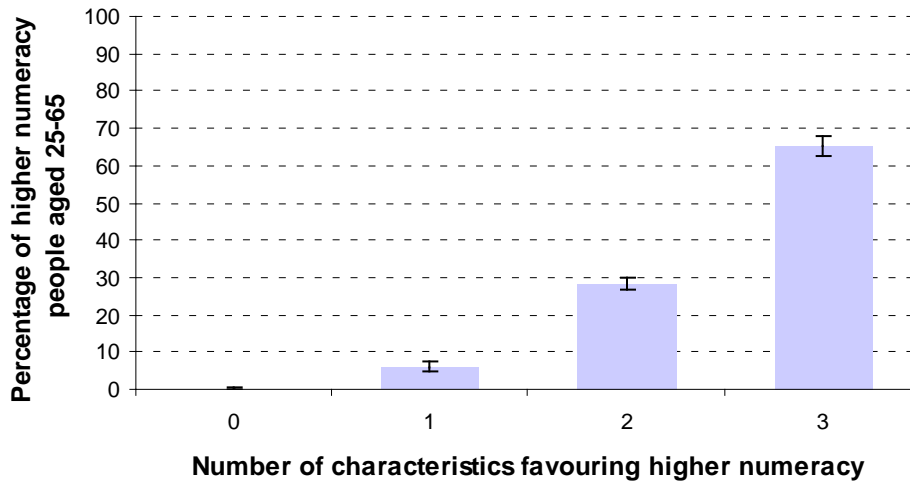
Figure 89
Breakdown of group with higher prose literacy by key factor scale



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: The bars represent the margins of error (at the 95% confidence level).

Figure 90
Breakdown of group with higher numeracy by key factor scale



Source: New Zealand results of the Adult Literacy and Life Skills Survey. Ministry of Education calculations

Note: The bars represent the margins of error (at the 95% confidence level).

In summary, there was a large overlap between the groups of people with higher prose literacy or numeracy and the group of people with the combination of upper secondary or tertiary education, English as a first language, and computer use at work. A majority of people with all three characteristics had higher prose literacy and numeracy, and a majority of those with higher prose literacy and numeracy had all three characteristics.

9 CONCLUSION

This report has analysed a number of variables with a view to accounting for variation (e.g. regional differences) in literacy and numeracy, and explored their relationships with English prose literacy and numeracy among people aged 25-65. These variables include:

- Level of education completed, and recent upskilling
- Labour force status
- Computer use at work and at home
- Occupation, industry and income
- First language, main language spoken at home, place of birth and ethnic identification
- Age and gender

Over 40 per cent of the variation in prose literacy and numeracy scores can be accounted for in regression models which include completed education, labour force status, work and home computer use, and first language and main home language. Occupational, age, gender and ethnicity variables have significant but relatively small additional effects.

Higher prose literacy and numeracy scores were strongly associated with having upper secondary or tertiary education, being employed, using a computer at work, using a computer at home for five or more hours per month, and having English as both first and main home language. The computer use variables are found to be strongly related to white collar employment, to involvement in upskilling and to the intensity of involvement in literacy and numeracy activities at work and in personal reading. Computer use at work distinguishes within occupation and within industry between jobs requiring or not requiring high involvement in literacy and numeracy activities.

Higher prose literacy and numeracy were also associated with working in a managerial, professional or technical occupation. After controlling for education, computer use, language and occupation, the additional characteristics of being male or the combination of having English as a first language and being Māori or Pasifika favoured low prose literacy (though the effects were relatively small); while being older, being female or the combination of having English as a first language and being Māori or Pasifika favoured low numeracy (although the age and gender effects were relatively small).

The various factors are now considered in a little more detail.

Education

There was a strong association between level of education completed and the percentage of people with higher prose literacy or numeracy. People whose highest completed level was lower secondary (Year 11 or less) were much less likely to have higher prose literacy or numeracy (i.e. more likely to have low prose literacy or numeracy) compared with people who had completed upper secondary or tertiary education. People who had completed bachelors or postgraduate degrees were much more likely than those who had not, to have higher prose literacy and especially higher numeracy.

At every level of completed education, people who had completed formal or non-formal courses in the past year were more likely to have higher prose literacy and higher numeracy than people who had not taken courses.

Labour force status, computer use and employment related factors

Among people aged 25-65, those who were employed and students were most likely to have higher prose literacy and higher numeracy, although there were very few people in this age range whose main labour force status was student.

People who had been employed in the past year were significantly more likely to have higher prose literacy and numeracy than people who had not, although the advantage of being employed was confined mainly to people who had used a computer at work.

People aged 25-65 who had been employed and used a computer at work in the past year were significantly more likely to have higher literacy and numeracy compared with people who had not been employed or who had been employed and not used a computer at work.

Use of a computer at work was strongly associated with being employed in managerial, professional, technical or clerical occupations, although a significant proportion of workers in other occupational groups also used computers. People who had used a computer at work in the past year were likely to be involved in a much wider range of regular work activities related to literacy and numeracy than those who had not, and those who were involved in a greater number of types of regular literacy or numeracy activities were more likely to have higher literacy or numeracy. Computer use at work appears to pinpoint, more effectively than occupational categories, those jobs which require or encourage regular literacy and numeracy activities, and this probably reflects the importance of the computer as a tool for literacy and numeracy activities. The difference in mean prose literacy and numeracy between work computer users and non-users within occupations was comparable with the difference between occupations, and was considerably greater than the differences between industries.

Similarly, people who used a computer at home were more likely to engage in a wide range of regular personal reading activities. There was a straightforward relationship between increase in the number of types of regular personal reading and higher literacy and numeracy scores.

Computer use at work and computer use at home were only moderately correlated with each other, and have separate and cumulative effects in the statistical models. Taken together they form a four-step scale, such that people who used a computer at work and also used a computer at home were more likely to have higher prose literacy or numeracy than those who used a computer only at work, who were more likely to have higher prose literacy and numeracy than those who used a computer only at home, who in turn were much more likely to have higher prose literacy or numeracy than those who did not use a computer in either location.

Those who used a computer both at work and at home, or who had used a computer at work, were significantly more likely to have taken formal or non-formal courses in the past year than those who used a computer at home but not at work, and these people were significantly more likely to have taken courses than people who did not use a computer at home or at work. The association between computer use and upskilling held across all levels of completed education.

There was a small but significant additional effect (incorporated in the extended statistical models) of occupation, with managers, professionals and technicians having higher prose literacy and numeracy than clerks and service workers and farmers, fishers and tradespeople, who in turn had higher prose literacy and numeracy than machine operators and elementary workers.

