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Research Report

New Light on Literacy and Numeracy

John Bynner and Samantha Parsons

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New Light on Literacy and Numeracy

John Bynner and Samantha Parsons

CONTENTS

List of tables and figures

Tables

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Appendix 2

Figures

Chapter 1

Chapter 2

Chapter 3

Acknowledgements

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Executive summary

1. The work reported here took place against the background of a major new initiative in Britain to understand and tackle the problem of poor literacy and numeracy in a substantial minority of the population. These concerns were fuelled by the growing body of evidence that literacy and numeracy difficulties were a major impediment to successful functioning in modern society, culminating in the work of the Moser Committee and the policy development that was the Government's response to it, *Skills for Life*.

2. An important part of the evidence considered by Moser was drawn from adult literacy and numeracy data collected for the Basic Skills Agency in a 12-year programme of longitudinal research that focused particularly on identifying the earlier circumstances and experiences that were connected with later literacy and numeracy difficulties. This work was based on the 1958 and 1970 British birth cohort studies, known respectively as the National Child Development Study (NCDS) and the 1970 British Cohort Study (BCS70). These are longitudinal studies that follow up all babies born in a single week from birth in the year the study began to adulthood, with new data collected at regular intervals throughout the cohort members' lives. Much of the Moser evidence was based on findings from the literacy and numeracy objective assessments that were conducted on 10 per cent representative sub-samples of the cohorts, first at age 21 in BCS70 (1991) and later, at age 37, in NCDS (1995).

3. As part of the *Skills for Life* strategy the National Research and Development Centre for Adult Literacy and Numeracy (NRDC) was established in 2001**.** This offered the opportunity to increase the potential of the longitudinal cohort studies for literacy and numeracy research. In 2004 the latest Economic and Social Research Council (ESRC) funded surveys in NCDS and BCS70 took place. With additional funding from NRDC, all BCS70 cohort members at age 34 completed new literacy and numeracy assessments, alongside exercises to assess symptoms associated with dyslexia. In addition, funding from the European Social Fund (ESF) allowed the cognitive skills of all resident natural or adopted children from a randomly selected 1 in 2 sample of cohort members to be assessed[1].

4. This report gives the results of analysis of data from the survey based on all 9,665 BCS70 cohort members who were finally interviewed[2]. The report supplies descriptive data concerning the cohort members' skills and their correlates that are of much significance for the development of the *Skills for Life* strategy.

5. Three ways of measuring literacy and numeracy were adopted in the 2004 survey. First, in the Core Interview, cohort members answered questions about self-reported difficulties. Next, they attempted a multiple-choice literacy and numeracy assessment and, finally, they attempted an open-response literacy and numeracy assessment.

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1 The details of the development of the assessment instruments for the BCS70 age 34 follow-up are supplied in an earlier report and an associated journal article. See Parsons, S. and Bynner, J. (2005) *Measuring Basic Skills for Longitudinal Study: The design and development of instruments for use with cohort members in the age 34 follow-up in the 1970 British Cohort Study (BCS70)*. London: National Research and Development Centre for Adult Literacy and Numeracy http://www.nrdc.org.uk/content.asp?CategoryID=424 ; Parsons, S. and Bynner, J. (in press) 'Measuring Basic Skills for Longitudinal Study', *Literacy and Numeracy Studies*.

2 An initial report based on the 7,180 (74 per cent) of respondents to the survey for whom data were available at the time was produced to check the data and signal the kind of results that the full survey was likely to produce. http://www.nrdc.org.uk/content.asp?CategoryID=870. By and large the broad findings reported there are fully supported by the analysis of the complete dataset. The complete data supply more precise statistical estimates and the larger sample size offers much richer opportunities for analysis.

6. After setting the context and describing both the BCS70 and the 2004 survey in more detail in Chapter 1, Chapter 2 concentrates on self-awareness of literacy and numeracy problems, attendance on courses for improvement, and motivation to improve skills. These results point to a continuing low awareness of literacy and numeracy difficulties, which is not surprising among adults, most of whom manage their lives well and learn to cope with any skills difficulties that they have. However, by asking questions about highly specific difficulties to the whole sample, not just, as in the past, to those who acknowledged difficulties generally, the proportions increased. This suggests that the more refined form of questioning is necessary to elicit the full range of problems that people have. In line with gender-typical stereotyping, more men perceive difficulties associated with written communication (spelling and handwriting), whereas more women report difficulties with the more advanced mathematical operations (multiplication and division).

7. What is particularly significant in policy terms is that, once the awareness is triggered, interest in improvement tends to follow. The very low number of adults who report difficulties with reading, writing or numbers and have actually been on a course to help improve their skills needs to be set against the significant proportion of those who acknowledge a problem and say that they want to improve their skills. Many local and regional campaigns are working towards this goal of heightening awareness, such as the Department for Education and Skills/Sure-Start-based *Step into Learning,* directed at helping early years workers to identify parents with numeracy and literacy difficulties, the Learning and Skills Council-based *Family Literacy, Language and Numeracy* programme (FLLN); and the National Literacy Trust's *Work with Offenders* programme. But there is still a substantial challenge for the *Skills for Life* strategy to address. The means need to be found to stimulate more self-awareness of literacy and numeracy problems across the population generally and to lay on provision that will match the specific needs identified by potential learners.

8. Chapter 3 reports the multiple-choice part of the adult literacy and numeracy assessments, compares the distribution of scores with those achieved in the *Skills for Life* Survey (2003), and contrasts outcomes at age 34 for men and women in the BCS70 2004 survey with performance in the assessments at age 21. In line with previous research, cohort members at the lowest literacy and numeracy levels (Entry Level 2 or below) were most likely to acknowledge problems with literacy and numeracy and those who did were more likely than others to want to improve their skills. However, substantial numbers neither acknowledged any problems nor had any desire to do anything to improve their skills. Very few in either group had attended any courses to improve their skills.

9. Substantial differences in life chances, quality of life and social inclusion were evident between individuals at or below Entry Level 2 compared with others at higher levels of literacy and numeracy competence. Entry Level 2 skills were associated with lack of qualifications, poor labour market experience and prospects, poor material and financial circumstances, poor health prospects and lack of social and political participation.

10. Gender differences were also marked in some of these relationships, including the tendency for men with poor skills to lead a solitary (single) and childless life in their mid-30s. In contrast, women with the same levels of skills were also more likely to be without a partner but more typically were parents, often with large families. These differences tended to be larger between the literacy groups than between the numeracy groups though, as we know from research on literacy and numeracy and employment, numeracy is becoming increasingly important for maintaining employment and gaining opportunities to progress within jobs.

11. The large sample also enabled cross-national differences between England, Scotland and Wales to be demonstrated with potential for separate analyses in the three countries. The discrepant findings for Wales raise particularly interesting research questions.

12. In Chapter 4 we move on to longitudinal analysis. To enable change in cohort members' skills to be investigated over time, short functional literacy and numeracy tests were constructed from seven literacy and six numeracy questions previously used to assess cohort members' skills in 1991 when the cohort members were aged 21. With the exception of one numeracy item, the percentages of the cohorts giving incorrect answers were remarkably consistent from one survey to the next and in the smaller sample that participated on both occasions. Similarly, the distribution of overall test scores was comparable across surveys and for the sample who took part both times. However, at the individual level, a substantial minority demonstrated a change in performance between the two surveys.

13. Improvement and deterioration in performance was evident for this group of cohort members. Most 'movement' was in numeracy performance, highlighting the more fluid and less ingrained nature of numerical skills. Further analysis will help shed light on which experiences bring about skills improvement or deterioration. More analysis will be needed to understand fully the differences in the individual experiences and outcomes at age 34 between 'improvers' and 'deteriorators'. However, there is a suggestion that the improvement of poor skills between age 21 and 34 may have a wider and more substantial influence on quality of life at age 34 than the deterioration of good skills across the same age period. The picture is particularly clear for men. For women the picture is more complex, with both improvement of numeracy and deterioration of literacy skills apparently relating to the largest number of personal outcomes at age 34 in many domains of adult life. Thus women with deteriorating skills were less likely to be in full-time employment, to have had any work-related training, to have access to a computer at home, to have any investments or to have any interest in politics. Clearly, skills enhancement seems likely to open up opportunities and improved self-confidence, which is reflected in the wide range of positive life outcomes associated with it. On the other hand, a change in life, such as a new job or getting married, may itself lead to skills enhancement. Similarly for women, a range of negative life-course changes such as giving up or losing full-time employment may prompt skills loss. The findings, however, do support the Moser viewpoint and the *Skills for Life* strategy that literacy and numeracy, economic wellbeing and social inclusion are intimately connected.

14. Chapter 5 describes the four dyslexia exercises taken from the Dyslexia Adult Screening Test (DAST)[3]. A significant minority of cohort members were identified as being 'at risk' of dyslexia, which was correlated with having a poor grasp of literacy and/or numeracy. There was also a relatively high degree of awareness of reading and writing difficulties among those with the highest 'risk' of dyslexia, coupled with a desire to improve these skills.

15. From a logistic regression analysis, it was clear that much of the relationship between dyslexia risk and other variables is overshadowed once literacy and numeracy scores are taken into account. Dyslexia risk maintains a negative association only with attaining qualifications, being employed (women), being in 'modern' employment (ie, using ICT), belonging to groups or clubs, and having political interest. Dyslexia is positively associated with indicators of 'dissatisfaction with life'.

3 Fawcett, A. and Nicolson, R. (1998). *The Dyslexia Adult Screening Test* (DAST). London: The Psychological Corporation.

16. These findings signal the need for policy-makers and practitioners to recognise and adopt appropriate remediation for the added component of literacy and numeracy learning difficulties that dyslexia presents. They also raise important research questions about the precise ways in which such difficulties are made manifest and the ways in which they affect functioning in adult life.

17. Chapter 6 moves on to the cognitive skills of the cohort members' children. Their performance in the British Ability Scales II (BAS II) assessments is compared with their expected performance, ie, the age-equivalent scores published by the National Foundation for Educational Research (NFER). A first look at the intergenerational transfer of skills from parent to child showed relatively weak overall correlations. However, comparing children's mean BAS II test scores across the parents' literacy and numeracy levels showed that the average scores of children were substantially lower for children of parents with the poorest grasp of literacy and numeracy. The gap was particularly marked between cohort member parents at Entry Level 2 (and to a lesser extent Entry Level 3) and at higher levels (Level 1 and Level 2).

18. The analysis continued with a preliminary logistic regression analysis to determine whether the apparent literacy and numeracy assessment was merely a surrogate for parents' general educational achievement, as reflected in highest qualification achieved. Somewhat surprisingly, the introduction of the highest qualification variable into the analysis barely affected the relationship between parents' literacy and numeracy skills and children's literacy and numeracy development, as assessed by the BAS II tests. Although much more penetrating analysis will be needed to understand the basis of intergenerational skill transfer, it seems that parents' literacy and numeracy is an important part of it.

19. The findings reported here establish the huge potential of the BCS70 data for enhancing understanding of the consequences of poor literacy and numeracy in adult life and for the transfer of these skills across the generations. They also reaffirm many earlier findings while recasting them in terms of the standards (skills levels) through which the *Skills for Life* strategy is delivered. They point to the considerable disadvantage faced by adults at the lowest literacy and numeracy levels as exemplified by Entry Level 2 and below – a disadvantage that is likely to be passed on to their children, as reflected in their relatively poor literacy and numeracy acquisition. The final chapter of the report, Chapter 7, brings all the findings together and sets out the key policy messages to be gleaned from them. The chapter also sets out research questions that follow from this first examination of the new BCS70 literacy and numeracy data and the research programme that should follow.

Chapter 1
Introduction to the survey

Background to the report

The work reported here took place against the background of a major new initiative in Britain to understand and tackle the problem of poor literacy and numeracy in a substantial minority of the adult population. These concerns were fuelled by the growing body of evidence that literacy and numeracy difficulties were a major impediment to successful functioning in modern society, culminating in the work of the Moser Committee[4] and the government policy development that followed in response to it, *Skills for Life*. The Moser committee recommended targets for improvement by 2012 and a continuing programme of research with two main foci:

- effective practice in teaching literacy and numeracy to adults;
- socio-economic outcomes ('increased productivity' and 'social inclusion') of basic skills enhancement.

The National Research and Development Centre for Adult Literacy and Numeracy (NRDC) was established at the London Institute of Education in 2001 as part of the *Skills for Life* strategy to take the research programme forward and develop the new curricula and professional training that would raise the skills level of the population to those proposed by Moser as government targets. The work reported here concerns the second of the two Moser research issues, socio-economic outcomes.

An important part of the evidence considered by Moser was drawn from literacy and numeracy data collected for the Basic Skills Agency in a 12-year programme of longitudinal research focused particularly on identifying the earlier circumstances and experiences which were connected with later literacy and numeracy difficulties. This work was based on the 1958 and 1970 British birth cohort studies, known respectively as the National Child Development Study (NCDS) and the 1970 British Cohort Study (BCS70). These are longitudinal studies that follow up all babies born in a single week in the year the study began from birth to adulthood, with new data collected at regular intervals throughout the cohort members' lives. At age 23 in the NCDS, cohort members were asked for a self-appraisal of their literacy and numeracy difficulties, which identified a small but significant minority who acknowledged serious problems with written communications and number work[5].

This information reinforced television-based literacy campaigns of the 1980s[6] (continuing on from the very influential *On the Move* series which began in 1975), targeted at helping people improve their literacy and numeracy with the help of volunteer adult tutors. This work was followed, first at age 21 in the BCS70 (1991) and later, at age 37 in NCDS (1995), by literacy

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4 DfEE (1999). *A Fresh Start: Improving Adult Literacy and Numeracy*. Report of the Working Group Chaired by Sir Claus Moser, Sudbury: DfEE Publications.
5 Hamilton, M. (1987) *Literacy, Numeracy and Adults*. London: ALBSU (Adult Literacy and Basic Skills Unit, now The Basic Skills Agency).
6 On the BBC: *Switch on to English*, 1984-5, *Write Now* 1985–6, *Spelling it Out* 1987–8, *Stepping Up and Step Up to WordPower and NumberPower*, 1989. For Granada/ITV: World in Action documentary *Starting at the Bottom*, 1987.

and numeracy objective assessments that were conducted on 10 per cent representative sub-samples of the cohort members. The sample data showed much more widespread literacy and, particularly, numeracy problems than the earlier self-appraisal data had indicated and laid bare the kind of disadvantaged education career, starting typically in difficult family circumstances and lack of educational support, that characterised the adults involved. Such adults also continued their disadvantage into adult life showing patchy work histories identified with low grade jobs, casual work and unemployment. Women in this situation frequently left the labour market, opting for early partnership and early child-bearing instead. Many of the other attributes of what became referred to as 'social exclusion' were also present, with higher levels of smoking and drinking than in the population at large and lower levels of psychological wellbeing and social and political participation.

The establishment of NRDC with a budget to carry out large-scale research offered the opportunity to develop this work in a number of directions.

- First, the small samples involved could be replaced by complete coverage of one of the cohorts with scope for charting geographical variation and much more fine-grained analysis of subgroup experience, including those with the learning difficulties associated with dyslexia.
- Second, the earliest test which had been developed for use in the surveys on an *ad hoc* basis could be replaced by the more developed and generally recognised baseline measures used in the *Skills for Life* Survey (2003)[7], while retaining some of the earlier test items to assess continuity and discontinuity in literacy and numeracy performance.
- Third, the focus of the work could shift to the longer-term consequences of literacy and numeracy deficiencies in adults, with particular emphasis on the socio-economic benefits to be gained by improving them, including the facility to project forward the likely consequence of such initiatives as the literacy and numeracy strategy in schools and *Skills for Life.*
- Fourth, through additional funding from the European Social Fund, a further dimension could be added to the programme. Following the precedent, established in the NCDS age 33 follow-up (1991), of assessing the cognitive development of one third of cohort members' children, it was decided to carry out a similar assessment with the focus on reading and maths performance for one half of the BCS70 cohort members' children. One half of the children was needed to compensate for the tendency towards later child-bearing in the more recent 1970 cohort (BCS70) compared with the 1958 cohort (NCDS) and consequently the smaller number of children in the BCS70 sample of 34-year-olds.

The details of the development of the assessment instruments for the BCS70 age 34 follow-up are supplied in an earlier report and an associated journal article[8]. To put the latest BCS70 survey in context, before describing the development and contents of the 2004 survey in more detail, some background to Britain's birth cohort studies is provided.

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7 Williams, J., Clemens, S., Oleinikova, K. and Tarvin, K. (2003). *The Skills for Life survey: A national needs and impact survey of literacy, numeracy and ICT skills*. DfES Research Report 490. Department for Education and Skills.
8 Parsons, S. and Bynner, J. (2005) *Measuring Basic Skills for Longitudinal Study: The design and development of instruments for use with cohort members in the age 34 follow-up in the 1970 British Cohort Study (BCS70)*. London: National Research and Development Centre for Adult Literacy and Numeracy http://www.nrdc.org.uk/content.asp?CategoryID=424 . Parsons, S. and Bynner J. (in press) 'Measuring Basic Skills for Longitudinal Study', *Literacy and Numeracy Studies*.

Introduction to Britain's birth cohort studies

Britain's nationwide birth cohort studies follow the same group of people from birth into and through adulthood, thus giving a picture of whole generations. By following up people from birth it is possible to find how present situations relate to past circumstances and to predict future functioning. Cohort studies are one of the richest resources for the study of human development, covering all aspects of life. They are widely used by government and in academic research, both nationally and internationally.

There are four such surveys in Britain:

- National Survey of Health and Development (NSHD), which began in 1946
- National Child Development Study (NCDS), which began in 1958
- 1970 British Cohort Study (BCS70), which began in 1970
- Millennium Cohort Study (MCS), which began in 2000

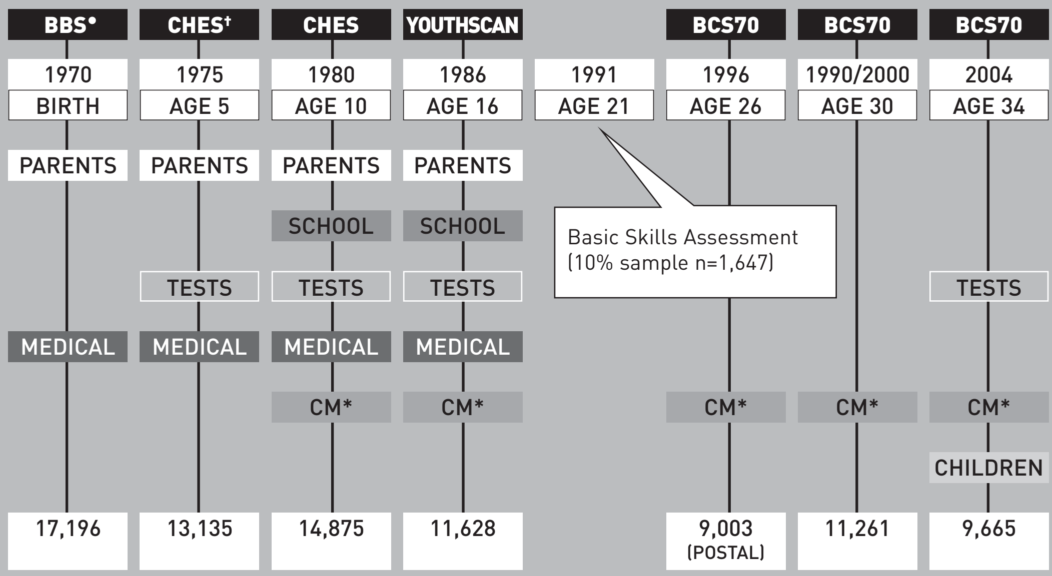
The first three of these studies are based on all births in Great Britain in one week in 1946, 1958 and 1970 respectively, whereas the MCS is based on births over a period of 12 months in selected areas in the United Kingdom. NCDS, BCS70 and MCS are all managed by the Centre for Longitudinal Studies (CLS) at the Institute of Education, University of London. NSHD is based in the Department of Epidemiology and Public Health at University College, London.