People in the industry category 'finance, business and community services' were more likely to have higher prose literacy and numeracy than people in other industries. Prose literacy and numeracy also correlated with income: people with higher personal incomes were more likely to have higher prose literacy or numeracy than people with lower incomes.

However, industry and personal income are redundant in the statistical models for prose literacy and numeracy once other factors (including labour force status, computer use and occupation) are taken account of, because of the correlations that industry and income have with those other variables; and the computer use variables have stronger predictive value in the statistical models.

On the basis of previous research it could be expected that there would be a relationship between the variables of work and home computer use and the measures of prose literacy and numeracy. How it would compare with employment-related factors such as occupation and industry was not clear.

It is therefore remarkable to find that the computer use variables are such strong predictors of prose literacy and numeracy, and that they are somewhat stronger than occupation and industry as predictors (when education is controlled for). Computer use at work in fact accounts for some of the variation between different occupations, but has a bigger effect within occupations and industries.

Language and ethnic identification

Of all people aged 25-65, 84 per cent had English as a first language, and 99 per cent of these had English as their main home language. Five per cent did not have English as a first language but had English as their main home language, while 10 per cent did not have English either as a first language or as their main home language.

There was a strong association between these language categories and higher prose literacy and numeracy. A majority of people with English as a first language had higher prose literacy and higher numeracy, while only a minority of people whose first language was not English had higher prose literacy or numeracy. Among those people whose first language was not English, those whose main home language was English were more likely to have higher prose literacy than those whose main home language was not English.

People whose first language was not English were much more likely to have a degree than native English speakers, but were significantly less likely to be employed, and if employed, to have used a computer at work.

There was a close relationship (though not an exact match) between language variables and ethnic identification. A minority of people aged 25-65 who identified as Asian (15 per cent) and Pasifika (33 per cent) had English as a first language, while a majority of people who identified as New Zealand European (97 per cent), Māori (94 per cent) and Other (65 per cent) were native English speakers.

In the statistical models, the language variables account for a large part of the relative advantage in prose literacy and numeracy of Europeans, and a large part of the relative disadvantage of Pasifika and Asian people.

However, the language variables do not account for the relative disadvantage of Māori and Pasifika who were native English speakers. This is dealt with in the extended statistical models by the inclusion of independent variables combining having English as a first language with having Māori or Pasifika ethnic identification, which have significant but small effects in improving the model of prose literacy, but much larger and also significant effects on the model of numeracy.

Age and gender

People aged 55-65 were significantly less likely to have higher prose literacy than people aged 45-54 or 35-44, but not significantly less likely than people aged 25-34. People aged 55-65 were significantly less likely to have higher numeracy than people aged 45-54, 35-44 or 25-34.

The percentage of men and women aged 25-65 with higher prose literacy was not significantly different, but there was a significantly greater percentage of men (57 per cent) with higher numeracy than women (46 per cent).

Age and gender were also considered together, with age divided into two bands (25-44 and 45-65) for statistical robustness.

There were no significant differences among the age/gender categories in the percentage with higher prose literacy, but there were significant differences in numeracy. Within each age band, men were significantly more likely to have higher numeracy than women, but younger women were on a par with older men. The percentage of younger and older men with higher numeracy was not significantly different, but younger women were significantly more likely to have higher numeracy than older women. In fact, the percentage of older women with higher numeracy was significantly less than that for each of the other three age/gender groups.

Women, especially older women, were disadvantaged in terms of education, employment and computer use. Once these gender differences were controlled for, women emerged as having a significant advantage in prose literacy.

These complexities are dealt with in the extended statistical models by including age and gender variables, with being older a negative predictor of higher numeracy, and being male a negative predictor of higher prose literacy but a positive predictor of higher numeracy.

Regional comparisons

A large number of variables have been considered in this report, and all of them show some relationship with prose literacy or numeracy. This analysis was originally developed for the purpose of comparing geographical regions within New Zealand. Trying to account for regional differences in prose literacy and numeracy in terms of all these variables could be a recipe for confusion. However, this report has identified a set of key factors which account for a large part of the variation in prose literacy and numeracy, and which provide a basis for a focused approach to comparing regions. These key factors are: level of completed education, work and home computer use, and first language and main home language.

Combined effect of education, computer use and language

The combined effect of the three key factors identified can be represented by a variable (the *key factor scale*) based on three characteristics which favour higher literacy and numeracy, namely having upper secondary or tertiary education (as opposed to lower secondary or less), using a computer at work (as opposed to not being employed, or being employed but not using a work computer), and having English as a first language (as opposed to not having English as a first language). The key factor scale is the number of these characteristics held by an individual, so that a scale value of zero represents anyone with lower secondary education or less who did not use a computer at work and who did not have English as a first language. A scale value of 1 or 2 represents anyone with any one or any two of the characteristics favouring higher prose literacy and numeracy. And a scale value of 3 represents anyone with upper secondary or tertiary education who used a computer at work and had English as a first language.

Of the estimated 2,122,000 people aged 25-65, 893,000 (42 per cent) had low prose literacy and 1,040,000 (49 per cent) had low numeracy. 1,230,000 (58 per cent) had higher prose literacy and 1,083,000 (51 per cent) had higher numeracy.

Among the 56,000 people with a key factor scale value of zero (i.e. low education, no work computer use, first language not English), 97 per cent had low prose literacy (Levels 1-2) and 97 per cent also had low numeracy (Levels 1-2). This group accounted for an estimated 54,000 (6 per cent) of those with low prose literacy and also 54,000 (5 per cent) of those with low numeracy. The numbers in this group with higher prose literacy or higher numeracy were too small to be reliably estimated.

Among the 399,000 people with a key factor scale value of 1 (i.e. only one of the characteristics favouring higher literacy and numeracy), 77 per cent had low prose literacy (and so 23 per cent had higher prose literacy) and 83 per cent had low numeracy (hence 17 per cent had higher numeracy). This group accounted for 307,000 (34 per cent) of those with low prose literacy and 333,000 (32 per cent) of those with low numeracy. This group also included 93,000 (8 per cent) of those with higher prose literacy and 66,000 (6 per cent) of those with higher numeracy.

Of the 702,000 people with a scale value of 2, 49 per cent had low prose literacy (and so 51 per cent had higher prose literacy) and 56 per cent had low numeracy (thus 44 per cent had higher numeracy). This group accounted for 343,000 (39 per cent) of those with low prose literacy and 394,000 (38 per cent) of those with low numeracy. This group also included 359,000 (29 per cent) of those with higher prose literacy and 308,000 (29 per cent) of those with higher numeracy.