BCS70 in detail

BCS70 began in 1970, when data were collected about all the babies born in England, Scotland and Wales[9] in one week of April 1970. As shown in Figure 1.1, cohort members have since been followed up six times, at ages 5, 10, 16, 26, 30, and most recently at 34, to collect data about their health, educational, social and economic circumstances. Additionally, a representative sample was followed up at age 21. In the early years, information was collected from parents, health professionals and teachers; the questionnaires were generally cross-sectional in design. As the cohort members became the primary source of the information gathered, the focus shifted to obtaining the 'complete history' of a cohort member's experience or involvement in, for example, education, full-time employment, independent living and home ownership, marriage, pregnancies and having children. Not all information is longitudinal, and current statuses that provide a snapshot of British life for the cohort members are routinely collected in all surveys. In the most recent (sixth) follow-up, carried out in 2004 when most cohort members were aged 34[10], histories were updated and a wide variety of current information pertinent to all domains of adult life was also gathered. The final 2004 sample size was 9,665 – 56 per cent of the original birth cohort and 74 per cent of the first (age 5) follow-up sample.

9 Data were collected about children born in Northern Ireland, but these children were not subsequently followed up.
10 Cohort members interviewed from April 2004 onwards, were still aged 34; cohort members interviewed after their birthday in April 2005 were aged 35.

Figure 1.1: **BCS70 follow-up studies from 1970–2004**



•BBS = British Birth Survey †CHES = Child Health and Education Survey *CM = Cohort member

Representativeness of the 2004 survey

Comparisons of the distributions of key cohort characteristics in the 2004 survey with those in the 1970 birth survey and the 2000 age 30 survey enabled us to check whether the 2004 survey, based on 9,665 cohort members, remained representative. Of the 9,665 interviewed in the 2004 survey, 92 per cent (8,879) were in the birth survey and 93 per cent (9,001) were in the age 30 survey. Table 1.1 shows the percentages of cohort members in 2004:

(a) whose fathers were in Social Class I or II and whose mothers had left full-time education by age 15 in 1970;
(b) who were female, were employed or unemployed, single with no children, or in a relationship with children, whose current occupation was classified as RGSC I or II in 2000[11], and who had a degree or higher.

The percentages suggest a slight bias in the 2004 survey towards women and towards the better educated. For example, compared with those cohort members who took part in 2000 or in the original birth survey, slightly more in the 2004 survey were women, were 'middle class', were employed, were in a relationship with children, and had a degree. However, despite the losses from the original sample over time, the overall profile of the cohort across the surveys is remarkably similar.

11 Great Britain Registrar General's Social Class classification of occupations, in which classes I and II are 'professional' and 'intermediate' non-manual occupations.

Table 1.1 Compatibility of BCS70 at 34 with birth and age 30 surveys

	Birth survey	Age 34 survey
1970: Social Class (RGSC) I or II	17%	19%
1970: Mother left FT education by 15	66%	64%
1970: CM mother ever a teenage mother	20%	17%
N(100%)	*17,196*	*8,879*
	Age 30 survey	**Age 34 survey**
2000: Female	51%	53%
2000: CM RGSC I or II	41%*	42%*
2000: CM employed	81%	83%
2000: CM unemployed	3%	3%
2000: CM single, no children	27%	26%
2000: CM in a relationship with children	39%	40%
2000: CM has a degree or higher	27%	29%
N(100%)	*11,261*	*9,001*
	**9,132*	**7,432*

Note: CM = Cohort member, RGSC = Registrar General's Standard Classifications of Occupations
I = Professional; II = Intermediate; III = Skilled non-manual; IV = Skilled manual; V = Semi-skilled manual; VI = Unskilled

Development of the 2004 survey

Development work to establish robust survey instruments for the 2004 survey, with special emphasis on the new literacy and numeracy assessments, began in 2002. Following extensive piloting and revisions of all survey instruments, the main fieldwork began in February 2004 with a view to completing it in nine months. However, because of problems in tracing all cohort members, fieldwork actually continued until May 2005.

The first design of the adult assessments was piloted on 177 members of the general public in their 30s in July 2003 (The Basic Skills Pilot – Pilot 1a). The child assessments were similarly piloted in September-October 2003 on 127 children from 60 households (The Child Assessment Pilot – Pilot 1b). After revisions to the design of some assessments, all survey instruments were piloted in a 'dress rehearsal' of the final survey design on 64 BCS70 cohort members and 40 of their children in November 2003 (The Dress Rehearsal – Pilot 2).

Coverage of the 2004 survey

The 2004 survey has two main parts, the Core Interview, which was completed by every cohort member who agreed to take part, and the Parent and Child Interview, which was completed only by cohort members with resident natural or adopted children from a randomly selected one-in-two sample.

The Core Interview involved a personal interview and an adult assessment.

- Personal Interview. A standard Computer Assisted Personal Interview (CAPI) and Computer Assisted Self Interview (CASI) were used to update the cohort members' lives and to observe their current situation in respect of education, housing, health, work, home and family life, social attitudes and opinions. The estimated average time to complete the CAPI and CASI, based on results from Pilot 2, was 50 minutes.

- Adult assessments. These assessment tools measured a cohort member's literacy and numeracy skills and the presence of some symptoms associated with dyslexia (the term 'dyslexia', however, was not used with cohort members). The estimated average time to complete this section, based on results from Pilot 2, was 40 minutes. Special instruments were designed for this assessment, comprising:
  - test items from the *Skills for Life* Survey (2003)[12], carried out to assess the general public's skills problems.
  - test items used in the previous 1991 BCS70 basic skills survey[13].
  - test items adapted from the Dyslexia Adult Screening Test[14].

The Parent and Child Interview contained an additional CAPI section in the personal interview, paper-based self-completion questionnaires, and the assessment of the children's cognitive skills[15] using tests selected from the British Ability Scales or BAS II[16].

- *CAPI interview.* Cohort members answered questions about the health, care and education experiences of each of their natural or adopted children aged up to 16 years 11 months who were resident in the same household. The estimated average time for completion of this section, based on results from Pilot 2, was ten minutes per child, though time would vary according to the age of the child.
- *Parent self-completion paper questionnaire*. Cohort members answered questions covering parenting styles, the development of their children and their parents' educational aspirations for them up to age 16 years 11 months. There was a questionnaire to complete for each of their resident natural or adopted children. The estimated average time for completion of the questionnaire, based on results from Pilot 2, was ten minutes.
- *Child self-completion paper questionnaire*. Resident natural or adopted children aged between 10 years and 16 years 11 months completed a questionnaire about their activities at home and school, their attitudes, self-esteem and own educational aspirations. The estimated average time for completion, based on results from Pilot 2, was 15 minutes.
- *Child assessments*. Resident natural or adopted children aged between 3 years and 16 years 11 months had their cognitive skills assessed. The assessments were selected from the battery of assessment tools that make up the BAS II. The estimated average time for completion, based on results from Pilot 2, was 20 minutes.

A technical report containing a detailed description of the content of each questionnaire included in the 2004 survey will be published at the same time as the data is deposited in the UK Data Archive.

First report – what do we have?

This report is based on the data collected from the 9,665 BCS70 cohort members who took part in the Core CAPI interview and the Parent and Child CAPI interview, and both the cohort member and child assessments. Table 1.2 shows the distribution of cohort members across

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12 Williams, J., Clemens, S., Oleinikova, K. and Tarvin, K. (2003). *The Skills for Life survey: A national needs and impact survey of literacy, numeracy and ICT skills*. DfES Research Report 490. Department for Education and Skills.
13 These items concerning the use of functional literacy and numeracy were developed by the Cambridge Training and Development Agency. For full details of all assessment items see Ekinsmyth, C. and Bynner, J. (1994) *The Basic Skills of Young Adults*. London: The Basic Skills Agency.
14 Fawcett, A. and Nicolson, R. (1998). *The Dyslexia Adult Screening Test (DAST)*. London: The Psychological Corporation.
15 All cohort members and eligible children participated in the assessments unless they were prevented from doing so by learning difficulties or communication difficulties to do with their sight, hearing or speech. The assessments were not carried out if the cohort member or their child refused. There were stopping rules specific to most of the assessments, and interviewers were instructed to stop the exercise if the CM, or the child, showed any signs of becoming distressed.
16 Elliot, C. D. (1983, 1996). *British Ability Scales II: Core Scale 2*. Berkshire: The NFER-NELSON Publishing Company Ltd.

England, Wales and Scotland. This distribution was identical to that of the overall population of Great Britain of 58,124,700 in mid 2004, 86 per cent of whom lived in England, 5 per cent in Wales, and 9 per cent in Scotland[17].

Table 1.2 Distribution of cohort members across Great Britain

Country	Sample size	Percentage
England	8,269	86%
Wales	505	5%
Scotland	891	9%
All	*9,665*	*100%*

Because several of the survey instruments required post-fieldwork coding, the dataset on which this report is based is limited to those measures that generated coded information and test scores in the course of the interview. Nevertheless, much rich information was available. More specifically the early dataset contained data from the:

- Core CAPI and CASI interview;
- literacy and numeracy assessments;
- dyslexia exercises;
- Parent and Child CAPI interview;
- assessment data of the cognitive skills of cohort members' children (age 3 years to 16 years 11 months).

In addition to the objective assessment, and to ensure consistency with the earlier surveys through adulthood, the cohort member Personal Interview included self-appraisal questions inviting the respondent to report any skills difficulties. These were responded to before the cohort member attempted the multiple-choice and open-response literacy and numeracy assessments.

Chapters in this report

Chapter 2 concentrates on self-awareness of literacy and numeracy problems, attendance on courses for improvement, and motivation to improve skills.

Chapter 3 reports the multiple-choice part of the adult literacy and numeracy assessments, compares the distribution of scores with those achieved in the *Skills for Life* Survey (2003) and cross-tabulates experiences and attributes at age 34 for men and women in the BCS70 2004 survey with performance in the assessments.

Chapter 4 reports the first longitudinal analysis. As questions from the 1991 literacy and numeracy assessments had been included in the 2004 assessment, performance at age 34 was compared with earlier performance at age 21. Skills that had improved or deteriorated over time were identified and differences in experiences and attributes at age 34 related to them were identified.

17 Source: Office for National Statistics; National Assembly for Wales; General Register Office for Scotland; (updated November 2005) http://www.statistics.gov.uk/census2001/profiles/64.asp

Chapter 5 describes the four dyslexia exercises taken from the *Dyslexia Adult Screening Test* (DAST)[18]. A significant minority of cohort members are identified as being 'at risk' of dyslexia and we correlate performance in the dyslexia exercises with performance in the literacy and numeracy exercises. The results of a preliminary analysis of the possible effect of dyslexia over and above poor literacy and numeracy are discussed.

Chapter 6 moves on to the cognitive skills of the cohort members' children. Their performance in the BAS II assessments was compared with expected performance, the age-equivalent scores published by NFER. A first look at the intergenerational transfer of skills from parent to child shows that the average scores of children were lowest for children of parents (cohort members) with the poorest grasp of literacy and numeracy. Moreover, although the overall correlation between parents' and children's literacy and numeracy scores was weak, it was relatively much higher for parents with the very lowest scores – 'Entry Level 2'. In this and all preceding chapters, the report signposts the areas where policy challenges arise and where the need for more extended programmes of analysis is indicated.

Chapter 7 gives a summary and conclusions of the findings.

18 Fawcett, A. and Nicolson, R. (1998). *The Dyslexia Adult Screening Test (DAST)*. London: The Psychological Corporation.

Chapter 2
Self-reported difficulties

Self-reported difficulties with literacy and numeracy in adulthood have a long history in the cohort studies. Questions were first asked in 1981 when NCDS cohort members were age 23. The initial questions asking cohort members to 'self report' if they thought they had reading, writing or number/maths difficulties were:

- Since leaving school have you had any problems with reading?[19]
- Since leaving school have you had any problems with writing or spelling?
- Since leaving school have you had any problems with numbers or simple arithmetic?

NCDS cohort members have subsequently answered such questions about difficulties with reading, writing and basic number skills at ages 33, 37 (10 per cent sample) and age 42. BCS70 cohort members similarly answered such questions at age 21 (10 per cent sample) and at age 30. It has been repeatedly noted that, as indicators of skills, such questions reveal discrepancies with the results found from objective tests. Although the two are correlated, many respondents whose test performance is very poor do not acknowledge any difficulty – a gap that is particularly large for numeracy. Similarly, though to a lesser extent, some of those who acknowledge a difficulty have average or better scores on the tests. It seems that self-appraisal is not necessarily grounded in objective evidence of performance but has more to do with self-concept and identity. 'Do I see myself as poor against the standard that I set for myself in the context of my everyday life?'[20]. It has been argued that self–appraisal may in fact be the more important indicator of the need for remediation than the objective measure because, as we shall see, it is closely linked to the motivation to change[21].

Such questions therefore gave one of the first insights into the literacy and numeracy experience of adults in Britain (ALBSU, 1987)[22] and in their subsequent use have been valuable in identifying the likely response to new provision, such as that offered under the *Skills for Life* programme.

Fundamental to raising adult literacy and numeracy levels therefore is, first, for people to recognise they have poor skills, and then to perceive these poor skills as a problem. In the research carried out for the Basic Skills Agency (BSA), reports based on self-reported difficulties using cohort data collected in earlier surveys established that acknowledgement of difficulties with basic skills was low, barely exceeding 5 per cent, even among those identified by the literacy and numeracy assessments[23] as having considerable problems. This presents a problem for skills enhancement policies. If people do not perceive a difficulty, then clearly the motivation to join classes to improve their skills is missing. A first step is to try to

19 If a cohort member answered 'yes', they were asked if their difficulties were due to sight problems or just difficulties with reading. If 'difficulties with reading', a number of additional questions were asked. The same applied for the question asking about writing or spelling difficulties.
20 Ekinsmyth and Bynner, and Bynner and Parsons, *op cit*
21 Tom Sticht. *ALL Wrong – Again! Can Adult Literacy Assessments Be Fixed?* May 17, 2005. www.nald.ca/WHATNEW/hnews/2005/murray.htm and personal communication.
22 Hamilton, M. (1987) *Literacy, Numeracy and Adults*. London: ALBSU (Adult Literacy and Basic Skills Unit, now The Basic Skills Agency).
23 Ekinsmyth, C. and Bynner, J. (1994). *The Basic Skills of Young Adults*. London: The Basic Skills Agency. Bynner, J. and Parsons, S. (1997): *It doesn't get any better*. London: The Basic Skills Agency. Parsons, S. (2002). *Do I want to improve my reading, writing or maths?* London: The Basic Skills Agency.

understand what distinguishes the men and women with poor skills who want to improve their skills from the majority of those with a poor grasp of reading, writing or numbers who see no need or have no desire to improve.

In the collection of cohort data over the years, question format and wording has changed[24]. However, Table 2.1 shows that the percentage of cohort members reporting reading, writing and/or spelling, or basic number and arithmetic problems has been remarkably consistent over time: 3 to 4 per cent reading, 3 to 5 per cent numbers and between 4 and 12 per cent for writing and/or spelling. The variation for writing and/or spelling is primarily dependent on whether spelling difficulties were reported separately from writing difficulties[25].

Table 2.1 Percentage of self-reported difficulties in NCDS and BCS70 at different ages

	Age of cohort member					
	NCDS				BCS70	
	23	33	37	42	21	30
Reading difficulties	**4%**	**4%**	**3%**	**3%**	**3%**	**3%**
Writing difficulties			**4%**	**6%**		**4%**
Writing and/or spelling difficulties	9%	9%	12%		9%	
Numberwork difficulties	**5%**	**3%**	**4%**		**4%**	
Problems with change calculation and/or with days/dates/calendars				**5%**		**5%**
(Change calculation problems)				(2%)		(2%)
(Days/dates/calendars problems)				(3%)		(3%)
Any difficulty (inc. spelling)	**13%**	**11%**	**15%**		**12%**	
Any difficulty			**8%**	**10%**		**9%**
n(100%) =	*12,537*	*11,407*	*1,714*	*11,419*	*1,623*	*11,261*

When preparations for the 2004 survey began, the value of repeating the same self-reported questions for the benefit of longitudinal consistency, or adapting question format in an attempt to capture more specific difficulties cohort members might be experiencing, were weighed up along with interviewee burden. For example, in the NCDS and BCS70 surveys in 2000, if a cohort member had reported they had no difficulties with the question 'When you buy things in shops with a five or ten pound note, can you usually tell if you are given the right change?' they would not be asked any further questions. By dropping this filter on the question, cohort members could be asked if they experienced difficulties with other types of number or maths calculations. After much consideration, the filter was dropped, and all but one of the basic skills questions included in 1999/2000 were asked in 2004, but this time all cohort members were required to answer all questions. In total this amounted to three questions on reading difficulties, four questions on writing difficulties and six on number and maths difficulties[26].

24 For full details see Parsons, S. and Bynner, J. (2005). *Measuring Basic Skills for Longitudinal Study: the design and development of instruments for use with cohort members in the age 34 follow-up of the 1970 British Cohort Study (BCS70)*. NRDC Report. http://www.nrdc.org.uk/content.asp?CategoryID=424 .
25 ALBSU, 1987; Ekinsmyth and Bynner, 1994; Bynner and Parsons, 1997.
26 In line with previous sweeps, cohort members were first asked if they had a sight problem. The 3 per cent of cohort members who reported they were blind or had a sight problem were not asked questions on reading or writing.

Results from the 2004 survey

The results from the main fieldwork are shown in Tables 2.2a, 2.2b and 2.2c compared, where possible, with the results for the same questions in previous NCDS and BCS70 surveys. The first point to note is that, when all cohort members were asked all questions, a higher percentage of cohort members in 2004 reported difficulties with at least one aspect of reading, writing or numbers (the first row in each of the three tables) than had been reported in previous years when they had been asked about general difficulties, or difficulties with just one specific aspect of reading, writing or numberwork. Writing difficulties were the most widely reported (25 per cent) while difficulties with reading were reported least often.

Table 2.2a Percentage reporting difficulties in response to the individual Reading questions

READING	NCDS age 42	BCS70 age 30	BCS70 age 34
Any reading difficulty?	3%	3%	8%
Can you usually read and understand what is written in a magazine or newspaper?	3%	3%	2%
Can you read aloud to a child from a children's storybook?			2%
Can you usually read and understand any paperwork or forms you would have to deal with?			7%
n(100%)	*11,419*	*11,261*	*9,349*

Table 2.2b Percentage reporting difficulties in response to the individual Writing questions

WRITING	NCDS age 42	BCS70 age 30	BCS70 age 34
Any writing difficulty?	6%	4%	25%
Can you write a letter to a friend to thank them for a gift or to invite them to visit?	6%	4%	2%
When you try to write something do you find it difficult to spell some words correctly?			19%
Do you find it difficult to make your handwriting easy to read?			6%
Do you find it difficult to put down in words what you want to say?			7%
n(100%)	*11,419*	*11,261*	*9,349*

Table 2.2c Percentage reporting difficulties in response to the individual Number questions

MATHS, NUMBERS AND ARITHMETIC	NCDS age 42	BCS70 age 30	BCS70 age 34
Any number/maths difficulty?	2%	2%	11%
When you buy things in shops with a five or ten pound note, can you usually tell if you have the right change?	2%	2%	1%
When you have to do things with numbers do you find it difficult to recognise numbers when you see them?			1%
Do you ever have difficulty adding up?			2%
Do you ever have difficulty with subtraction – that is taking one number away from another?			3%
Do you ever have difficulty with multiplication?			6%
Do you ever have difficulty with division?			9%
n(100%)	*11,419*	*11,261*	*9,630*

Table 2.3 compares levels of self-reported difficulties in the three Great Britain (GB) countries. We can see that cohort members in Scotland were the least likely to report reading, writing or numberwork difficulties. In England and Wales, a near-identical percentage of cohort members reported reading, writing or number/maths difficulties.

Table 2.3 Percentage reporting difficulties in England, Wales and Scotland

	England	Wales	Scotland
Any reading difficulty?	8%	7%	5%
Any writing difficulty?	26%	27%	18%
n(100%)	*7,993*	*491*	*865*
Any number/maths difficulty?	11%	12%	7%
n(100%)	*8,236*	*503*	*891*

The three questions previously asked of all cohort members following the initial question were:

- Can you usually read and understand what is written in a magazine or newspaper?
- Can you write a letter to a friend to thank them for a gift or to invite them to visit?
- When you buy things in shops with a five or ten pound note, can you usually tell if you have the right change?

We can see that the percentages who reported such difficulties with reading, writing or numbers in 2004 were similar, but slightly lower than reported in previous sweeps.

For the questions not previously asked to all cohort members in previous sweeps, higher percentages of cohort members involved in 2004 reported difficulties with at least one aspect of reading, writing or numberwork than had done in response to the initial question. This explains the higher overall percentage who felt they had difficulties with at least one aspect of reading, writing or numberwork. As Table 2.2a shows, of the three aspects of reading covered, difficulties with form-filling and similar paperwork were reported most frequently (7 per cent). Of the four writing questions (Table 2.2b) spelling was the most widely reported difficulty (19 per cent) and, not unexpectedly, of the six questions to do with numbers and mathematical calculations (Table 2.2c), most cohort members reported difficulties with division (9 per cent).

Figures 2.1a, 2.1b and 2.1c take the analysis a stage further, showing the percentages of men and women who reported each of a number of specific situations in which they had reading, writing or number difficulties. Although for the three aspects of reading the differences were generally small, marginally more men than women reported difficulties. Differences between men and women reporting difficulties with each of the four aspects of handwriting were more pronounced (Figure 2.1b), particularly for spelling (24 per cent men, 15 per cent women) and handwriting (10 per cent men, 3 per cent women). For number and maths difficulties (Figure 2.1c) the picture reversed. Although differences between men and women were generally small, more women than men reported difficulties with each of the four mathematical operations, in particular for multiplication (4 per cent men and 8 per cent women) and for division (7 per cent men and 10 per cent women). These results are in line with gender-typical stereotyping. More men perceive difficulties associated with written communication (spelling and handwriting): more women report difficulties with the more advanced mathematical operations (multiplication and division).

Figure 2.1a **Percentage of men and women who reported specific reading difficulties**

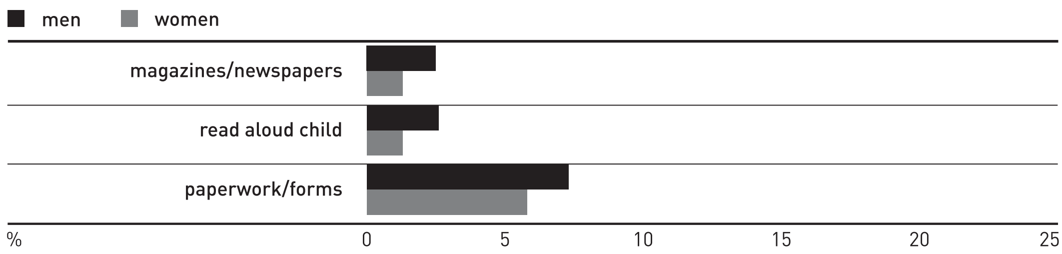


Figure 2.1b **Percentage of men and women who reported specific writing difficulties**

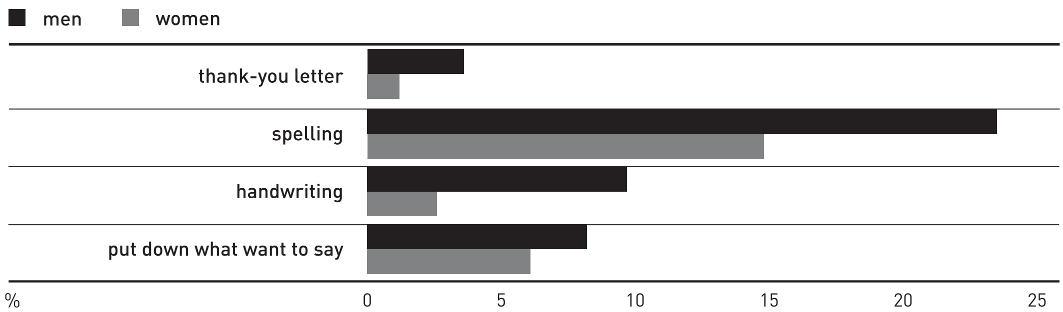
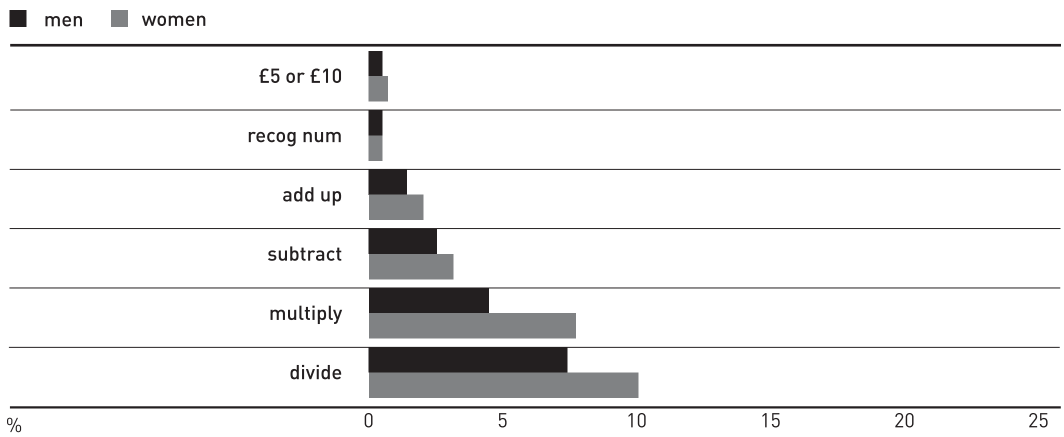


Figure 2.1c **Percentage of men and women who reported specific number/maths difficulties**



Literacy and numeracy courses and the desire to improve skills

Only about 3 per cent of the 2004 survey members reported that they had been on a course to help them improve their reading, writing or number and maths calculations. This was lowest at 2 per cent in Scotland and highest at 4 per cent in Wales. However, although remaining low, Figures 2.2a and 2.2b show that more of the men and women who reported skills difficulties also reported that they had been on a course in the past four years to help overcome these difficulties, compared with those who did not report difficulties.

As many as one in five (20 per cent) of all men and women wanted to improve their reading, writing or number skills, with more men reporting that they wanted to improve their writing skills (12 per cent men, 7 per cent women) and women their grasp of numbers (15 per cent women, 10 per cent men). Men and women in Scotland were the least likely to report wanting to improve any of these skills.

Among those who reported reading, writing or number difficulties, as many as 39 per cent of men and women wanted to improve at least one of these skills. More specifically, Figures 2.2a and 2.2b show that, among those reporting reading or writing difficulties, more than one in four men and one in five women reported that they wanted to improve these skills. Among the men and women who reported difficulties with some aspect of numberwork, Figure 2.2c shows that as many as 38 per cent of men and 45 per cent of women wanted to improve their skills. By comparison, among the respondents who did not acknowledge problems, very small proportions wanted to improve their skills (usually less than 5 per cent). The main exception was number skills for women, where 7 per cent of men and 11 per cent of women who did not acknowledge a problem wanted to improve their skills.

Figure 2.2a **Percentage of men and women who had been on a course or wanted to improve their reading skills, by self-reported problems with reading**

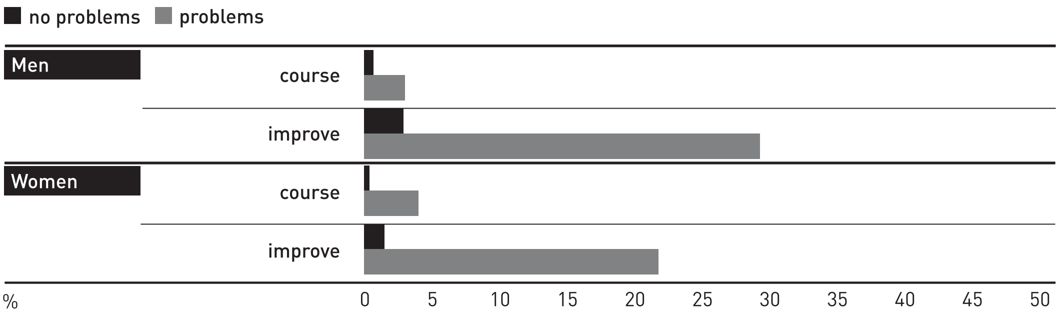


Figure 2.2b **Percentage of men and women who had been on a course or wanted to improve their writing skills, by self-reported problems with writing**

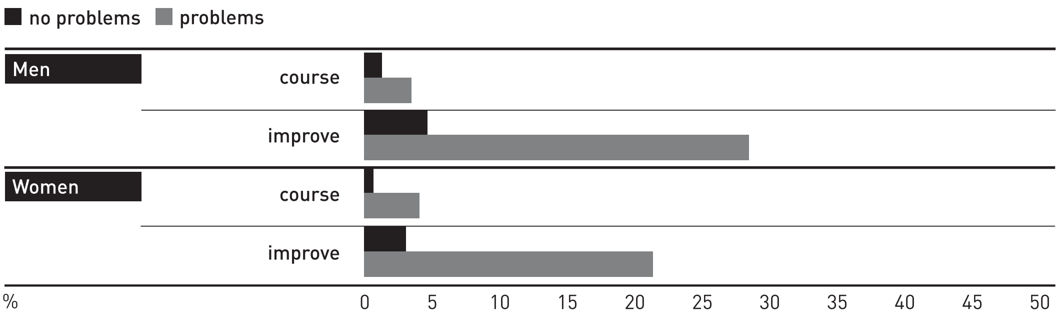
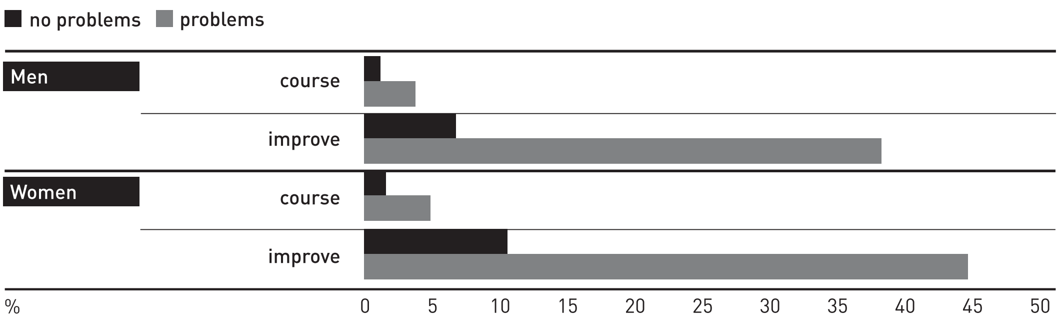


Figure 2.2c **Percentage of men and women who had been on a course or wanted to improve their number skills, by self-reported problems with numbers**



Conclusion

These results point to a continuing low self-awareness of literacy and numeracy difficulties, which is not surprising among adults, most of whom manage their lives well and learn to cope with any skills difficulties that they have. However, by asking questions about highly specific difficulties to the whole sample not, as in the past, just to those who acknowledged difficulties generally, the proportions increased. This suggests that the more refined form of questioning is necessary to elicit the full range of problems that people have.

What is particularly significant in policy terms is that, as the last analysis shows, once the awareness is present, interest in improvement tends to follow. The very low number of adults who report difficulties with reading, writing or numbers and have actually been on a course to help improve their skills needs to be set against the significant proportion of those acknowledging a problem who say that they want to improve their skills. The relationship between awareness of difficulties, attendance on courses and desire to improve the skill is revisited in later chapters for cohort members who have skills problems that are objectively identified by tests. However, this first insight from the new data points to challenges and opportunities that the *Skills for Life* strategy needs to address. The means need to be found to stimulate awareness of problems and to offer provision that matches the specific needs identified by potential learners.

Chapter 3
Profile of national assessment levels

Although the earlier assessments used in NCDS (age 37) and BCS70 (age 21) had proved their worth in the investigation of literacy and numeracy skills difficulties and in explaining their origins, the instruments employed were designed *ad hoc* to reflect the City and Guilds WordPower and NumberPower standards of the time[27]. They were therefore valuable for studying continuities and discontinuities in cohort members' performance from the earlier to the new survey, but were inadequate for placing individuals at the levels of performance defined by the new *Skills for Life* standards. Accordingly, new literacy and numeracy assessments that combined both elements were designed for the age 34 follow-up of BCS70 cohort members. In line with the recommendations from the review by Greg Brooks and colleagues of adult reading, writing and numeracy assessment instruments for use in a UK setting[28], the new instrument combined two methods of questioning:

1. Open-response (OR) literacy and numeracy questions previously used to assess BCS70 cohort members' functional literacy and numeracy skills;
2. Multiple-choice (MC) questions extracted from the 2003 *Skills for Life* Survey[29].

The aim was that, by retaining some test items that cohort members completed in the earlier survey and importing items from the *Skills for Life* Survey (2003), the new assessment would enable cross-referencing from one survey to another and supply benchmarking to the national standards. Importantly, the proven strengths of the two chosen assessment methods were retained. All items used would be presented in their original format and medium. Questions from the *Skills for Life* Survey would be MC in format and presented on the computer; questions from the previous BCS70 age 21 assessment would be OR, paper-based, and administered by the interviewer in conversational mode.

For the MC questions, and following an extensive period of development and consultation, a simple method of adaptive testing involving two tiers was piloted. Essentially, all respondents answered an initial set of 'screening' questions (Entry Level 3). Depending on the number of correct answers a respondent gave to these initial questions, they progressed to either:

- a set of harder questions – the 'upper tier' (Level 1 and Level 2); or
- a set of easier questions – the 'lower tier' (Entry Level 2 or Entry Level 3).

NB. Entry Level 2 should be read throughout as incorporating all levels below.

This approach supplied an overall test score for all respondents while allowing a 'spiky profile' to be built for those with the poorest grasp of literacy and numeracy. Such profiles reflect a respondent's ability, through practice, to develop and show a high level of competence in one or more skills while performing badly in other skills. For example,

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27 WordPower comprised of Foundation Level and three higher levels. For NumberPower there was a Foundation Level and two higher levels.
28 Brooks, G., Heath, K. and Pollard, A. (2005). *Assessing adult literacy and numeracy: a review of research instruments*. London: National Research and Development Centre for Adult Literacy and Numeracy.
29 Williams, J., Clemens, S., Oleinikova, K. and Tarvin, K. (2003). *The Skills for Life survey: A national needs and impact survey of literacy, numeracy and ICT skills*. DfES Research Report 490. The baseline survey was devised by the Centre for the Development and Evaluation of Lifelong Learning (CDELL) at the University of Nottingham, for the Department for Education and Skills. Special thanks are reserved for Peter Burke, John Gillespie and Bob Rainbow, consultants at CDELL for their help and guidance in all stages of the test development.

individual experiences mean that most people develop competent numeracy skills in particular application areas, while needing help in others.

By giving respondents who struggled with the initial set of questions an additional set of easier questions, we therefore had the opportunity to see what the men and women assessed with the poorest skills were really capable of, rather than just knowing what they could not do. We also needed to provide a distribution of cohort members across test score 'levels', in line with the *Skills for Life* Survey[30].

Design of final assessments

For the literacy assessment, results from the pilot work were in line with expectations and suggested that the screening questions were able to identify accurately the small group of adults with the most severe literacy difficulties (5–6 per cent). However, for numeracy, 34 per cent of respondents, many more than expected, moved down to the lower tier of the test. This suggested that the screening questions were either too difficult, or maybe too specific, ie, they were not broad enough to capture a range of number skills. As a result, more respondents were relegated to the lower tier for not having the skills being assessed by the specific screening questions selected, though it was likely that many of them would have been able to do some of the higher level tasks.

Literacy

In the final version of the test, the two tiers were retained for literacy but with some modifications. A total of 20 multiple-choice literacy questions made up the final assessment, of which ten were screening questions (Entry Level 3) (see Figure 3.1). Respondents failing to answer at least six of these questions correctly went on to answer ten Entry Level 2 questions on the lower tier. Respondents who answered between six and ten screening questions correctly proceeded to the upper tier and answered five Level 1 and five Level 2 questions.