Finally, of the 965,000 people with a scale value of 3 (i.e. those with upper secondary or tertiary education, who used a computer at work and had English as a first language), 20 per cent had low prose literacy (and so 80 per cent had higher prose literacy) and 27 per cent had low numeracy (hence 73 per cent had higher numeracy). This group accounted for 189,000 (21 per cent) of those with low prose literacy and 259,000 (25 per cent) of those with low numeracy. This group also included 776,000 (63 per cent) of those with higher prose literacy and 706,000 (65 per cent) of those with higher numeracy.

Some implications and cautions

Educational qualifications have often been used as approximate indicators of literacy and numeracy. Previous analyses of the ALL survey data (Earle, 2009b; Earle, 2009c; Smyth and Lane, 2009) have highlighted a number of situations in which educational qualifications do not give a good guide to literacy or numeracy skills.

This study provides a basis for similar caution more broadly. After controlling for other factors, the difference between having English as a first language, and not having English as either a first language or as the main home language, was of the same order as the difference between having a degree and having a lower secondary education or less, in terms of the likelihood of having higher literacy or numeracy. The difference between being employed and using a computer at work, and not being employed or not using a computer at work, was of the same order as the difference between having a degree and having an upper secondary education but no tertiary education.

Although computer use at work was a good guide to higher prose literacy and numeracy (at least in 2006 when the survey was done), it does not follow that increasing the use of computers would in itself improve the literacy or numeracy rate. Computer use at work appears to be a clue to the kind of work undertaken, that is, the computer is a tool for literacy and numeracy and that is why it is an indicator of jobs which regularly involve a wide range of literacy and numeracy activities. One would need a certain level of literacy and/or numeracy to begin such a job, and working in such a position would provide continuing practice and probably enhancement of literacy and/or numeracy.

There would be much more involved in increasing the proportion of jobs which have this character than changing the technology to be used (although this would be a part of it). The fact that education and language were key factors in the variation in literacy and numeracy indicates that provision of education in general, and specifically English for speakers of other languages, has a significant role to play.

One way to appreciate the implications of this analysis is to examine the characteristics of people with higher prose literacy or numeracy, and of those with low prose literacy or numeracy.

Of people with higher prose literacy or numeracy, the majority had all three of the key characteristics favouring higher literacy and numeracy, namely upper secondary or tertiary education, English as a first language, and use of a computer at work.

People who lacked just one of these key characteristics were approximately as likely to have low literacy or numeracy as they were to have higher literacy or numeracy. The majority of people with none or only one of the key characteristics had low literacy or numeracy.

Of people aged 25-65 with low prose literacy or numeracy (Levels 1-2), those with lower secondary education or less, and those whose first language was not English, were considerably over-represented. A majority of people with low prose literacy or numeracy had not used a computer at work in the past year, just as a majority of those who had not used a computer at work had low prose literacy and numeracy.

This high degree of overlap between the groups of people with low prose literacy and low numeracy, and the group who had little or no use of computers is of considerable importance. It indicates that programmes seeking to use information and communication technologies in improving people's literacy and numeracy need to take into account their likely lack of proficiency in using computers. Programmes aimed at introducing non-computer users to ICT need to allow for the likely low literacy and numeracy of learners. It also indicates that there may be scope for combining upskilling in ICT and literacy and numeracy in integrated programmes.

10 DATA AND DEFINITIONS

Sampling and weighting for the Adult Literacy and Life Skills Survey 2006

The survey was based on a probability (proportional to size) sample of 896 meshblocks (from the 2001 Statistics New Zealand meshblock classification) in the North and South Islands and Waiheke Island. Within each meshblock a sample of permanent private dwellings was sought, consisting of an initial sample and then a screened sample designed to over-sample Māori and Pasifika. One person usually resident in each sampled dwelling and aged between 16 and 65 was sought. The achieved response rate was 64 per cent.

Each respondent was interviewed face-to-face, the interviewer completed the background questionnaire and the respondent completed a number of test booklets designed to assess prose and document literacy, numeracy and problem solving. A pilot survey was undertaken between July and September 2005 and the main survey took place from May 2006 to March 2007. The pilot data was included in the final data set, which consists of records from 7,131 respondents, of whom 6,048 were aged between 25 and 65. Four of these respondents were unclassified in terms of completed education and were not included in the analyses, leaving a total of 6,044 respondents in the data set analysed.

The sample data was validated against Statistics New Zealand census and household survey data and Ministry of Education statistics.

Each respondent was assigned a weight which was a product of a probability weight, a non-response weight and a benchmark adjustment. The benchmark adjustment was based on 2006 Census data for gender, ethnicity and age.

To calculate replicate weights, the 896 meshblocks were divided into 30 groups (each of 29 or 30 meshblocks with a wide geographical spread) and weights recalculated based on deleting one group in turn and readjusting to the benchmarks. Standard errors and 95 per cent confidence intervals (using a normal approximation) have been derived from a jackknife variance estimation procedure using these 30 replicate weights.

Differences between proportions and means were considered significant if the 95 per cent confidence intervals did not overlap. This procedure is known to be considerably more conservative than hypothesis testing with $\alpha = 0.05$, and in fact when the standard errors of two estimates are approximately equal (as they generally are in this report), this procedure approximates a test with $\alpha = 0.01$ (Schenker and Gentleman, 2001). This conservatism is considered appropriate here given the overall large sample size, and the large number of comparisons of estimates in this report.

Scores in the Adult Literacy and Life Skills Survey

Satherley and Lawes (2007) give an account of the scoring approach in the ALL survey:

To each individual, and for each of the domains, a score from zero to 500 is assigned. Zero indicates extremely low proficiency, and 500 extremely high. In addition, based on this score, one of five 'cognitive levels' is assigned. These cognitive levels are used in national and international comparison, essentially as a benchmark. The following list provides descriptions of typical tasks associated with each cognitive level.

Level 1 (Scores 0–225):

Tasks at this level require the ability to read simple documents, accomplish literal information-matching with no distractions, and perform simple one-step calculations.

Level 2 (Scores 226–275):

This level includes tasks that demand the capacity to search a document and filter out some simple distracting information, achieve low-level inferences, and execute one- or two-step calculations and estimations.

Level 3 (Scores 276–325):

Typical tasks at level 3 involve more complex information-filtering, sometimes requiring inferences and the facility to manipulate mathematical symbols, perhaps in several stages.

Level 4 (Scores 326–375):

A level 4 task might demand the integration of information from a long passage, the use of more complex inferences and the completion of multiple-step calculations requiring some reasoning.

Level 5 (Scores 376–500):

Level 5 tasks incorporate the capability to make high-level inferences or syntheses, use specialised knowledge, filter out multiple distractors, and to understand and use abstract mathematical ideas with justification.