The adult literacy core curriculum covers 'Speaking and Listening', 'Reading' and 'Writing'. The items in the *Skills for Life* Survey (2003) cover aspects of Reading and Writing only[31]. There are three main aspects of reading and writing covered by the adult literacy core curriculum:

- **Reading**
  - Reading Comprehension (RC)
  - Grammar and Punctuation (GP)
  - Vocabulary, Word Recognition, Phonics (V, WR, P)
- **Writing**
  - Writing Composition (WC)
  - Grammar and Punctuation (GP)
  - Spelling and Handwriting (SH)

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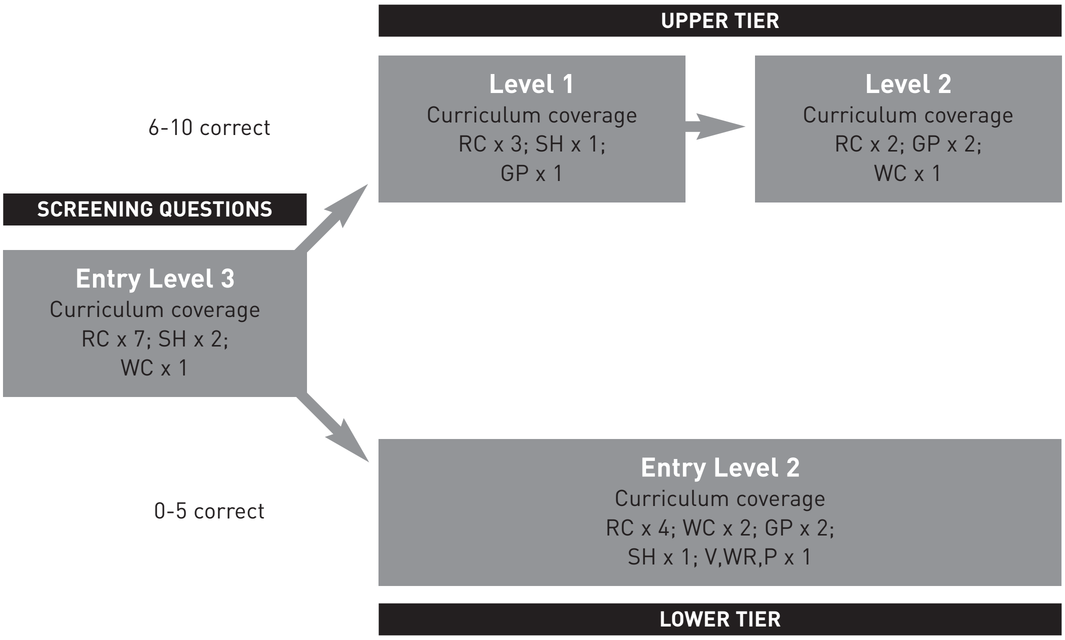
30 For comprehensive details of the design and content of the assessment see: Parsons, S. and Bynner, J. (2005). *Measuring Basic Skills for Longitudinal Study: The design and development of instruments for use with cohort members in the age 34 follow-up in the 1970 British Cohort Study (BCS70)*. London: National Research and Development Centre for Adult Literacy and Numeracy. http://www.nrdc.org.uk/content.asp?CategoryID=424

31 The work undertaken by colleagues at CDELL for the *Skills for Life* Survey (2003) pre-dated the Adult Literacy Core Curriculum document. The National Standards for Adult Literacy (QCA 2000) were used instead. Each question was designed to meet a specific criterion or criteria for reading and/or writing. Level 1 and Level 2 questions were based on multiple-choice items used in the national key skills tests. However, some questions needed re-formatting for computer-based use.

As with the *Skills for Life* Survey (2003), item selection was heavily concentrated on the many aspects of 'Reading Comprehension'. However, Figure 3.1 shows that 'Writing Composition' (WC), 'Grammar and Punctuation' (GP) and 'Spelling and Handwriting' (SH) were also covered by items on both the lower and upper tiers. A sample of handwriting obtained from each cohort member at the end of the interview completed the picture of their literacy skills (see Appendix 1 for details).

Figure 3.1: **Final literacy multiple-choice assessment**



Numeracy

All respondents attempted all questions in the revised numeracy MC assessment. Earlier research, reinforced by the pilot work, has established that a high proportion of men and women in the general population have number difficulties[32]. The widespread and diverse nature of difficulties associated with numeracy suggested that creating a 'spiky profile' of number skills at the population level would have equal, if not more, value than restricting this examination to the one in four or one in three with the poorest grasp of numeracy.

There were 17 questions in the final version of the assessment. To obtain as balanced a set of questions as possible in relation to curriculum coverage, difficulty levels and no repeated images[33], the final instrument was made up of five questions set at Entry Level 2, four at Entry Level 3, five at Level 1 and three at Level 2.

32 Parsons, S., and Bynner, J. (1999) *Literacy, Leaving School and Jobs: the effect of poor basic skills on employment in different age groups*. London: The Basic Skills Agency; Bynner, J. and Parsons, S. (1997) *Does numeracy matter?* London: Basic Skills Agency. Parsons, S. and Bynner, J. (2005). *Does numeracy matter more?* London: National Research and Development Centre for Adult Literacy and Numeracy.

33 Repeated images (visual test stimuli to which testees responded) were avoided to stop the confusion felt by respondents who thought they had already answered an individual question. This was a problem particularly in the numeracy assessment as images were not grouped together as they had been for the literacy assessment.

Seven aspects of number skill from the numeracy curriculum were assessed by the items in the original *Skills for Life* Survey (2003). These were:

- Basic Money (BM)
- Whole Numbers and Time (NT)
- Measures and Proportion (MP)
- Weights and Scales (WS)
- Length and Scaling (LS)
- Charts and Data (CD)
- Money Calculations (MC)

Other than 'Basic Money', at least one question at each level of difficulty was available for selection for each aspect of number skill assessed. Questions on 'Basic Money' ranged in difficulty from Entry Level 1 up to Entry Level 3. Although the *Skills for Life* Survey (2003) included questions set at Entry Level 1, very few adults had difficulty with these questions. Within the design constraints – especially the time limitation for the assessment component of the BCS70 2004 survey – questions at this level were of limited value for discriminating between cohort members and were therefore not included.

The 17 selected questions were presented in order of difficulty within each curriculum topic, eg, all questions set at different levels of 'Money Calculations' were attempted, before moving to the next set of questions on 'Whole Numbers and Time'. This method was adopted because of its potential value for capturing more of the elements of numeracy that an individual respondent could and could not do. The revised assessment started and ended with an Entry Level 3 question, as shown in Figure 3.2.

Figure 3.2: **Final numeracy assessment: curriculum coverage and sequence of difficulty of questions**

START	**EL3** NT	→	**L1** NT	→	**EL3** MP
→	**L1** MP	→	**EL2** WS	→	**L1** WS
→	**L2** WS	→	**EL2** LS	→	**L1** LS
→	**L2** LS	→	**EL2** CD	→	**EL2** MC
→	**EL3** MC	→	**L1** MC	→	**L2** MC
→	**EL2** BM	→	**EL3** BM	**END**	

Note 1: Aspects of the numeracy core curriculum: NT = Whole Numbers and Time, MP = Measures and Proportion, WS = Weights and Scales, LS = Length and Scaling, CD = Charts and Data, MC = Money Calculations, BM = Basic Money.

Note 2: In combination, the selected MC and OR questions ensured that each aspect of the curriculum was covered by at least three questions at different levels of difficulty.

The whole assessment, comprising both MC and OR questions, was administered in the following order:

- introduction to multiple-choice questions as used in the *Skills for Life* Survey (2003) (with minor amendments);
- multiple-choice literacy questions;
- multiple-choice numeracy questions;
- open-response literacy questions;
- open-response numeracy questions.

Cohort members had to answer the 20 MC literacy questions and 17 MC numeracy questions before answering the seven OR literacy and six OR numeracy questions.

Calculation of overall scores

It is anticipated that most analysts using the new BCS70 assessment data will wish to work with total scores that reflect cohort members' performance relative to that of the whole population across the whole range of performance. Accordingly, in addition to providing the opportunity for a detailed examination of the adults in BCS70 with the poorest literacy and numeracy skills, the final literacy and numeracy assessments also had to produce a total score that could be calculated for all cohort members. This assumes a reasonably high level of reliability of the scores, ie, differences in test performance between groups will not be missed through large measurement errors. Table 3.1 shows that the reliability estimates for the MC literacy and numeracy assessment items surpassed the levels generally considered acceptable for survey analysis purposes, exceeding 0.8 (alpha coefficient) in both cases[34]. The reliability estimates for the assessments comprising only the much smaller number of OR items were lower but, when these items were combined with the MC items, in two cases the reliability levels increased.

Table 3.1 Reliability estimates for items in literacy and numeracy assessments

	Alpha	No. of items	N
MC Literacy	.82	20	9,567
MC Literacy	.87	30	9,567
MC Numeracy	.82	17	9,561
OR Literacy	.58	7	9,520
OR Numeracy	.62	6	9,509
All Literacy	.83	27	9,520
All Literacy	.85	37	9,520
All Numeracy	.84	23	9,509

For numeracy, computation of an overall score was straightforward as all cohort members completed all questions. Any correct answer was given '1' point, any incorrect answer '0' points. The maximum numeracy score available from the multiple-choice questions is within the range 0 to 17 for all cohort members.

34 For further details see Parsons, S. and Bynner J. (in press) 'Measuring Basic Skills for Longitudinal Study', *Literacy and Numeracy Studies.*

For the vast majority of cohort members who progressed along the upper tier of the literacy assessment the identical scoring technique applied: any correct answer was given '1' point, any incorrect answer '0' points. However, to calculate an overall score that included the 4 per cent of cohort members who, because they failed to answer six or more of the screening questions correctly, moved down to the lower tier of the MC assessment, we have to assume they would not have been able to answer any of the more difficult questions on the upper tier (Level 1 and Level 2). Accordingly, a score of '0' was automatically awarded to this group for the ten questions on the upper tier. Likewise, a score of '1' for each of the ten questions on the lower tier was automatically awarded to the 96 per cent of cohort members who progressed along the upper tier. The maximum literacy score available from the multiple-choice questions is therefore within the range 16 to 30 for cohort members on the upper tier and 0 to 15 for cohort members who progressed on the lower tier.

Figure 3.3a gives the total score achieved by the cohort members who progressed from the screening questions along the upper tier of the literacy multiple-choice assessment (20 questions) and those who moved down from the screening questions along the easier lower tier of the literacy multiple-choice assessment (20 questions). The diversity of ability among the 4 per cent of lower tier (Entry Level 2) cohort members within a shorter and more accessible scoring range is clear to see, while the upper tier sample shows a good spread of scores with the expected bias towards high performance.

The distribution of cohort members' total literacy score (0 to 30) is shown in Figure 3.3b. The performance of lower tier cohort members is represented by the long tail towards the low scores, reflecting the relatively low incidence of very poor reading skills in the population. The total numeracy score is displayed in Figure 3.3c. We can see that, by removing the 'screen' that placed relatively high numbers of respondents on a lower tier (creating a 'bimodal' distribution), the main aim of the test construction – to achieve continuity in the measurement of performance in the population from one level to the next – was achieved.

Using all 30 questions to compute the overall literacy score, a strong and highly significant (product moment) correlation of 0.64 ($p<.001$) was recorded between cohort members' performances in the literacy and numeracy MC assessments. Product moment correlation coefficients range from -1.0 to +1.0. A correlation coefficient of 0 signifies that there is no linear relationship between performance in one test and another. Thus, the larger the correlation coefficient, the stronger is the linear relationship. A positive correlation signifies that a high score in one exercise is associated with a high score in the other; a negative correlation signifies that a high score in one test is associated with a low score in the other.

Figure 3.3a **Total literacy score from 20 multiple-choice questions on the upper tier and the lower tier**

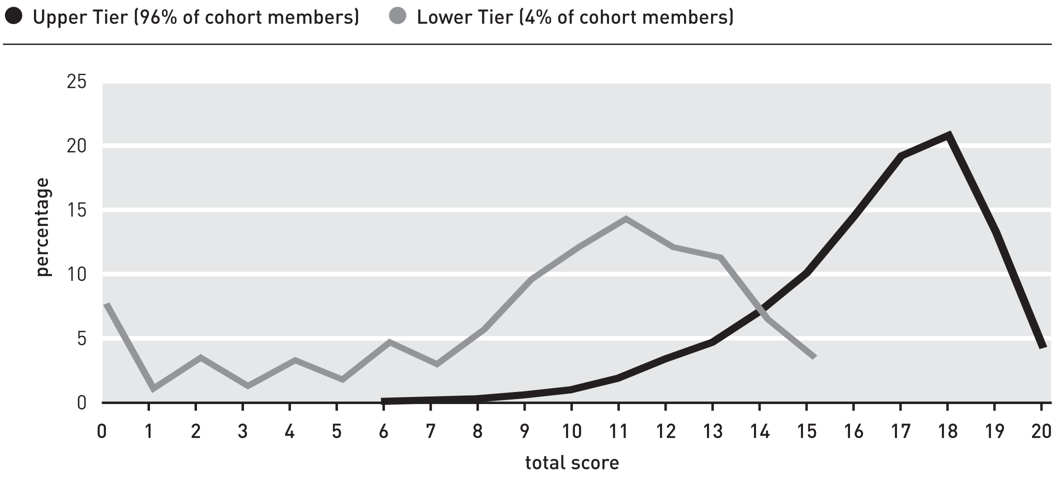


Figure 3.3b **Total literacy score from multiple-choice questions**

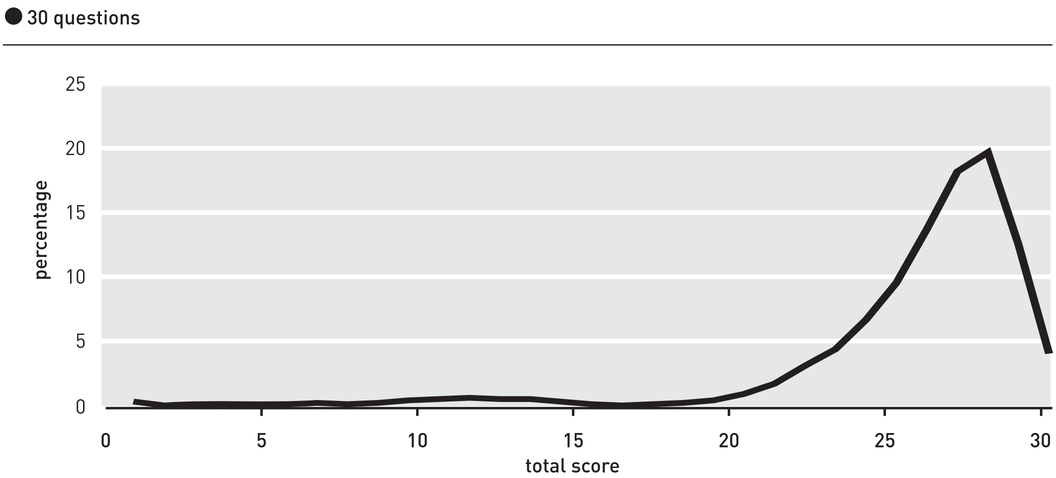
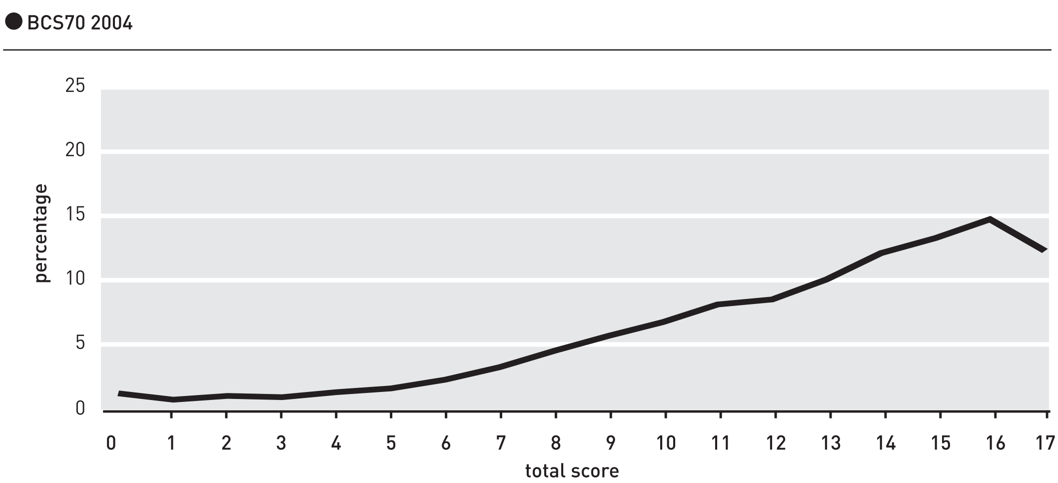


Figure 3.3c **Total numeracy score from multiple-choice questions**

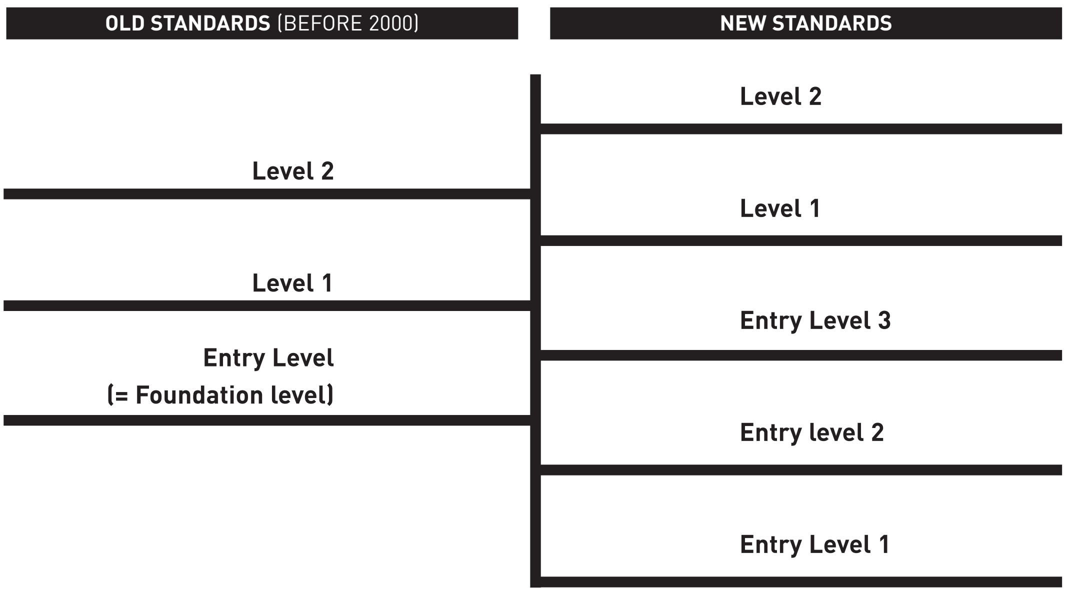


Converting performance in literacy and numeracy assessments into levels

Another important aim of the survey was to compare the BCS70 performances with those obtained in the *Skills for Life* Survey (2003) in terms of the levels in the *Skills for Life* national standards. We cannot guarantee the same degree of reliability for this comparison because of the relatively small number of items available to assess performance at each level and the complexity, in scaling terms, of the 'adaptive testing' approach used in the *Skills for Life* Survey (2003). As we discuss below, there were also problems in precisely mapping performance levels from the age 21 survey (OR questions) to the age 34 survey (MC questions). Hence only a limited comparison could be undertaken and caution is needed in interpreting the results.

By converting performance – the number of correct answers in both the MC and OR parts of the assessment – into levels, we were able to classify respondents by their achieved level. There are many ways of doing this, and several were tried. Much attention was given to the levels of the OR questions as the levels of the OR assessment items (old standards) do not directly correspond with the levels of the MC questions (new standards). As shown in Figure 3.4, OR Foundation Level questions (old standards) fall across MC Entry Level 2 and Entry Level 3 (new standards), OR Level 1 questions across MC Entry Level 3 and Level 1, and OR Level 2 questions across MC Level 1 and Level 2.

Figure 3.4: **Comparison of old and new standards**



Should the levels of the OR items therefore be downgraded or upgraded? The main fieldwork results suggested that the OR assessment items worked better (in terms of total score distributions) if they were slightly downgraded, ie, Foundation Level questions (old) were treated as Entry Level 2 questions (new), Level 1 questions (old) as Entry Level 3 questions (new) and Level 2 questions (old) as Level 1 questions (new). However, the whole issue of equivalence between the two classifications merits further investigation. In the analysis reported here, the assessment data from the two forms of test were generally treated separately, ie, a combined score was not employed.