OECD and Statistics Canada (2000) provide the following characterisation of Level 3:

Level 3 is considered a suitable minimum for coping with the demands of everyday life and work in a complex, advanced society. It denotes roughly the skill level required for successful secondary school completion and college entry.

Completed education

Highest level of completed education was derived from responses to questions A4B and A4C of the ALL background questionnaire which asked respectively “What is the highest level of primary or secondary school that you have ever completed?” and “What is the highest level of formal education or training that you have ever completed?” The New Zealand coded responses were used and grouped in two different ways, as shown in Tables 4 and 5.

Table 4

Detailed classification of highest level of education completed

Detailed Grouping	Responses (from A4B & A4C)	Frequency	Weighted Frequency
Up to Year 10	Up to Standard 3/Year 5 Standard 4/Year 6 Form 1, 2 or 3/Year 7, 8 or 9 Form 4/Year 10	723	224,000
Year 11	Form 5/Year 11	923	290,000
Year 12 or 13	Form 6 or 7/Year 12 or 13	825	295,000
Level 1, 2 or 3 certificate	Level 1, 2 or 3 certificate	792	271,000
Level 4 certificate	Level 4 certificate	564	205,000
Level 5, 6 and 7 certificate/diploma	Level 5, 6 and 7 certificate or diploma	825	284,000
Bachelors degree or higher	Bachelors degree Professional degree Bachelors degree with honours or postgraduate diploma Masters degree Doctorate	1,392	553,000
TOTAL		6,044	2,122,000

Table 5

Broad classification of highest level of education completed

Broad Grouping	Responses (from A4C)	Frequency	Weighted Frequency
Lower secondary	Up to Form 5/Year 11	1,646	514,000
Upper secondary	Form 6 or 7/Year 12 or 13 Level 1, 2 or 3 certificate	1,617	566,000
Tertiary	Level 4 certificate Level 5, 6 and 7 certificate or diploma Bachelors degree Professional degree Bachelors degree with honours or postgraduate diploma Masters degree Doctorate	2,781	1,042,000
TOTAL		6,044	2,122,000

Upskilling

The number of people who had taken formal courses (which count towards a qualification) or non-formal courses (which do not) was determined from responses to questions F2 and F16 in the ALL background questionnaire. F2 asked “During the last 12 months ... did you take any courses as part of a programme of study toward a certificate, diploma or degree?” F16 asked “During the last 12 months, did you participate in any courses that were not part of a programme of study?” The distribution of responses is shown in Table 6.

Table 6

Formal and non-formal upskilling in the past year

	Frequency	Weighted Frequency
Formal or non-formal courses taken	2,875	1,009,000
No courses taken	3,169	1,113,000
TOTAL	6,044	2,122,000

Labour force status

Current labour force status is based on responses to question D1 in the ALL background questionnaires, which asked “I would now like to talk about your employment status. What is your current work situation?” Respondents were asked to select one option only from the list in Table 7.

Table 7

Classification of current labour force status

Labour force status	Option as worded in D1	Frequency	Weighted Frequency
Employed	Employed or self employed	4,559	1,668,000
Unemployed	Not working <u>and</u> looking for work	315	94,000
Retired	Retired	228	73,000
Student	A student (including work programmes)	144	49,000
Homemaker	Doing unpaid household work	586	174,000
Other	Other, specify ...	212	64,000
TOTAL		6,044	2,122,000

Employment

Employment in the past year was based on responses to question D2 in the ALL background questionnaire, which asked “Did you work at a job or business at any time in the last 12 months ... (regardless of the number of hours per week)?” According to the instructions to the interviewers, ‘the last 12 months’ covered the period up to the month prior to the month of the interview. It needs to be noted that those who were ‘employed’ in terms of employment status in the past year were not necessarily ‘employed’ in terms of current labour force status (and vice versa). The distribution of people who were employed or not in the past year is classified by current labour force status in Table 8.

Table 8

People aged 25-65 employed or not employed in the past year, by current labour force status

Employment status in past year	Current labour force status	Frequency	Weighted Frequency
Employed	Employed	4,494	1,643,000
	Not employed	532	171,000
Not employed	Employed	65	25,000
	Not employed	953	284,000
TOTAL		6,044	2,122,000

Computer use at work

The work computer use variable was based on question H7 in the ALL background questionnaire. This question was only asked of people who had answered yes to D2 (see Employment above) and yes to question H2, “Have you ever used a computer?”. H7 asked “In the last 12 months, did you use a computer in your job? (If you have more than one job, tell us about the one at which you work the most hours)”. Table 9 cross-classifies the responses to H7 and to D2 on employment in the past year.

Table 9

Work computer use or non-use in past year

Work computer use in past year	Frequency	Weighted Frequency
Employed and used computer	3,472	1,298,000
Employed but did not use computer	1,554	516,000
Not employed	1,018	309,000
TOTAL	6,044	2,122,000

Computer use at home

The variable used in analysis was whether the respondent used a home computer for 5 or more hours per month, or otherwise. This variable is based on question H13 in the ALL background questionnaire, which was only asked of people who had answered yes to H2, “Have you ever used a computer?” and yes to H11, “Do you have personal access to a computer in your home (including a laptop you bring home from your work)?”. H13 asked “In a typical month, how many hours did you use a computer at home?” The lowest use category was less than 5 hours, which includes the possibility of not using the computer at all. In order to have a variable which reflects actual computer use, responses indicating at least 5 hours of use per month were aggregated in a single variable, as opposed to using a home computer less than 5 hours per month, or not having access to a computer at home, or never having used a computer, as set out in Table 10.

Table 10

Home computer access and use

	Frequency	Weighted Frequency
Used home computer 5+ hours/month	3,585	1,320,000
Used home computer less than 5 hours/month	1,144	428,000
Had used a computer, but no home computer access	795	222,000
Never used a computer	520	153,000
TOTAL	6,044	2,122,000

Occupation and industry

The ALL background questionnaire contains a series of questions (D17 to D43) about the most recent job that the respondent had worked at within the last five years. Occupation and industry categories were assigned on the basis of this job. People who had not been employed in the previous five years were not assigned an occupation or industry.

Occupation

Occupation is coded to the International Standard Classification of Occupation (ISCOR) in the ALL data set. This has been concorded to the New Zealand Standard Classification of Occupation 1999 (NZSCO99). Occupations at level one of this classification have been aggregated for this analysis, following Pool et al. (2005), as shown in Table 11.

A small number of people with military occupations were included in the survey but these are excluded from the occupational analysis. Because the survey was limited to permanent private dwellings, a large number of military personnel living in military institutional dwellings were not eligible to be surveyed, and so the survey could not fairly represent this occupational category.