Using the MC assessment, the classification by levels is based on the principle that, to pass a level, at least half the test questions at the given level had to be answered correctly, as follows.

For Literacy

- Below Entry Level 2: 0–5 correct answers at EL2
- Entry Level 2: 6–10 correct answers at EL2 and 0 – 5 at EL3
- Entry Level 3: 6–10 correct answers at EL3 and 0 – 2 at L1
- Level 1: 3–5 correct answers at L1 and 0 – 2 at L2
- Level 2: 3–5 correct answers at L1 and 3 at L2

For Numeracy

- Below Entry Level 2: 0–3 correct answers at EL2
- Entry Level 2: 4–5 correct answers at EL2 and 0 – 2 at EL3
- Entry Level 3: 3–4 correct answers at EL3 and 0 – 3 at L1
- Level 1: 4–5 correct answers at L1 and 0 – 2 at L2
- Level 2: 3 correct answers at L2

After classifying performance on the number of correct answers to the MC questions in terms of the literacy and numeracy levels used in the 2003 *Skills for Life* Survey (Entry Level 2, Entry Level 3, Level 1 and Level 2) we compare in Figures 3.5a and 3.5b the distribution of BCS70 cohort members across the four levels of literacy and numeracy against the distributions of all respondents and those of a similar age (30 – 35) who took part in the *Skills for Life* Survey (2003)**.** This survey is based on a representative sample of all age groups of the working population of England.

For literacy, Figure 3.5a shows that overall performance in the *Skills for Life* Survey (2003) was slightly lower than in BCS70 2004 with, for example, 13 per cent (8 + 5 per cent) of both the overall sample and age 30 to 35–year-olds having below Level 1 literacy compared with 8 per cent (4 + 4 per cent) in BCS70 2004. Interestingly, more of the 30 to 35-year-olds had Entry Level 2 (or below) literacy skills than in the overall sample.

Figure 3.5b shows that, for numeracy, the two distributions were very similar but slightly fewer BCS70 2004 cohort members performed at the lowest level (at or below Entry Level 2), and slightly more 30 to 35-year-olds in the *Skills for Life* Survey (2003) performed at the highest level (Level 2).

Figure 3.5a **'Profiles of competence' based on national standards: literacy performance in BCS70 2004 and *Skills for Life* Survey (2003)**

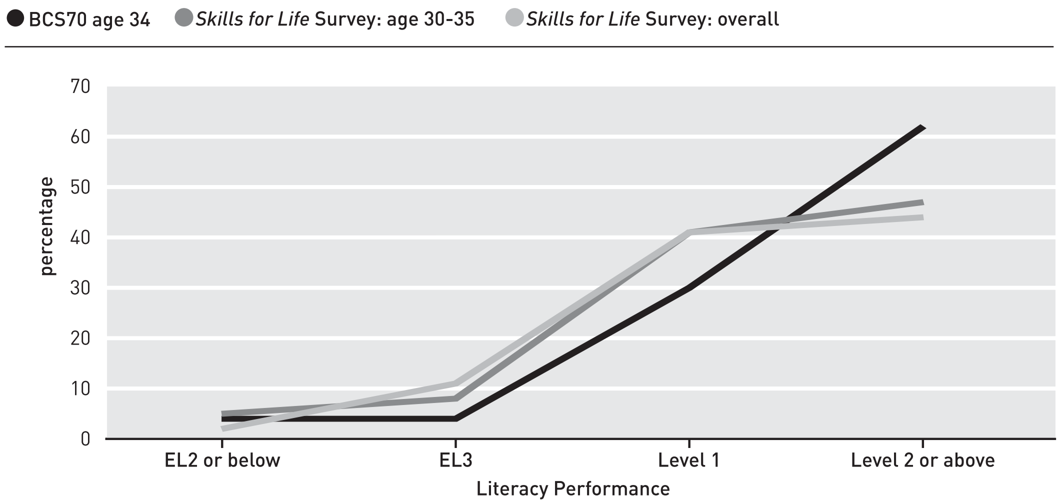
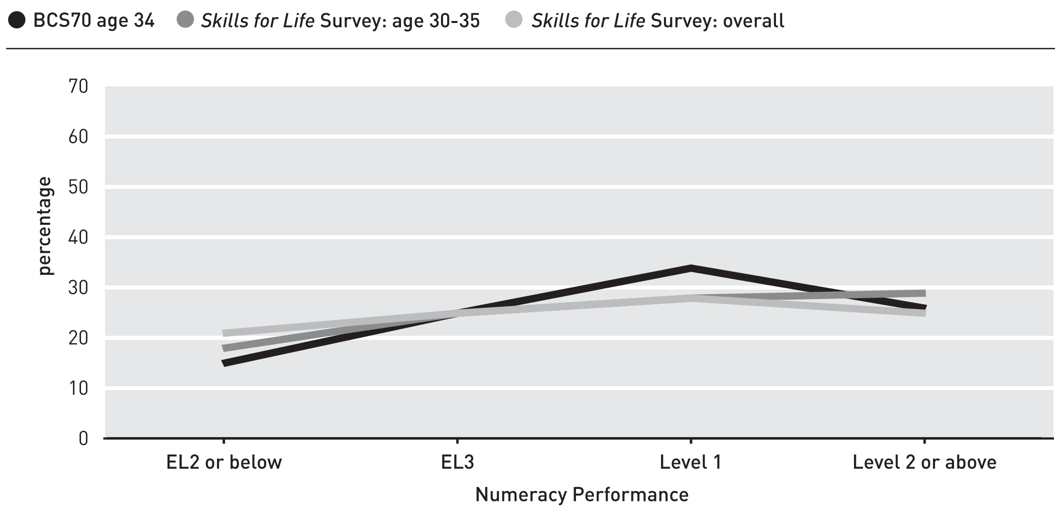


Figure 3.5b **'Profiles of competence' based on national standards: numeracy performance in BCS70 2004 and *Skills for Life* Survey (2003)**



As BCS70 has followed a representative sample of all babies born in Great Britain, in Figure 3.6a and 3.6b we also compare the distribution of BCS70 2004 cohort members across the four levels in England, Wales and Scotland. As 86 per cent of the cohort members were currently living in England, their distribution was essentially that of the overall sample. The literacy performance of cohort members in Scotland was nearly identical to that of the majority living in England, but there were slightly more who performed at the upper end for numeracy.

Cohort members living in Wales performed markedly less well than their English and Scottish peers at the highest levels in both literacy and numeracy[35]. More were also located at the lowest levels. Further analysis will tease out the reasons for this, which may be to do with the social composition of the Welsh population. Alternatively, there may be a genuine performance

35 The analysis showed that the differences in the percentage distributions across the skills levels between i) England and Wales and ii) Scotland and Wales were highly statistically significant (p<.000). There was no statistically significant difference between distributions across the skills groups between England and Scotland.

difference that raises important policy questions about literacy provision in Wales. The Welsh language, as the first language for some respondents, may of course also be a factor.

Figure 3.6a **'Profiles of competence' based on national standards: comparing literacy performance in BCS70 2004 by country**

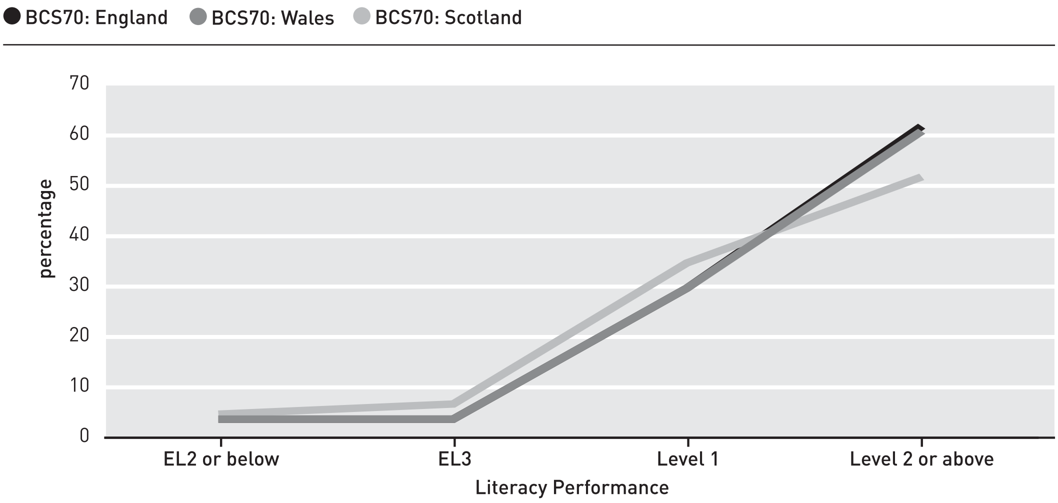
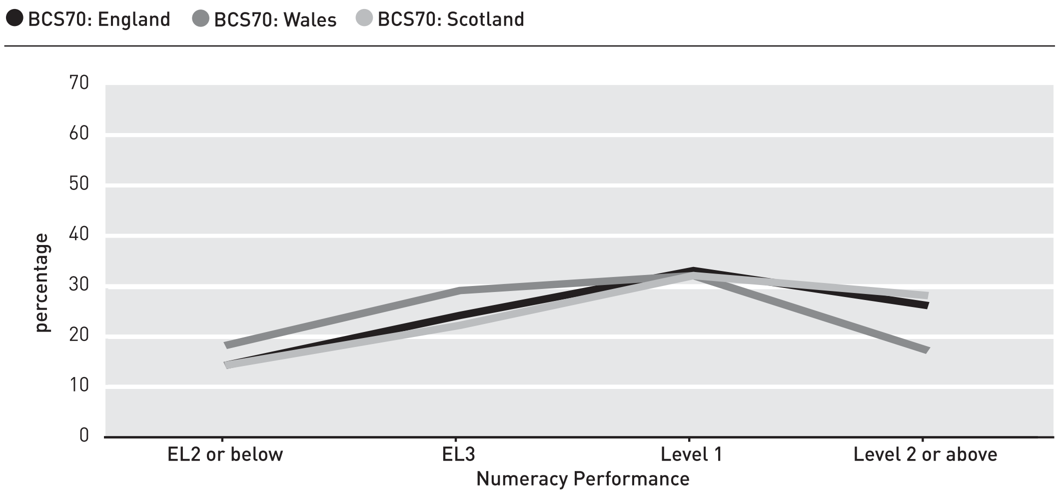


Figure 3.6b **'Profiles of competence' based on national standards: comparing numeracy performance in BCS70 2004 by country**



Comparison of outcomes at age 34

We now focus on differences across the performance levels in cohort members' experiences and attributes by age 34, again restricted to cohort members' performance in the MC part of the assessment. All such age 34 variables included are derived from questions included in the Core CAPI or CASI interview. Essentially we look at how men and women in BCS70 2004 with the poorest skills (those classified as at or below Entry Level 2) compared, in many aspects of adult life, with men and women with more accomplished functional literacy or numeracy.

Although many negative relationships are shown between poor skills and outcomes at age 34, other important factors such as qualifications and geography would need to be accounted for before attributing any causal interpretation to the relationships.

Awareness of skills difficulties

We start by returning to the subject matter of Chapter 2, examining the relationship between self-assessed literacy and numeracy difficulties and the national standards.

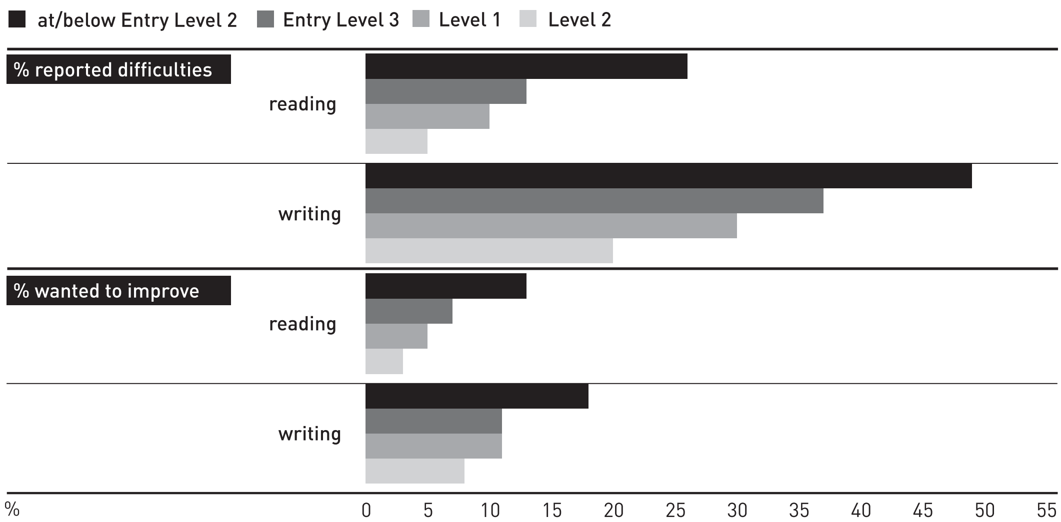
Literacy

In comparison with the overall 8 per cent of cohort members who reported difficulties with reading, this increased to as many as 30 per cent of men and 22 per cent of women with Entry Level 2 literacy. The difficulties were most likely to be related to understanding paperwork and forms. Similarly, whereas 25 per cent of all cohort members reported some difficulty with writing, this increased to 61 per cent of men and 39 per cent of women assessed with Entry Level 2 literacy. Most of the reported difficulties were associated with spelling, but a substantial minority of men and women with Entry Level 2 literacy said they struggled 'to put down in words' what they wanted to say (25 per cent men, 13 per cent women).

Men and women with Entry Level 2 literacy were the most likely to want to improve their reading or writing skills (see Figure 3.7a), but just 6 per cent of men and 3 per cent of women had been on a course to help them to do so.

Figure 3.7a combines the data for men and women. It is clear that, as for the self-assessed skills difficulties, the highest proportions of those who wanted to improve their reading or writing skills were at the lowest performance levels: 13 per cent Entry Level 2 literacy compared with 3 per cent Level 2 (reading), and 18 per cent Entry Level 2 literacy compared with 8 per cent Level 2 (writing).

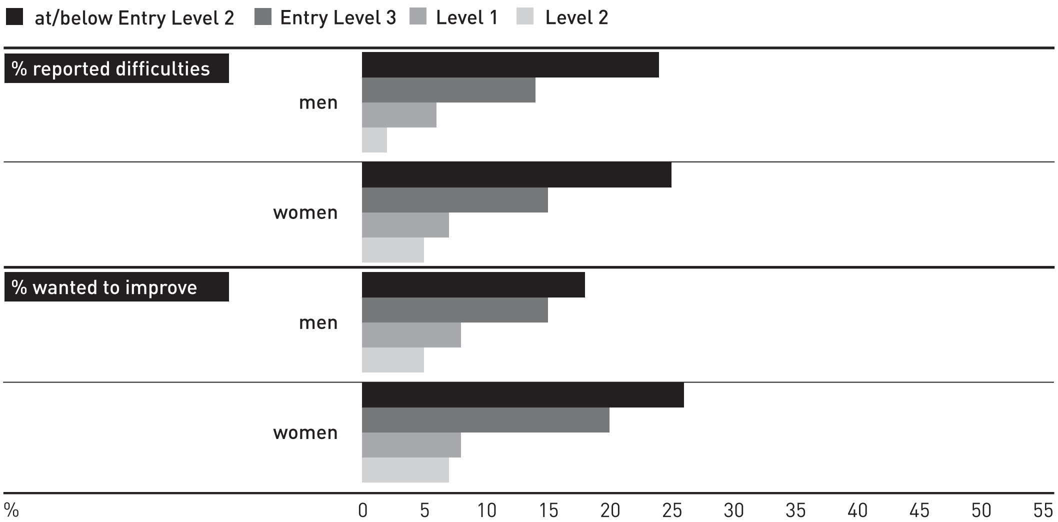
Figure 3.7a **Literacy, awareness of difficulties, and wish to improve skills**



Numeracy

For numeracy, Figure 3.7b shows that as many as one in four (24 per cent) men and women (25 per cent) with Entry Level 2 numeracy reported having some difficulties with numbers and mathematical calculations in comparison with just one in 50 (2 per cent) men and one in 20 (5 per cent) women with Level 2 numeracy. As expected, most of the difficulties were associated with multiplication and division. Notably, around three-and-a-half times as many men and women with Entry Level 2 numeracy wanted to improve their numerical skills in comparison with men and women with Level 2 numeracy (18 per cent to 5 per cent for men, 26 per cent to 7 per cent for women). However, only 2 per cent of men and women with Entry Level 2 numeracy had been on a course to help improve their grasp of numbers.

Figure 3.7b **Numeracy, awareness of maths/numberwork difficulties, and wish to improve maths/numberwork skills**

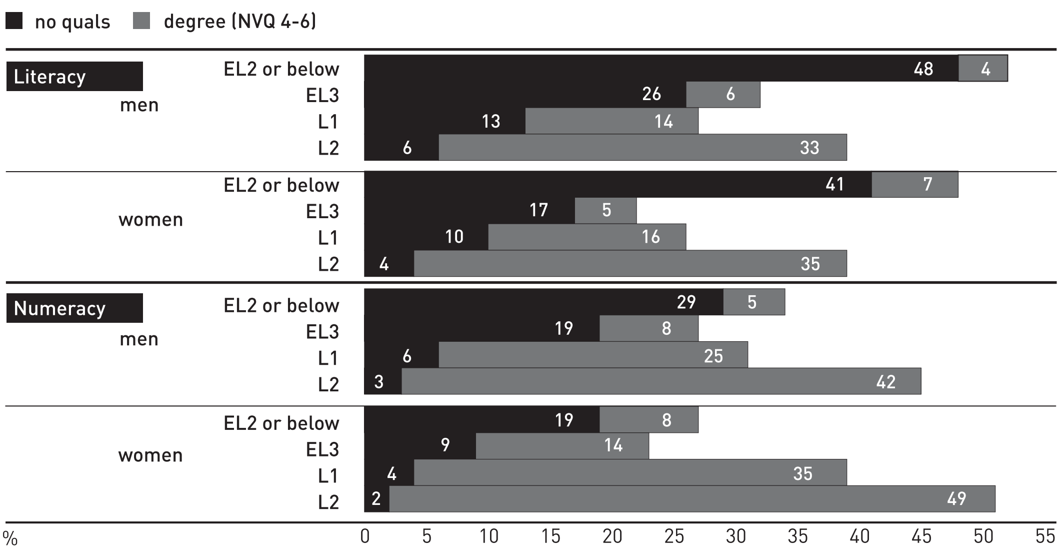


Academic qualifications

As might be expected, there were considerable differences in highest achieved academic qualification between the literacy and numeracy skills groups. Figure 3.8 shows that, whereas one in three men and women with Level 2 literacy had a degree, just 7 per cent of women and 4 per cent of men with Entry Level 2 literacy were qualified at this level. Differences by numeracy for those holding a degree or higher were even greater.

At the other end of the academic scale, nearly one in two men with Entry Level 2 literacy had no academic qualifications at all, compared with just 6 per cent with Level 2 literacy. For women, 41 per cent with Entry Level 2 literacy had no academic qualifications compared with just 4 per cent of women with Level 2 literacy. The gradient was weaker for numeracy, suggesting that poor numeracy is not such a barrier to gaining some qualifications as poor literacy.

Figure 3.8 **Literacy, numeracy and qualifications**

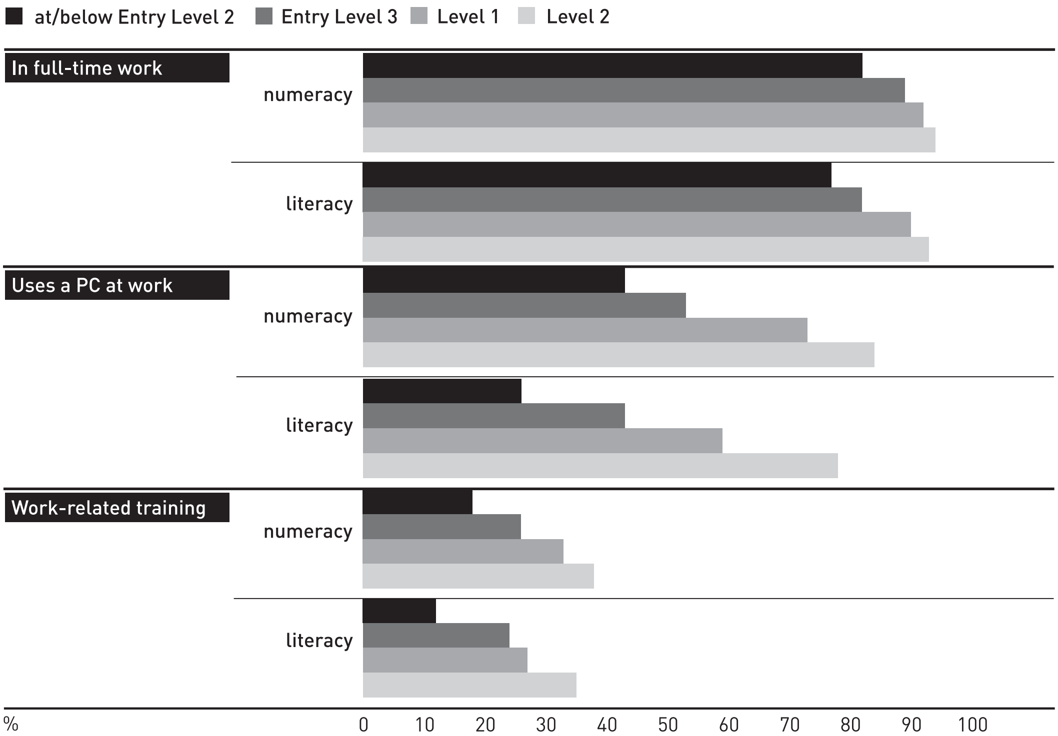


Employment and employment-related

Men

Figure 3.9a shows that men with a poor grasp of literacy or numeracy were the least likely to be in full-time work at age 34. The exclusion of men with the poorest skills from modern service sector jobs was very apparent. In comparison with men who were classified with Level 2 skills, men with Entry Level 2 numeracy were half as likely to have used a computer at work (43 per cent to 84 per cent) or to have received work-related training from their employer (18 per cent to 38 per cent). Men with Entry Level 2 literacy were one third as likely to have used a computer at work (26 per cent to 78 per cent) or to have received work-related training from their current employer (12 per cent to 35 per cent).

Figure 3.9a **Men: numeracy, literacy, full-time work, PC use, work-related training**

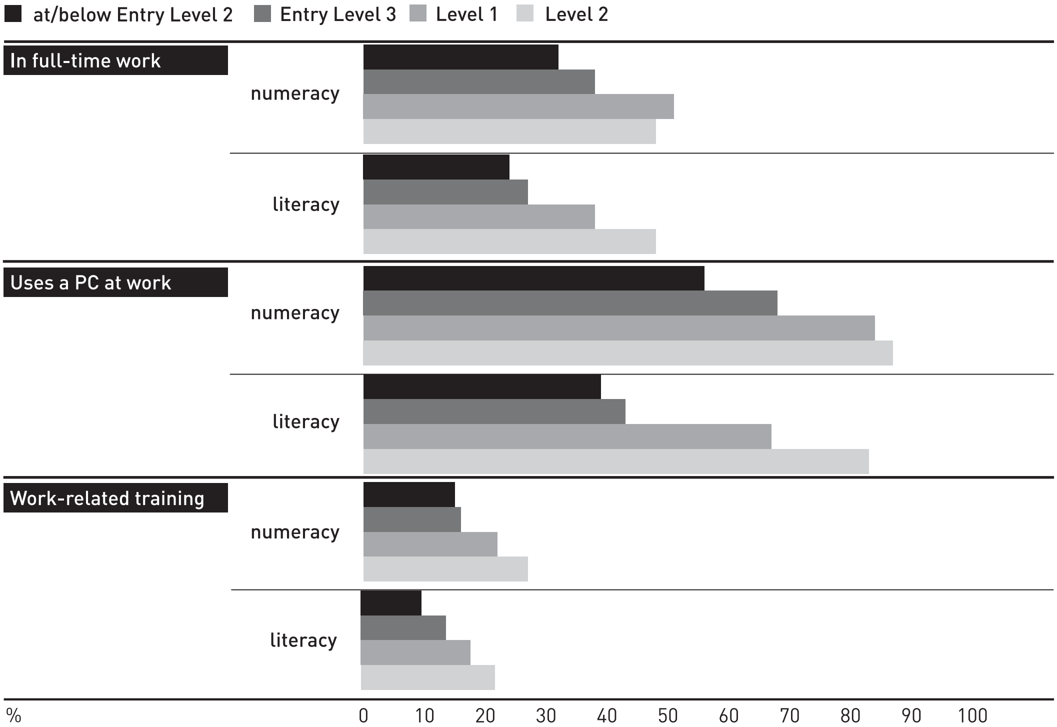


Women

Figure 3.9b shows that women with Entry Level 2 literacy or numeracy were the least likely to be in full-time work. Differences were most pronounced between literacy groups. Just 24 per cent of women with Entry Level 2 literacy had a full-time job at age 34 compared with half (48 per cent) of women with Level 2 skills. There were indications of exclusion of those with poor skills from the more desirable office-based secretarial/administrative positions. Whereas more than 80 per cent of women with Level 2 skills used a computer at work, this declined to 56 per cent for women with Entry Level 2 numeracy and to 39 per cent for women with Entry Level 2 literacy.

No more than one in five of all women in work had received work-related training, but this reduced to one in ten for women with Entry Level 2 literacy and one in six for those with Entry Level 2 numeracy, probably as a result of the high numbers in low-skilled casual work.

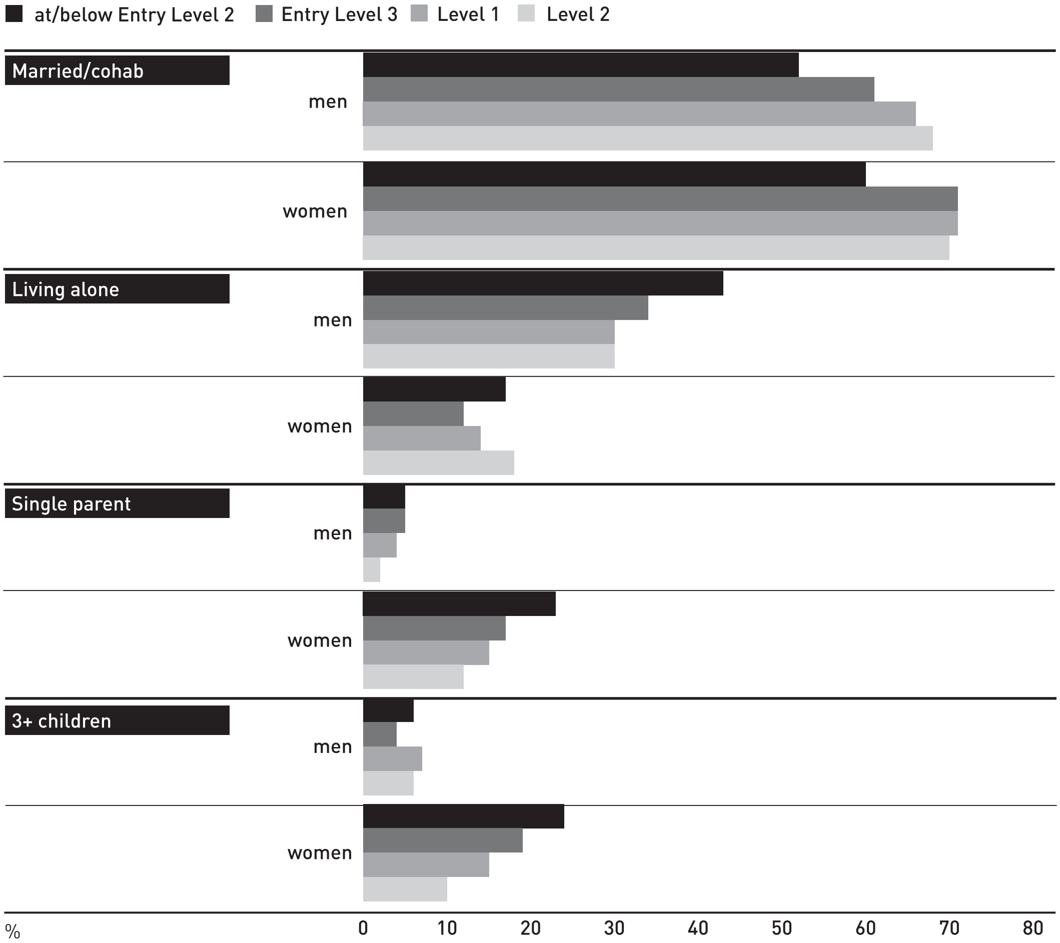
Figure 3.9b **Women: numeracy, literacy, full-time work, PC use, work-related training**



Family life

Figure 3.10 shows that men and women with the poorest grasp of literacy were the least likely to be married or cohabiting at age 34 but, whereas the majority of such men had no children, the majority of the women in this position had become parents. Figure 3.10 shows that 48 per cent of men and 39 per cent of women with the poorest literacy were not married or cohabiting. More Entry Level 2 literacy men (though not women) were also living alone but, whereas just 5 per cent of these men had at least one child, this increased to 23 per cent for women. In fact, 24 per cent of all women with Entry Level 2 literacy had three or more children by age 34, compared with 10 per cent of all women with Level 2 literacy or numeracy, and they were twice as likely to have been a teenage mother. Far fewer differences of this kind were evident between numeracy groups.

Figure 3.10 **Literacy, relationships and parenthood**



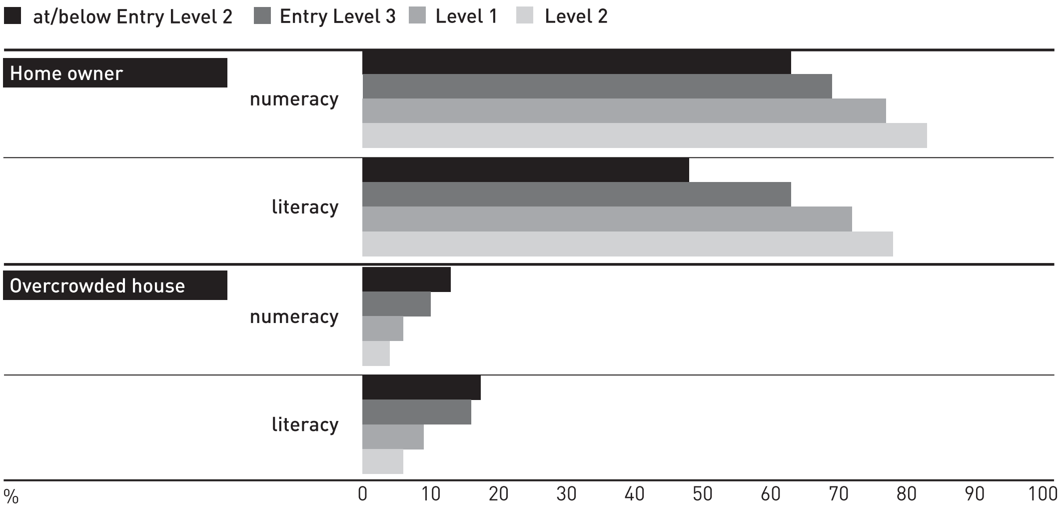
Socio-economic status

At home

In line with the previous research discussed earlier[36], socio-economic status differed widely across literacy and numeracy groups. Among those with the weakest grasp of literacy or numeracy, home ownership was less common and experience of rented or overcrowded accommodation more common. From Figure 3.11 we see that, whereas just over eight in ten men and women with Level 2 literacy skills were home owners, this fell to less than half of men and women with Entry Level 2 literacy. Just 4 per cent of men and women with Level 2 numeracy and 6 per cent with Level 2 literacy lived in an overcrowded home, ie, more than one person per room. Figure 3.11 shows this increased at least threefold for men and women with Entry Level 2 literacy (17 per cent) or numeracy (13 per cent), and was highest at 21 per cent for women with Entry Level 2 literacy.

36 Ekinsmyth, C. and Bynner, J. (1994). *The Basic Skills of Young Adults*. London: The Basic Skills Agency. Bynner, J. and Parsons, S. (1997) *It doesn't get any better*. London: The Basic Skills Agency.

Figure 3.11 **Literacy and home life**



Local environment

Questions on the local area, included for the first time, showed that cohort members with poor literacy and numeracy were more conscious of graffiti and felt less safe living there. Potentially, this indicates a relatively poor local environment for these groups of individuals, though any conclusions will require a much closer look at the data.

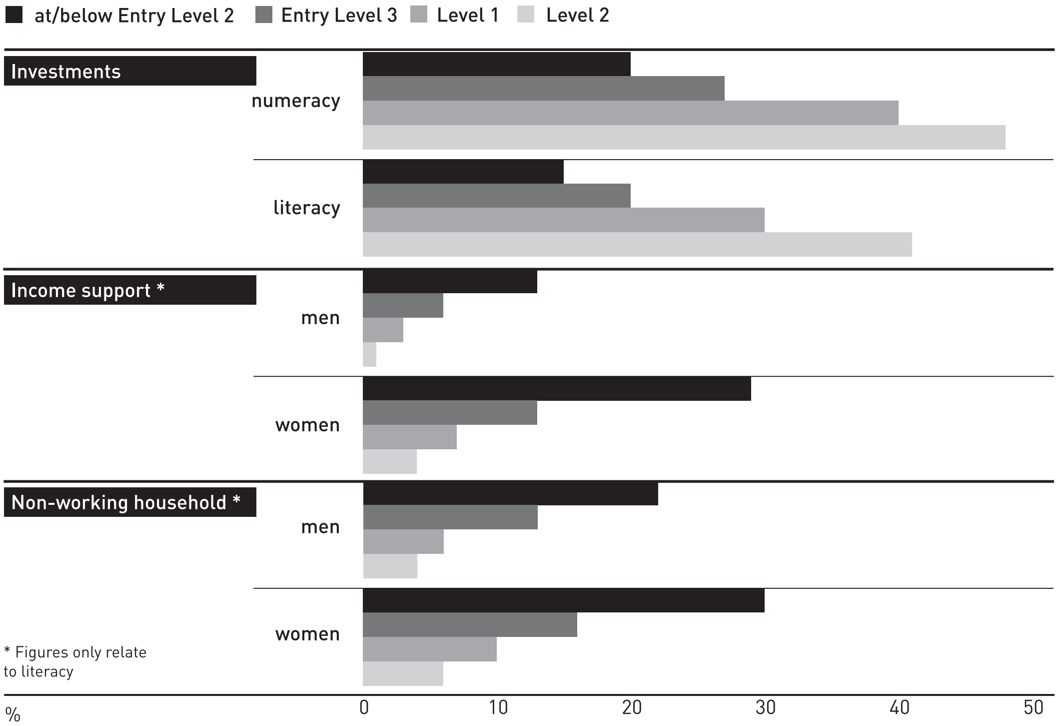
Finances

Men and women with the poorest grasp of literacy or numeracy were most likely to be experiencing economic disadvantage, shown through a variety of measures, some of which are illustrated in Figure 3.12. Men and women with Entry Level 2 literacy or numeracy, or their partner if they had one, were more likely to receive state benefits (eg income support, housing benefit, council tax benefit) with differences being strongest between literacy groups. Women in all skills groups were more likely to report receipt of state benefits. Men and women with Entry Level 2 literacy or numeracy were less likely, or less able, to make regular savings from their income, and far less likely to have any investments. They were also three times more likely to have borrowed money from a pawnbroker, moneylender, friends or family members.

Men and women with Entry Level 2 literacy or numeracy were also the most likely to be part of a non-working household[37]. Substantial differences were apparent by grasp of literacy and numeracy, but were most marked between literacy groups: 22 per cent of men and 30 per cent of women with Entry Level 2 literacy were part of a non-working household compared with just 4 per cent of men and 6 per cent of women with Level 2 literacy.

37 A cohort member was defined as being part of a non-working household if they (or their live-in partner if they had one) were not in full-time or part-time employment at the time of interview.

Figure 3.12 **Literacy, numeracy, investments, income support, non-working households**



Health and wellbeing

Relatively poor physical health and mental wellbeing were associated with poor literacy and numeracy, with the differences being generally stronger between the literacy groups. Poor skills were also related to poor health-related practices. While fewer than one in five men and women with Level 2 skills reported that they did not exercise, this increased to just over one in three (35 per cent) of men with Entry Level 2 literacy and just under one in three (30 per cent) with Entry Level 2 numeracy. Figure 3.13a shows women with Entry Level 2 literacy were more than twice as likely as women with Level 2 skills to smoke every day – 42 per cent compared with 19 per cent. Similar but less pronounced differences were apparent between men. Men and women with Entry Level skills were also more than twice as likely to report being in 'very poor' or 'poor' health in comparison with men and women with Level 2 skills.

Figure 3.13a **Relationship between literacy, numeracy and smoking cigarettes daily**

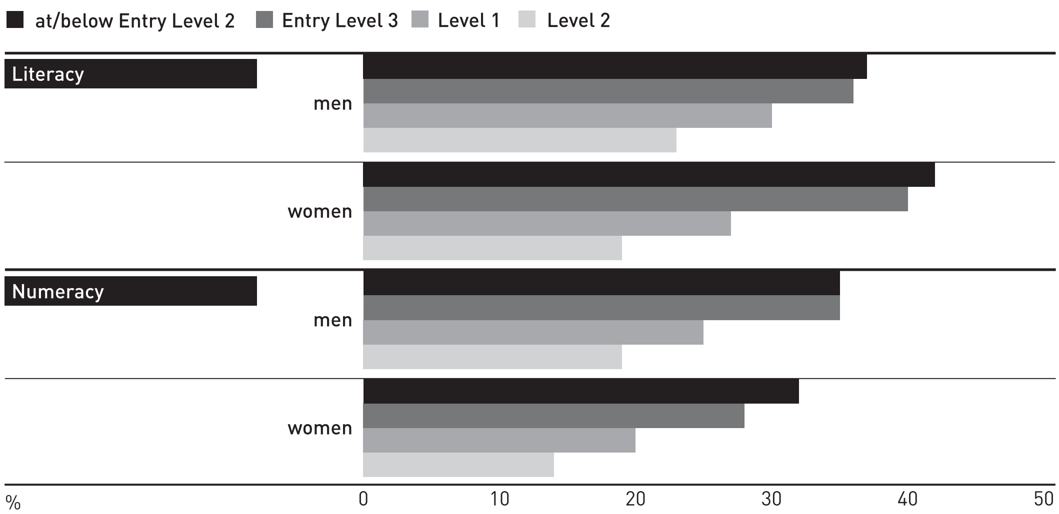


Figure 3.13b shows that a far higher proportion of the men and women with Entry Level 2 literacy or numeracy reported four or more symptoms of depression out of a maximum of nine questions that formed a shortened version of the Malaise scale[38] (Rutter et al., 1970) – highest at one in three women with Entry Level 2 literacy. From Figure 3.13c we can also see that Entry Level 2 men and women were more than twice as likely to feel that they 'never got what they wanted from life' and up to four times as many felt that 'whatever they did had no effect on what happened to them' compared with those with Level 2 skills. Differences were most marked among men, being highest for the men and women with the poorest grasp of literacy.