Table 11

Classification of occupations

Group	NZSCO99	Frequency	Weighted Frequency
Managers, professionals and technicians	Administrators and managers Professionals Technicians and associate professionals	2,339	880,000
Clerks and service workers	Clerks Service and sales workers	1,611	552,000
Farmers, fishers and tradespeople	Agricultural workers Trades workers	787	287,000
Machine operators and elementary workers	Plant and machinery operators and assemblers Labourers	831	266,000
Other (excluded from analysis)	Military	5	2,000
No occupation assigned		471	136,000
TOTAL		6,044	2,122,000

Industry

Industry is coded in the ALL data set using the International Standard Industry Classification (ISIC). For this analysis, the ISIC has been concorded to the Australia and New Zealand Standard Industry Classification 2006 (ANZSIC06), and industries in the top level of classification have been grouped together, following Pool et al. (2005), as shown in Table 12.

Table 12
Classification of industries

Group	ANZSIC06	Frequency	Weighted Frequency
Agriculture, forestry, fishing and mining	A Agriculture, forestry and fishing B Mining	446	157,000
Manufacturing and construction	C Manufacturing E Construction	1,145	396,000
Wholesale and retail trade, transport and communications	F Wholesale trade G Retail trade H Accommodation and food services I Transport, postal and warehousing J Information media and telecommunications	1,321	483,000
Finance, business and community services	D Electricity, gas, water and waste services K Finance and insurance services L Rental, hiring and real estate services M Professional, scientific and technical services N Administrative and support services O Public administration and safety P Education and training Q Health care and social assistance R Art and recreation services S Other services	2,655	947,000
No industry assigned		477	139,000
TOTAL		6,044	2,122,000

Income

Personal income is based on responses to ALL questions K6 to K9. K6 asks “What is your best estimate of your personal income” in the previous year “from all sources ... before taxes and deductions?”. Respondents who were unable or unwilling to provide an estimate were asked in the subsequent questions to choose among a series of income ranges. One of the range boundaries was \$40,000, and this was selected as a dividing value between low and high personal income. The distribution of responses is shown in Table 13.

Table 13
Distribution of responses to income questions

Gross annual personal income (from K6 to K9)	Frequency	Weighted Frequency
Under \$20,000	1,635	538,000
\$20,000 to \$39,999	1,796	574,000
\$40,000 to \$69,999	1,634	618,000
\$70,000 or more	706	298,000
Not specified	273	94,000
TOTAL	6,044	2,122,000

First language and main language spoken at home

Information on first language(s) was derived from responses to ALL questions B1A and B1B which asked “What is the language that you first learned at home in childhood and still understand?” Respondents could nominate two languages if they were learned at precisely the same time, and 56 did so. Respondents who provided English as a response to one of these questions were categorised as having English as a first language, and all others as not having English as a first language, as shown in Table 14.

Table 14

Classification by first language – English or not

First language (from B1A and B1B)	Frequency	Weighted Frequency
English is a first language	5,069	1,793,000
English is not a first language	975	329,000
TOTAL	6,044	2,122,000

A more detailed classification of first language was based on responses to both B1A and B1B for all languages (i.e. total response). Table 15 displays this classification and the distribution of responses. ‘Other European’ first languages among people aged 25-65 were: French, German, Spanish, Polish, Russian, Ukrainian, Yugoslav, Portuguese, Dutch, Swiss-German, Romanian, Swedish, Finnish, Czech, Danish, Hungarian and Croatian. Respondents were classified as having a major Asian first language if their responses to either B1A or B1B were coded as one of the following: Chinese, Korean, Japanese, Vietnamese, Malay, Indonesian, Hindi, Punjabi, Tamil, other Indian language. The residual category of ‘Other languages’ may include some Asian languages, such as Thai, Khmer and Tagalog, which were not specifically identified in the coding of the survey responses.

Table 15

Detailed classification by first language (total response)

First language	Frequency	Weighted Frequency
English	5,069	1,793,000
Other European language	125	50,000
Māori	86	19,000
Samoa, Tongan, Cook Is Maori	317	63,000
Major Asian language	327	152,000
Other language	173	63,000
TOTAL RESPONSES	6,097	2,139,000

Note: The totals are greater than the total number of people because of the small number of people with two first languages.

Main language spoken at home is based on responses to question B2 in the ALL background questionnaire, which asked “What language do you speak most often at home?” Table 16 shows the distribution of responses in terms of whether the main home language was English or not, and whether the first language was English or not.

Table 16

Classification of home and first language

Main home language (from B2)	First language	Frequency	Weighted Frequency
English	English	5,023	1,777,000
	Language other than English	371	107,000
Language other than English	English	46	16,000
	Language other than English	604	222,000
TOTAL		6,044	2,122,000

Birthplace

Birthplace was derived from responses to ALL question A1, which asked “Were you born in New Zealand?” Details of the responses are given in Table 17. No further information relating to birthplace (such as country of birth) is available from the survey data.

Table 17

Distribution of birthplaces

Responses (from A1)	Frequency	Weighted Frequency
Born in New Zealand	4493	1,555,000
Born overseas	1551	568,000
TOTAL	6,044	2,122,000

Ethnic identification

Ethnic identification is based on questions AA3ZA-AA3ZE of the ALL background questionnaire. This set of questions allows each respondent to nominate up to five ethnic identifications. There were 12 categories of response to the five questions, and these categories were aggregated as total response variables, as set out in Table 18. As noted above, Māori and Pasifika were deliberately over-sampled, but the weighting adjusts the ethnic population estimates so that they correspond with 2006 Census figures.

Table 18

Classification of ethnic identifications (total response)

Ethnic identification	Responses to AA3ZA-AA3ZE	Frequency	Weighted Frequency
European	New Zealand European Other European	4,423	1,641,000
Māori	Māori	952	231,000
Pasifika	Samoan Tongan Cook Is Maori Niuean Other Pacific Peoples	598	104,000
Asian	Chinese Indian (including Fiji Indian) Other Asian	479	217,000
Other	Other	137	54,000
TOTAL RESPONSES		6,589	2,247,000

Note: The totals are greater than the total number of people because of the large number of people with multiple ethnic identifications.

Age and gender

Respondents were asked their date of birth and whether they were male or female. In each age group there were considerably more female than male respondents, and a correction for this gender imbalance was incorporated in the weighting through the benchmark adjustments.