Figure 3.13b **Relationship between literacy, numeracy and symptoms of depression**

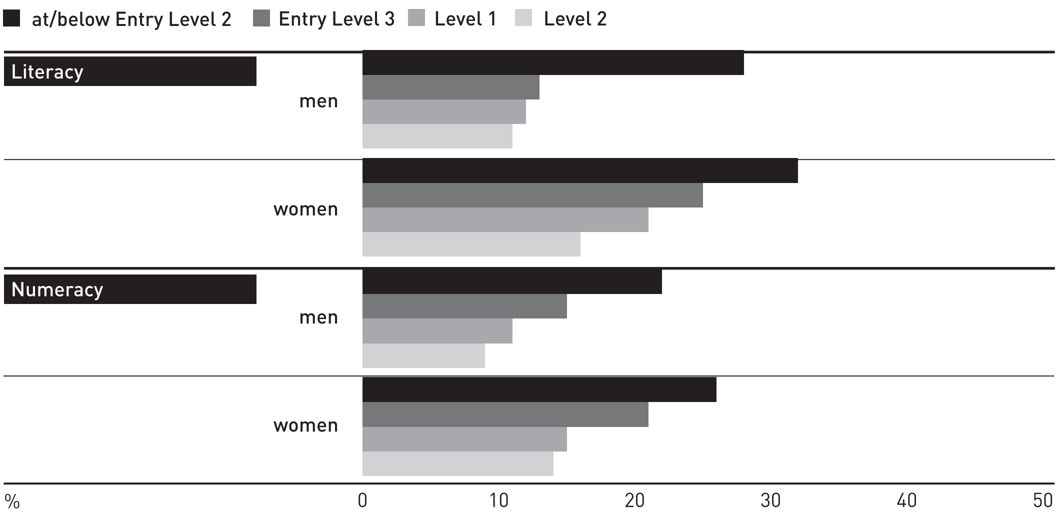
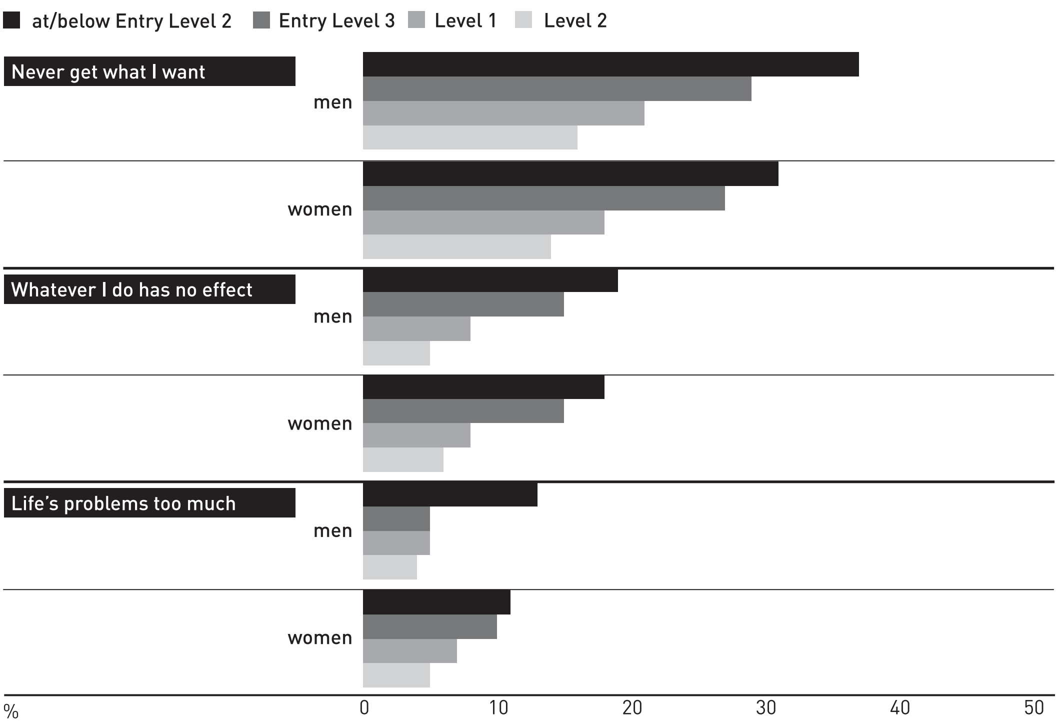


Figure 3.13c **Relationship between literacy and psychological wellbeing**



38 Rutter, M., Tizard, J. and Whitehouse, K. (1970). *Education, Health and Behaviour*. London: Longman.

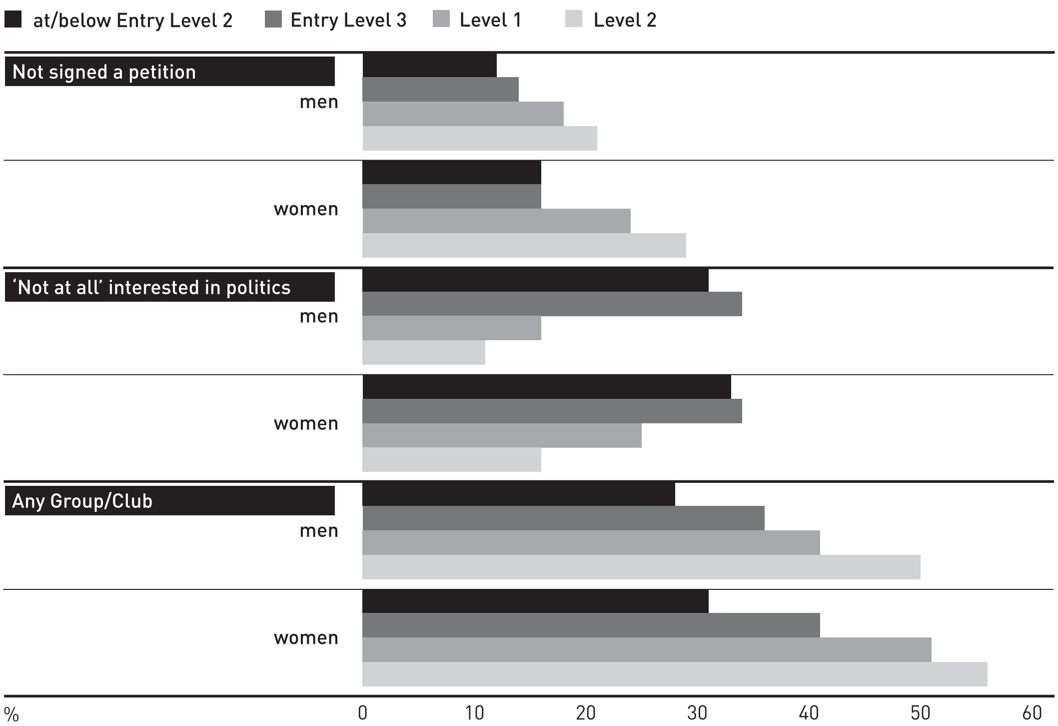
Community and social participation

Community participation or involvement, measured across a variety of activities such as involvement in some sort of community, charitable, interest or activity club or group, or voting, and/or interest in politics, was lowest among men and women with the poorest grasp of literacy or numeracy. Differences between groups were once again most pronounced for literacy (Figure 3.14).

Voting apathy in the overall population in the 2001 General Election was widespread, matching that found in earlier analysis of BCS70[39]. In 2001, approximately one in three men and women with Level 2 skills did not vote. This proportion increased to one in two of the men and women with Entry Level 2 literacy or numeracy. Not voting was lowest among women with Level 2 numeracy (28 per cent).

Figure 3.14 shows that men and women with Entry Level 2 or Entry Level 3 literacy were also at least twice as likely as men and women with Level 2 or Level 3 literacy to be 'not at all' interested in politics. Figure 3.14 also shows that men and women with Entry Level 2 or 3 literacy were nearly twice as likely never to have signed a petition as those at Level 2.

Figure 3.14 **Literacy, community activity, political interest, petitions**



Conclusions

The new assessment instrument has met the requirements specified for it. Acceptable reliability levels were achieved with question coverage that mapped onto the new national standards, enabling total scores for the multiple-choice part of the test to be classified in terms of the same levels as in the *Skills for Life* Survey (2003). The large sample also enabled cross-national differences between England, Scotland and Wales to be demonstrated, with

39 Bynner, J. and Parsons, S. (2003) in Ferri, E., Bynner, J. and Shepherd, P. (eds) *Changing Britain: Changing Lives*. London : Institute of Education Press.

potential for separate analyses in the three countries. The discrepant findings for Wales raise particularly interesting research questions. The two-tier design employed for the literacy assessment also offers opportunities for much more detailed examination of poor literacy performance at the lowest (Entry) levels than has been possible in the past.

These preliminary findings for the multiple-choice assessment point to much the same picture as drawn from earlier surveys in BCS70, but are now confirmed on the much larger scale that a survey of the whole sample provides. Differences between poor skills groups and others are also demonstrated for the first time with cohort data in terms of the national standards for adult literacy and numeracy.

Cohort members at the lowest literacy and numeracy levels (Entry Level 2 or below) were most likely to acknowledge problems with literacy and numeracy and those who did were more likely than others to want to improve their skills. However, substantial numbers neither acknowledged any problems nor had any desire to do anything to improve their skills. Very few in either group had attended any courses to improve their skills

Substantial differences in life chances, quality of life and social inclusion were evident between individuals at or below Entry Level – especially Entry Level 2 – compared with others at higher levels of literacy and numeracy competence. Entry Level skills were associated with lack of qualifications, poor labour market experience and prospects, poor material and financial circumstances, poor health prospects, and lack of social and political participation.

Gender differences were also marked in some of these relationships including the tendency for men in their mid-30s with poor skills to lead a solitary (single) life without children. In contrast, women with the same levels of skills were also more likely to be without a partner but more typically were parents, often with larger families.

These differences tended to be larger between the literacy groups than between the numeracy groups though, as we know from earlier research on literacy and numeracy and employment[40], numeracy is becoming increasingly important for long-term employment and in job opportunities such as training and promotion.

Notably, the groups whose disadvantage was most apparent had rarely had any exposure to basic literacy or numeracy courses. This presents the major policy challenge for the *Skills for Life* strategy**.**

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40 Bynner, J. and Parsons, S. (1997) *Does Numeracy Matter?* London: The Basic Skills Agency. Parsons, S. and Bynner, J. (2006) *Does Numeracy Matter More?* London: National Research and Development Centre for Adult Literacy and Numeracy.

Chapter 4
Continuities and discontinuities in literacy and numeracy problems

As noted in Chapter 3, the previous BCS70 literacy and numeracy assessment was carried out in 1991 on a representative 10 per cent sample of the whole cohort at age 21. Each literacy and numeracy assessment item comprised a visual stimulus presented to the cohort member on a 'showcard' about which they were asked a number of questions. Questions were set at levels of difficulty in accordance with the City & Guilds WordPower/NumberPower standards at the time: Foundation Level, Level 1, Level 2 and Level 3 (for literacy only) and were open response (OR) in format. Figure 3.4 in Chapter 3 showed how this set of levels relates to those defined by the new standards.

From the responses supplied by the 1,627 cohort members who completed the assessments in the 1991 survey, seven literacy and six numeracy questions were selected for the 2004 assessment[41]. Inclusion of some of the 1991 questions in the new 2004 basic skills assessment tool offered the opportunity for longitudinal analysis of changes in the skill measured by these test items, ie, we can investigate improvement and deterioration over time and what may lie behind them. However, to perform any longitudinal analysis, which is the main focus of this chapter, cohort members had to have completed both the 1991 and the 2004 assessments. As the 1991 assessment was completed by just 1,627 cohort members, this was the maximum number available for longitudinal analysis. Given the attrition that is part and parcel of all longitudinal surveys (see Chapter 1) the actual number of cohort members was reduced to a little under 1,200. More details of this longitudinal sample are provided later in the chapter.

Question amendments

Although in essence the selected questions remained the same, amendments were made to six of the literacy and two of the numeracy questions, largely to bring the images on the showcards up to date. These revised showcards and the questions relating to them were extensively piloted before being included in the final assessment. Figure 4.1 gives an example of original and revised literacy and numeracy show-cards[42]. In the case of the literacy showcard 'Yellow Pages', the cohort member was asked to find the address of a particular restaurant. For the numeracy showcard, showing items with prices, the cohort member was asked to work out the change that would be expected from a £20 note.

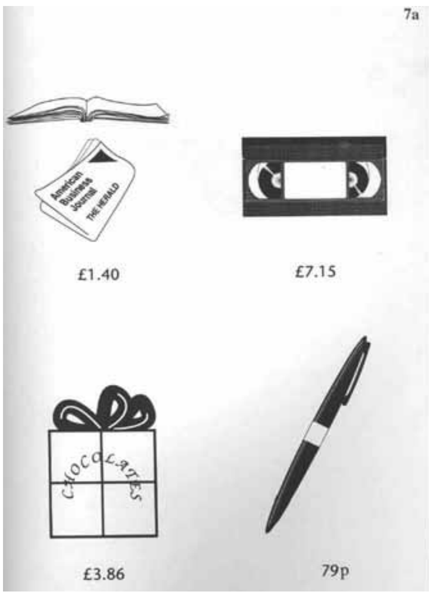
41 For details of the analysis behind question selection see Parsons, S. and Bynner, J. (2005). *Measuring Basic Skills for Longitudinal Study: The design and development of instruments for use with cohort members in the age 34 follow-up in the 1970 British Cohort Study (BCS70)*. Research Report, National Research and Development Centre for Adult Literacy and Numeracy. http://www.nrdc.org.uk/content.asp?CategoryID=424
42 For full details of amendments see Parsons, S. and Bynner, J. (2005), as above.

Figure 4.1: **Original and revised showcards**

ORIGINAL SHOWCARD	REVISED SHOWCARD

LITERACY

NUMERACY



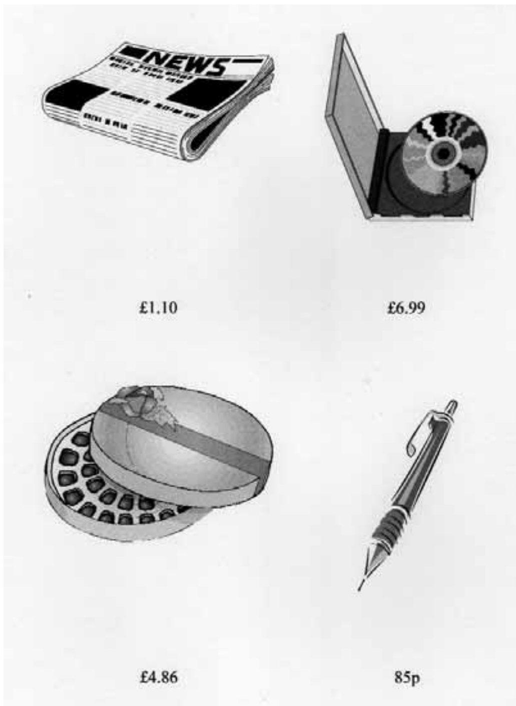


Table 4.1 compares responses (percentage incorrect) given by cohort members to the seven literacy and six numeracy questions asked at age 21 and age 34. Four sets of results are shown.

- **Age 21:** all cohort members completing the assessments in the original age 21 survey (n=1,627)
- **Age 21:** cohort members in the original age 21 survey who also completed the assessments in the age 34 survey (n=1,189 literacy; n=1,185 numeracy)
- **Age 34:** all cohort members completing the assessments in the age 34 survey (n=9,529 literacy; n=9,484 numeracy)
- **Age 34:** cohort members in the original age 21 survey who also completed the assessments in the age 34 survey (n=1,189 literacy; n=1,185 numeracy)

There is a high level of consistency across the four sets of percentages and, as we might expect, a higher level of incorrect responses for questions at each level of difficulty for numeracy than for literacy.

Table 4.1 **Comparing percentages of incorrect responses in BCS70 age 21 and age 34**

	Level of difficulty	BCS70 age 21	BCS70 age 21 (in 21 + 34)	BCS70 age 34	BCS70 age 34 (in 21 + 34)
NUMERACY					
L1a: Yellow Pages – address	FL	5%	4%	2%	2%
L1b: Yellow Pages – phone no.	FL	2%	2%	1%	1%
L2a: Map – quickest route	L1	5%	5%	6%	6%
L2b: Map – East or West	L1	7%	6%	9%	8%
L3a: Bar chart – approx	L1	11%	9%	7%	6%
L3b: Bar chart – Y-axis	L2	25%	22%	27%	26%
L3c: Bar chart – why prefer	L2	21%	19%	19%	17%
n(100%)		*1,627*	*1,189*	*9,529*	*1,189*
NUMERACY					
N1a: Video timer – start	FL	14%	12%	10%	10%
N1b: Video timer – finish	FL	17%	16%	12%	10%
N2a: In a shop – How many £ coins?	L1	41%	39%	24%	22%
N3a: Deposit on a car	L1	24%	22%	12%	11%
N4a: Ferry – when can go	L2	27%	24%	22%	21%
N4b: Ferry – return cost	L2	50%	48%	39%	38%
n(100%)		*1,627*	*1,185*	*9,484*	*1,185*

Key: FL = Foundation Level; L1 = Level 1; L2 = Level 2

Literacy

Overall, the percentages of cohort members incorrectly answering each of the seven literacy questions at age 21 or age 34 were highly consistent. Differences in percentage incorrect at the two ages varied only between 0 and 4 per cent. At both ages, cohort members found that questions L3b and L3c were the most difficult. These required cohort members to extract and interpret information from two graphs. The 'reduced' sample of cohort members who had taken part in the assessments at age 21 and at age 34 had identical or slightly lower percentages answering each of the questions incorrectly, suggesting that their skills were marginally better than those of the 'drop-outs', ie, non-respondents at age 34. This is a reflection of the common finding that attrition in longitudinal surveys tends to be more common among the less educated and more disadvantaged groups (see Table 1.1 in Chapter 1). From our point of view, the more notable finding is that substantial proportions with relatively low skills participated in both surveys.