Table 19

Age and gender distribution

Age	Gender	Frequency	Weighted Frequency
25-34	Male	618	248,000
	Female	876	271,000
35-44	Male	767	294,000
	Female	1,089	321,000
45-54	Male	642	267,000
	Female	775	278,000
55-65	Male	541	218,000
	Female	736	225,000
TOTAL		6,044	2,122,000

New Zealand Deprivation Index

The New Zealand Deprivation Index (NZDep) was developed by public health researchers in the Department of Public Health, University of Otago, Wellington, and has since been adopted by the Ministry of Health for a range of purposes including research and the allocation of funding. The index has been calculated on the basis of each Census since 1991 and is a well established measure. The latest index is NZDep2006 (Salmond et al., 2007; White et al. 2008).

The index applies to small geographical areas (not individuals), namely meshblocks and area units as defined by Statistics New Zealand. The index is a measure of the socioeconomic deprivation of people living in each small area, expressed in terms of deciles (decile 1 represents the least deprivation, and decile 10 the greatest deprivation). NZDep2006 was derived from the proportions of people in each small area

- receiving a welfare benefit
- with low household income
- living in a home they do not own
- living in a single parent family
- unemployed
- without educational qualifications
- in overcrowded housing
- without access to a telephone
- without access to a car

The Ministry of Health provides concordance tables matching meshblock numbers with the New Zealand Deprivation Index 2001 and 2006. These were downloaded from the Ministry of Health website and merged with the ALL data set.

Respondents were assigned the NZDep2006 value where it could be matched with the 2001 meshblock number used in the survey design. This could not be done for 620 respondents in the analysis data set because of changes in Statistics New Zealand's meshblock classification between 2001 and 2006. For all these respondents, a value for New Zealand Deprivation Index was imputed by assigning the NZDep2001 value. For the subsample of 5424 respondents with assigned values for both NZDep2006 and NZDep2001, the weighted correlation between NZDep2001 and NZDep2006 was 0.87, indicating that this imputation was unlikely to distort the analysis.

APPENDIX A STATISTICAL MODELS

Previous studies of the ALL survey data (Earle 2009a, b, c; Satherley and Lawes 2007, 2008; Satherley, Lawes and Sok 2008a, b; Smyth and Lane 2009) have explored bivariate associations between literacy and numeracy measures and a range of variables including immigrant status, educational attainment, labour force status, income, occupation, industry, age, gender, ethnicity and language. These were considered as the basis for multivariate OLS regression models for prose literacy and numeracy, with the addition of computer use at work as another employment-related factor. When computer use at work was found to be a strong predictor of prose literacy and numeracy, computer use at home was also considered as a potential predictor. Geographical variables (regional grouping, urban vs. rural, New Zealand Deprivation Index) were also considered.

Ordinary least-squares regression models were run in SAS using Statistics Canada's STATTOOL macro.

A very good fit to the data could be obtained by including a large number of variables in a model, but the aim of the modelling was not necessarily to get the best fit, but to develop a model that fitted the data well using a small number of variables, which would provide a focus for explaining variation, especially regional variation, in prose literacy and numeracy.

The strongest predictors (as indicated by relative F values) of prose literacy and numeracy scores in exploratory modelling were completed education, language factors and computer use. Once these factors were included in a model, the addition of further variables to the model could improve its predictive power only to a small extent.

Two models are summarised here for each of prose literacy and numeracy. The dependent variables are the prose literacy and numeracy scores. The first is a basic model, containing only educational, language and computer use variables as independent variables. The second is an extended model, which also includes variables reflecting occupation, ethnic identification, gender, age and deprivation.

For each model, variables suitable for descriptive analysis of regional data have been incorporated as far as possible, and the same sets of variables have been used to model both prose literacy and numeracy. The independent variables are all binary categorical variables, with the value 1 for membership of the relevant category and 0 for non-membership. The prose and numeracy scales have been standardised with a mean of 0 and a standard deviation of 1. The basic models include eight independent variables and are summarised in Table 20.

The extended models include the same eight variables, together with an additional seven. The extended models are summarised in Table 21.

The set of independent variables has been chosen so that pairwise correlations between variables are low to moderate and so that multicollinearity is avoided. For example, because the European and Asian ethnic categories have high correlations (around 0.6) with the language variables, it is problematic to use these ethnic categories directly in an extended model. However, ethnic categories can be distinguished within the group of first-language speakers of English: Māori and Pasifika native speakers of English form two categories with low correlations with the language variables used in the models, and these two categories are included in the extended models.

First language (English or other) and home language (English or other) were not suitable for use in the models because they are highly correlated ($r = 0.76$), but the language variables used in

the models have low correlation ($r = -0.08$). The pairwise correlation coefficients for the variables used in the basic and extended models are listed in Table 23. For the basic models, the largest correlation between independent variables is -0.32, between Tertiary (non-degree) and Tertiary (degree). For the extended models, the highest correlation is 0.42, between Tertiary (degree) and Managerial, professional or technical occupation.

The standardised regression coefficients for the extended models are represented graphically, together with their margins of error (at the 95 per cent confidence level) in Figures 91 and 92. All the coefficients are statistically significant, with the exception of the age variable in the extended prose literacy model.

The models for prose literacy and numeracy are similar in both the basic and extended forms, but there are a number of important differences. The main one is that the variable ‘Neither first nor home language is English’ has a stronger effect on prose literacy than on numeracy. The other main difference is that demographic variables have a stronger additional effect on numeracy than on prose literacy. The age variable is significant for numeracy but not for prose literacy, and though the variables English first language/Māori, English first language/Pasifika and Male are significant for both, they have considerably stronger effects on numeracy than on prose literacy. Additionally, gender has an opposite effect on prose literacy and numeracy: being male has a negative effect on prose literacy but a positive effect on numeracy.

Basic models

The basic models for prose literacy and numeracy are outlined in Table 20.

Table 20

Basic regression models for prose literacy and numeracy

Factor	Independent variable	Dependent variable					
		Prose literacy			Numeracy		
		Coefficient	p-value	R ²	Coefficient	p-value	R ²
	Intercept	-0.21	0.000		-0.34	0.000	
Language	Neither first language nor home language is English	-1.20	0.000	0.128	-0.93	0.000	0.080
	First language is not English but main home language is English	-0.55	0.000		-0.57	0.000	
Highest level of education completed	Year 10 or less	-0.74	0.000	0.253	-0.66	0.000	0.277
	Year 11	-0.34	0.000		-0.33	0.000	
	Tertiary qualification (non-degree)	0.19	0.000		0.20	0.000	
	Tertiary qualification (bachelors degree or higher)	0.48	0.000		0.56	0.000	
Computer use	Employed and used computer at work in past year	0.37	0.000	0.050	0.46	0.000	0.069
	Used home computer at least 5 hours per month	0.26	0.000		0.27	0.000	
R² for model				0.431			0.426

Population = All people aged 25 to 65. Reference categories used were: Education completed = Year 12 or 13 or Level 1-3 certificate, First language = English, Home language = English, Used computer at work = No, Used home computer 5+ hours per month = No.

The partial R^2 values are based on entering the variables in the model in the order language variables, then education variables, then computer use variables, following Desjardins (2003) in building models in an order that approximates an individual's life course, i.e. home background and demographic variables, then education, then variables related to current employment and personal activities.

Alternatives to each of these basic models were considered in which the computer use variables were replaced with employment (employed in past year or not), occupation variables (1-digit categories namely manager, professional, technician, clerk, service occupation, skilled agriculture/fisheries occupation, tradesperson, machine operator, elementary occupation, with people without assigned occupation as the reference category) and industry variables (Agriculture, forestry, fishing and mining; Manufacturing and construction; Wholesale, retail, transport and communications; and Finance, business and community services; with people without assigned industry as the reference category). In this alternative model, R^2 was 0.418 for prose literacy and 0.403 for numeracy. This alternative thus does not improve on the basic model represented in Table 20.

Extended models

The extended models for prose literacy and numeracy are outlined in Table 21.

The partial R^2 values are based on entering the variables in the model in the order language variables, then other home background and demographic variables (ethnic identification, age, gender and deprivation), then education variables, then computer use variables, then occupation variables. If the occupation variables are entered before the computer use variables, the partial R^2 for occupation is 0.018 in the prose literacy model and 0.019 in the numeracy model; the partial R^2 for the computer use variables is then 0.036 in the prose literacy model and 0.047 in the numeracy model.

If the language and other home background and demographic variables are taken together, the partial R^2 is almost identical (0.195 in the prose literacy model, and 0.196 in the numeracy model) but the balance is different, with the language variables accounting for more of the variation in prose literacy and the other variables (especially ethnic identification, gender and age) for more of the variation in numeracy. In the basic models, the education variables take up most of the variation accounted for by these non-language variables. This is consistent with Desjardins' (2003) more complex model, in which home background and demographic variables are related to literacy indirectly via education.

In both extended models, the largest effects, as indicated by the regression coefficients, occur in the completed education, language, computer use and occupation variables. Additionally the effects of gender, and of ethnic identification (Māori and Pasifika) among those with English as a first language, are relatively large for numeracy.

Table 21

Extended regression models for prose literacy and numeracy

Factor	Independent variable	Dependent variable					
		Prose literacy			Numeracy		
		Coefficient	p-value	R ²	Coefficient	p-value	R ²
	Intercept	-0.06	0.197		-0.23	0.000	
Language	Neither first language nor home language is English	-1.18	0.000	0.128	-0.96	0.000	0.080
	First language is not English but main home language is English	-0.56	0.000		-0.57	0.000	
Highest level of education completed	Year 10 or less	-0.67	0.000	0.203	-0.58	0.000	0.206
	Year 11	-0.31	0.000		-0.27	0.000	
	Tertiary qualification (non-degree)	0.15	0.003		0.14	0.001	
	Tertiary qualification (bachelors degree or higher)	0.38	0.000		0.45	0.000	
Computer use	Employed and used computer at work in past year	0.32	0.000	0.047	0.38	0.000	0.060
	Used home computer at least 5 hours per month	0.25	0.000		0.27	0.000	
Occupation	Managerial, professional or technical	0.12	0.002	0.007	0.11	0.002	0.006
	Machine operator or elementary worker	-0.19	0.002		-0.18	0.001	
Language & ethnic identification	First language English, Māori ethnic identification	-0.21	0.000	0.067	-0.36	0.000	0.116
	First language English, Pasifika ethnic identification	-0.28	0.000		-0.42	0.001	
Gender	Male	-0.07	0.011		0.23	0.000	
Age	Aged 45-65	0.01	0.729		-0.11	0.011	
Deprivation	New Zealand Deprivation Index above median (deciles 6-10)	-0.12	0.000		-0.15	0.000	
R² for model				0.453			0.468

Population = All people aged 25 to 65. Reference categories used were: Education completed = Year 12 or 13 or Level 1-3 certificate, First language = English, Home language = English, Used computer at work = No, Used home computer 5+ hours per month = No, Occupation = Clerical, service, agricultural or trades workers, Language & ethnic identification = First language English & European, Gender = Female, Age = 25-44, Deprivation = Low (deciles 1-5).

Simplified models

In regional comparisons in Lane (2010), I use three variables as representative of the three key factors of completed education, language and computer use, namely:

- Highest completed education: lower secondary (Year 11 or less) vs. upper secondary or tertiary
- Language: English as first language or not
- Computer use: work computer user vs. not employed or employed but work computer non-user

Simplified models based on these three variables are set out in Table 22. The partial R^2 values are based on the variables entering the model in the order language, then education, then computer use.

Table 22

Simplified regression models for prose literacy and numeracy

Factor	Independent variable	Dependent variable					
		Prose literacy			Numeracy		
		Coefficient	p-value	R^2	Coefficient	p-value	R^2
	Intercept	-0.05	0.067		-0.14	0.000	
Language	First language is not English	-0.86	0.000	0.114	-0.67	0.000	0.075
Highest level of education completed	Year 11 or less	-0.69	0.000	0.143	-0.68	0.000	0.148
Computer use	Employed and used computer at work in past year	0.58	0.000	0.072	0.68	0.000	0.098
R^2 for model				0.328			0.321

Population = All people aged 25 to 65. Reference categories used were: Education completed = Year 12 or 13 or Level 1-3 certificate or tertiary (Level 4+), First language = English, Used computer at work = No.

Table 23

Correlation matrix for variables in extended models

	Numeracy	Year 10-	Year 11	Non-degree	Degree	English not home, not L1	English home, not L1	Work computer use	Home computer use	Manager, professional, technician	Machine operator, elementary	L1 English, Māori ethnic id	L1 English, Pasifika ethnic id	Male	Aged 45-65	High NZDep
Prose literacy	0.83	-0.36	-0.13	0.09	0.29	-0.34	-0.08	0.41	0.30	0.35	-0.27	-0.10	-0.04	-0.04	-0.03	-0.23
Numeracy		-0.35	-0.15	0.08	0.35	-0.26	-0.09	0.44	0.32	0.37	-0.26	-0.16	-0.06	0.12	-0.09	-0.25
Year 10-			-0.25	-0.09	-0.24	-0.01	0.00	-0.26	-0.19	-0.22	0.18	0.11	-0.01	0.04	0.14	0.14
Year 11				-0.01	-0.28	-0.10	-0.05	-0.08	-0.11	-0.16	0.09	0.06	0.02	-0.02	0.11	0.07
Non-degree					-0.32	-0.07	-0.03	0.09	0.06	0.05	-0.08	-0.01	-0.01	0.03	0.05	-0.04
Degree						0.16	0.06	0.24	0.21	0.42	-0.17	-0.12	-0.03	0.03	-0.09	-0.15
English not home language, not L1							-0.08	-0.14	-0.04	-0.04	0.07	-0.12	-0.04	0.03	-0.09	0.08
English home language, not L1								-0.03	0.01	-0.03	0.02	-0.08	-0.03	-0.04	-0.03	0.03
Work computer use									0.27	0.39	-0.25	-0.06	-0.03	0.07	-0.05	-0.14
Home computer use										0.20	-0.12	-0.03	-0.04	-0.02	-0.10	-0.11
Manager, professional, technician											-0.32	-0.10	-0.02	0.01	0.02	-0.20
Machine operator, elementary												0.08	0.01	0.10	-0.00	0.16
L1 English, Māori ethnic id													0.03	-0.01	-0.07	0.16
L1 English, Pasifika ethnic id														0.00	-0.07	0.08
Male															0.01	-0.02
Aged 45-65																-0.08

Figure 91

Standardised regression coefficients (with margins of error) for extended prose literacy model

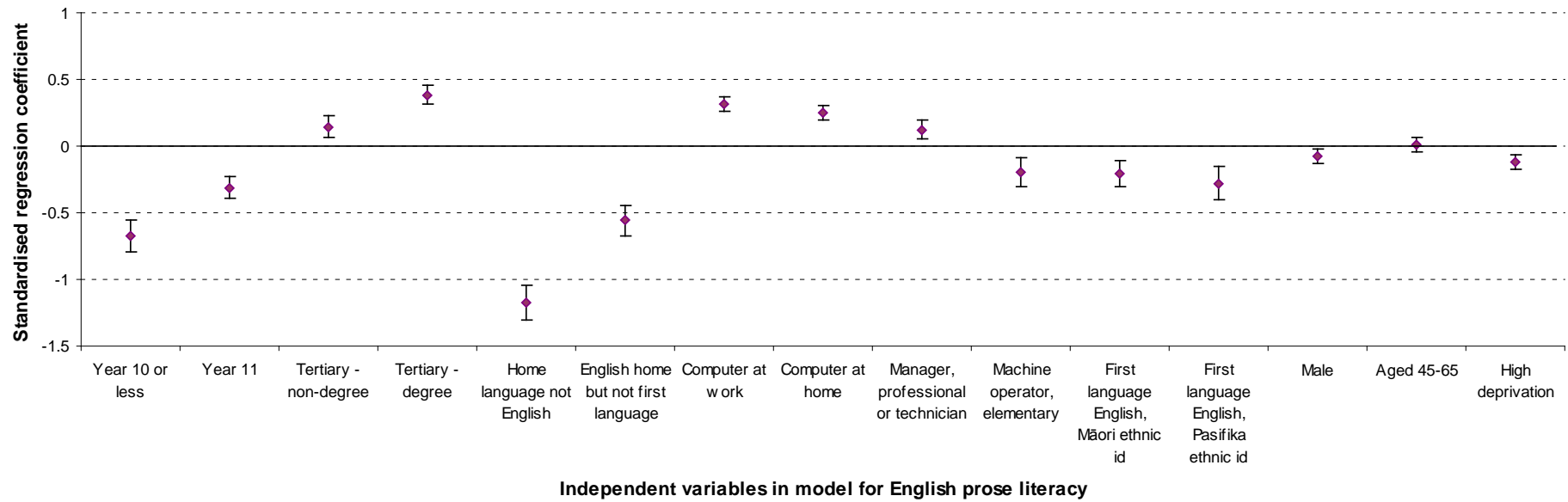
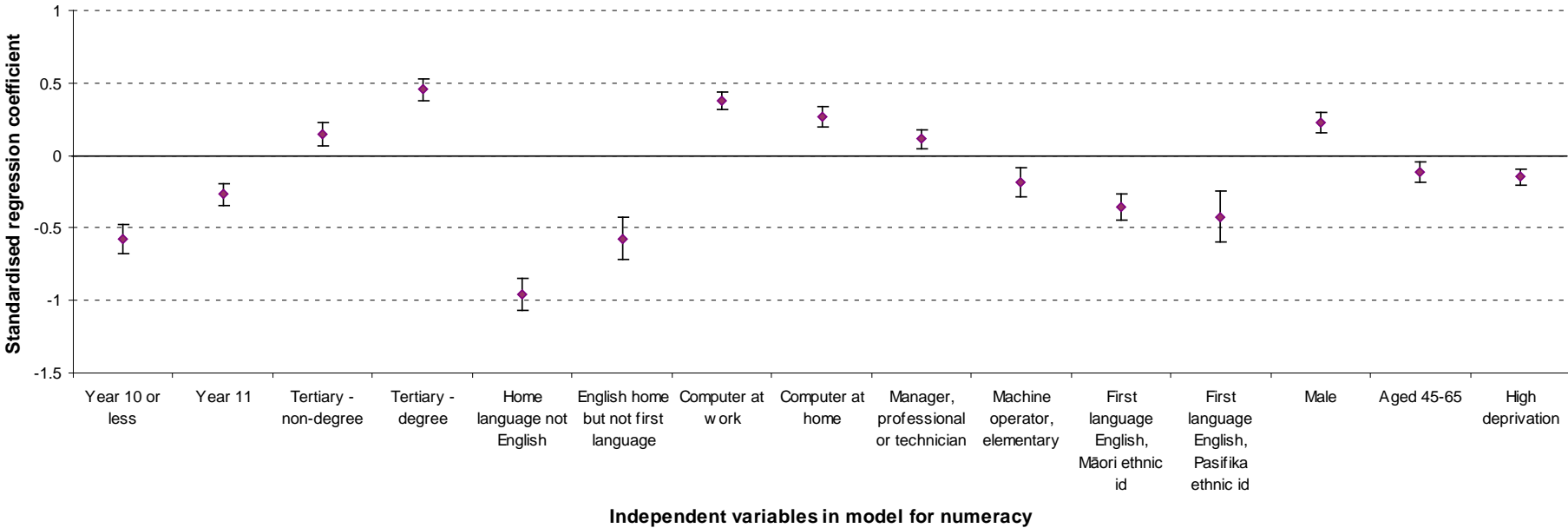


Figure 92
Standardised regression coefficients (with margins of error) for extended numeracy model



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