Numeracy

For numeracy, the picture was less straightforward, illustrating the more varied set of skills that are embedded within 'numeracy'. Although the percentage incorrect for each question only varied from 1 to 5 per cent across the age 21 and age 34 samples for three of the six questions, for the other three questions differences in the percentage incorrect increased to between 11 and 17 per cent. The biggest difference in percentage incorrect was recorded for question N2a. We concluded that the substantial reduction in the percentage of cohort members answering incorrectly in the more recent survey (41 per cent at age 21 down to 24 per cent at age 34) was largely due to a faulty interviewer instruction in the 1991 survey at age 21. Such an anomaly would be a serious problem if the items were used singly to assess individual numeracy performance but produces only a modest distortion in the test scores as a whole. For all numeracy questions, the percentage incorrect was lower at age 34 than it had been at 21, suggesting that, at the group level at least, there is a small improvement of numerical skills associated with age.

With one exception (N3a), the rank order of questions, in terms of which question cohort members found the most difficult, was replicated at the two age points. Despite the greater variation in percentages incorrect, N2a (calculating cost of items in a shop) and N4b (working out the cost of a ferry trip from information on a timetable) were found to be the hardest questions by the highest proportion of cohort members at both ages. As for the literacy questions, the reduced sample of cohort members who had taken part in the assessments at both ages had slightly lower percentages answering each of the questions incorrectly when compared with the full sample at ages 21 and 34.

Overall scores from OR literacy and numeracy assessments

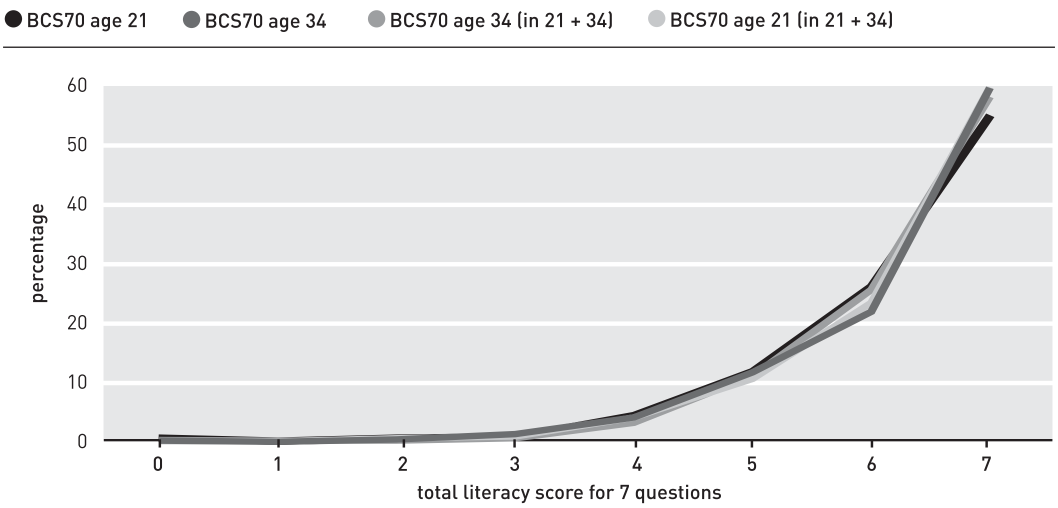
As for the Multiple Choice (MC) items, a total score for the assessment can be obtained by aggregating correct answers across all the test items. Figure 4.2 compares the total numbers of correct responses to the seven literacy and six numeracy questions given by cohort members participating in the assessments at age 21, 34, or at both ages. We can see that the distribution of the four total scores from the three groups of cohort members was near identical for literacy. For numeracy, the higher percentage of cohort members who answered question N2a incorrectly at age 21 results in the 'blip' in the distribution; this accounts for the lower percentage answering all six numeracy questions correctly at age 21. For numeracy, we can see that the sub-sample of cohort members completing the assessments at age 21 and 34 had a higher overall score at both ages. For literacy, differences in overall scores are barely distinguishable.

For all cohort members in the age 34 survey who completed the literacy and numeracy OR assessments (n=9,484) a substantial correlation of 0.48 ($p<.001$) was recorded between their performance in the literacy and numeracy OR assessments. A good performance in one assessment was a reasonably strong indicator of a good performance in the other, as had been the case for performance in the MC assessments. However, the correlations between the literacy and numeracy scores from the OR assessment are lower than those found for the comparable correlations between the literacy and numeracy scores from the MC assessment. This largely reflects the smaller number of items in the OR tests and consequently the lower reliabilities (see Table 3.1 in Chapter 3) as can be demonstrated by applying the 'correction for attenuation'[43]. The corrected correlation for the OR literacy and numeracy scores increases from 0.48 to 0.80 and for MC literacy and numeracy from 0.64 to 0.86.

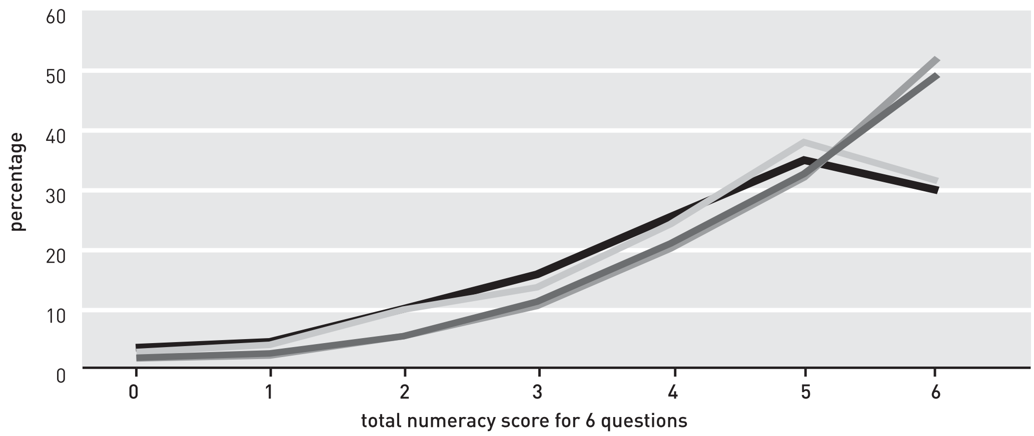
Performance in one mode of assessment was also significantly correlated with performance in the other. An uncorrected correlation of 0.50 ($p<.001$) was recorded between the OR and MC literacy scores and 0.52 ($p<.001$) between the OR and MC numeracy scores.

Figure 4.2 **Comparing total scores by cohort members for identical questions in BCS70 age 21 and age 34 assessments.**

a) Literacy: Percentage of cohort members by number of questions answered correctly



b) Numeracy: Percentage of cohort members by number of questions answered correctly



43 The correction for attenuation is given by the formula: r(corrected) = r/(√Reliability test 1x √Reliability test 2), where r is the original uncorrected correlation (Nunnally, J.C. (1978) Psychometric Theory, p219-220. New York: McGraw Hill).

Improvement and deterioration between ages 21 and 34

Table 4.2 provides further details of the original 1,627 cohort members who completed the assessments in 1991 and the sub-sample of these cohort members (n=1,205)[44] who took part in the 2004 interview. For this analysis we group the scores in terms of the qualitative distinctions used in previous work ('very low', 'low', 'average', 'competent')[45] rather than curriculum levels. We can see that, despite the loss of cohort members from the least skilled groups (see the last column for each skill group), the distribution of cohort members across the original literacy and numeracy groups was remarkably consistent and forms a sound platform on which to base the longitudinal analysis.

Table 4.2 **Distribution of BCS70 cohort members by literacy and numeracy scores: comparing all cohort members in 1991 survey with cohort members participating in 1991 and 2004 surveys**

	LITERACY					NUMERACY				
	age 21		21 + 34			age 21		21 + 34		
	%	n	%	n	% still in survey in 2004	%	n	%	n	% still in survey in 2004
very low	**8**	141	**7**	80	**57**	**27**	444	**24**	280	**63**
low	**16**	265	**15**	176	**68**	**21**	347	**22**	257	**74**
average	**30**	480	**30**	353	**74**	**24**	388	**25**	292	**75**
competent	**46**	741	**48**	580	**78**	**28**	448	**30**	356	**79**
n(100%)		*1,627*		*1,189*	**73**		*1,627*		*1,185*	**73**

By asking identical questions at age 21 and 34, we can compare answers given to individual questions for the cohort members who took part in both surveys. Had performance improved, deteriorated or remained at the same level between ages 21 and 34? For the 1,180+ cohort members who answered literacy and numeracy questions at age 21 and 34, Figure 4.3 shows the percentage who answered each question:

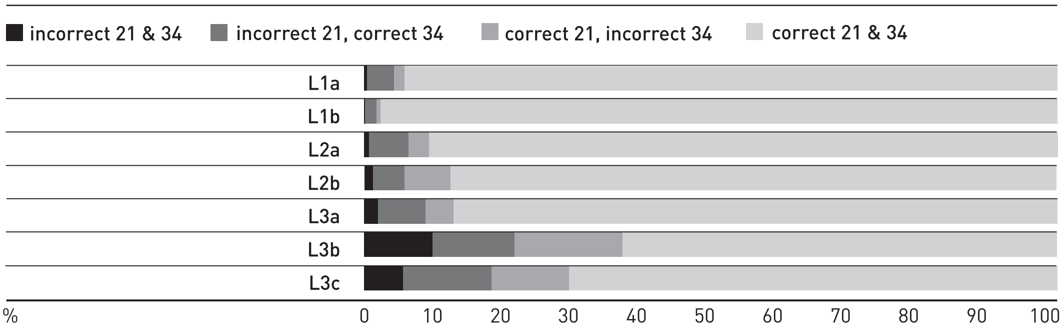
- correctly at age 21 and 34;
- incorrectly at age 21 and 34;
- correctly at age 21, incorrectly at age 34;
- incorrectly at age 21, correctly at age 34.

It is apparent that the questions that most cohort members found the most difficult (L3b and L3c, literacy; N2a and N4b, numeracy) also showed the most 'improvement' or 'deterioration' over time. Around one in four of the reduced sample of cohort members either answered the literacy questions L3b and L3c incorrectly at age 21 and correctly at age 34, or vice versa. For the numeracy questions there was much more volatility in the scores across time. For questions N2a and N4b between 25 and 29 per cent of cohort members showed improvement and between 12 and 15 per cent showed deterioration between ages 21 and 34.

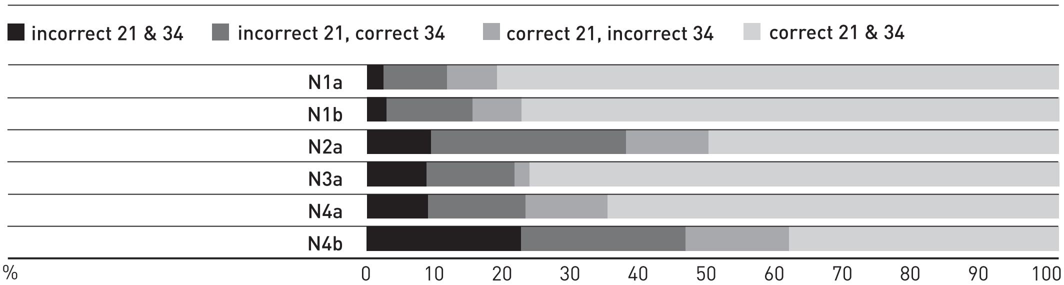
44 1,205 cohort members who took part in the 1991 survey also took part in 2004. Of these, 1,189 completed the literacy assessment and 1,185 completed the numeracy assessment.
45 Parsons, S. and Bynner, J. (2006). *Does Numeracy Matter More?* London: National Research and Development Centre for Adult Literacy and Numeracy.

Figure 4.3 **Comparing responses given by cohort members for identical questions in BCS70 age 21 and age 34 assessments**

a) How cohort members answered literacy questions at age 21 and 34



b) How cohort members answered numeracy questions at age 21 and 34



Calculation of an individual cohort member's overall 'improvement' or 'deterioration' status

To take full advantage of the longitudinal data, as discussed earlier, the cohort members who completed the literacy assessments (n=1,189) and numeracy assessments (n=1,185) at ages 21 and 34 were classified further in accordance with their performance. Performance was defined as 'poor' or 'good' at each age to create a fourfold typology. A number of ways of measuring improvement or deterioration were looked at, with a relatively blunt easy-to-understand measure being adopted for this initial examination of the data. Literacy scores between 0 and 5 were defined as 'poor' and between 6 and 7 as 'good'. For numeracy, scores between 0 and 4 were defined as 'poor' and between 5 and 6 as 'good'[46]. Essentially, two groups of cohort members with 'poor' or 'good' skills at 21 were split into four groups dependent on their performance at age 34:

- poor at 21, poor at 34 (poor skills remained poor);
- poor at 21, good at 34 (poor skills improved);
- good at 21, poor at 34 (good skills deteriorated);
- good at 21, good at 34 (good skills remained good).

The distribution of cohort members across these four groups is given in Table 4.3. By the classification adopted, we can see that the majority of cohort members fell into the two groups that had kept the same skills at age 34 as they had at age 21: as many as 80 per cent for literacy (74 per cent 'good' and 6 per cent 'poor') and 64 per cent for numeracy (45 per cent 'good' and 19 per cent 'poor') had either good skills that remained good, or poor skills

46 Whichever ways the performance scores were 'cut' and categorised, the same pattern of differences in outcomes at 34 emerged between groups.

that remained poor. However, this meant that between age 21 and 34 one in five cohort members had changed literacy skills and one in three had changed numeracy skills. 10 per cent of cohort members had good literacy skills at age 21 but poor literacy skills at age 34; another 10 per cent had poor literacy skills at age 21 but good literacy skills at age 34. For numeracy, a substantial 24 per cent had poor numeracy skills at age 21 but good numeracy skills at age 34, and 12 per cent had good numeracy skills at age 21 and poor numeracy skills at age 34.

Notably, 'change' or 'movement' in skills status was more strongly associated with poor skills than good skills at age 21. Among cohort members with poor skills at age 21, proportionately more had improved their skills by age 34 than had kept the same poor skills. For example, 191 cohort members had poor literacy at age 21 but, of these, 115 (60 per cent) had gone on to have their skills classified as good at age 34. However, among the 998 cohort members with good literacy skills at age 21 just 123 (12 per cent), had 'lost' their good skills by age 34, while 88 per cent had retained them. It seems that good skills, once attained, were more resistant to deterioration than poor skills were resistant to improvement.

Table 4.3 Distribution of cohort members by good and poor skills at age 21 and 34

LITERACY					NUMERACY				
	Poor at 34		Good at 34			Poor at 34		Good at 34	
	%	n	%	n		%	n	%	n
Poor at 21	**6**	76	**10**	115	Poor at 21	**19**	223	**24**	288
Good at 21	**10**	123	**74**	875	Good at 21	**12**	145	**45**	529

Outcomes at age 34

Before going on to explore any differences between groups in terms of economic and social outcomes at age 34, it was important to establish that this classification could indeed measure improvement or deterioration over time. We needed to be sure that any 'improvement' of poor performers at age 21 was real when compared to those whose performance remained poor at age 34, and that the 'deterioration' of good performers at age 21 was genuine when compared to those whose performance remained good at age 34. A simple way to check this was to see if the average (mean) scores at age 21 for the two groups of cohort members who were 'poor' at 21 were similar and, likewise, that average (mean) scores at age 21 for the two groups of cohort members who were 'good' at 21 were also similar.

Table 4.4a and 4.4b give the average (mean) scores in the OR literacy and numeracy assessment for men and women in the four performance groups. We can see that average scores at age 21 between the two groups who had either 'poor' or 'good' skills are indeed very similar. For the two groups with 'poor' scores at age 21, average literacy scores at age 21 only differed by 0.7 for men (4.0, 4.7) and 0.2 for women (4.4, 4.6); average numeracy scores differed by 0.5 for men (2.8, 3.3) and 0.7 (2.6, 3.3) for women. For the two groups with 'good' scores at age 21, average literacy scores only differed by 0.2 for men (6.5, 6.7) and 0.3 for women (6.4, 6.7) and average numeracy scores by just 0.1 for men (5.4, 5.5), while they were identical for the two groups of women (5.4). These very small differences in average scores at age 21 contrast with the substantial differences in average scores shown at age 34 between the 'static' and the 'mover' groups.

Table 4.4a **Average scores in the literacy open-response assessment at age 21 and 34**

	MEN			WOMEN		
	age 21	age 34	n	age 21	age 34	n
(1) Poor at 21, poor at 34	4.0	4.3	26	4.4	4.1	50
Poor at 21, good at 34	4.7	6.6	50	4.6	6.6	65
(2) Good at 21, poor at 34	6.5	4.7	42	6.4	4.6	81
Good at 21, good at 34	6.7	6.8	414	6.7	6.7	461
All	6.4	6.4	532	6.3	6.2	657

Table 4.4b **Average scores in the numeracy open-response assessment at age 21 and 34**

	MEN			WOMEN		
	age 21	age 34	n	age 21	age 34	n
(1) Poor at 21, poor at 34	2.8	2.9	80	2.6	3.0	143
Poor at 21, good at 34	3.3	5.6	112	3.3	5.6	176
(2) Good at 21, poor at 34	5.4	3.5	65	5.4	3.6	80
Good at 21, good at 34	5.5	5.6	273	5.4	5.6	256
All	4.6	5.0	530	4.2	4.8	655

Outcomes of improvement and deterioration

The comparisons that are of most interest here are between the experiences and attributes of the cohort members whose skills improved or deteriorated between the two surveys and those whose skills remained unchanged. We focus on:

a) differences between the cohort members who had 'poor' skills at age 21 and either remained 'poor' ('non-movers') or improved to have 'good' skills at age 34;
b) differences in the experiences of the cohort members who had 'good' skills at age 21 and retained these 'good' skills ('non-movers') or deteriorated to have skills classified as 'poor' at age 34.

Although the numbers involved in producing the differences are relatively small, statistical significance enables us to judge their robustness. The comparative analyses that follow therefore serve as a good initial enquiry into the tangible benefits of improvement and the consequences of deterioration[47]. For present purposes, differences in a number of experiences and statuses by age 34 are demonstrated for 'improvers' compared with 'non-movers' and for 'deteriorators' compared with 'non-movers'. Many of these differences reflect the possible role of changes in literacy and numeracy in processes of social exclusion and inclusion. If we can demonstrate, for example, that improved literacy or numeracy is significantly associated with positive social and economic outcomes, this would support the hypothesis that literacy and numeracy enhancement may similarly help social inclusion.

However, it should be borne in mind that the results we present are no more than simple (bivariate) associations between literacy and numeracy changes from age 21 to age 34 and statuses at age 34; they should not be taken to signify causal connections. We cannot be certain, for example, whether the literacy and numeracy change lies behind the experience or

47 Further research will attempt to unravel the experiences between age 21 and 34 that underlie improvement and deterioration and the other outcomes that accompany them.

status at age 34, whether the status change lies behind the literacy and numeracy change, or whether some other factor altogether, such as social class, lies behind the association. Resolving this issue will be a major aim of the next stage of our analysis.

The results for men and women are considered separately. Percentage differences and associated significance levels for a wide range of age 34 outcomes (43 dichotomous statuses at age 34) are shown in Tables App2.1, App2.2, App2.3 and App2.4 in Appendix 2. Figures 4.4a and 4.4b show the percentages for a selection of the statuses at age 34 with statistically significant differences for the men and women improvers and Figure 4.5a and 4.5b the percentages for the men and women deteriorators. All differences discussed below were statistically significant at $p<.05$ (odds of 19 to 1 against a chance result) or very occasionally $p<.1$ (odds of 9 to 1 against a chance result). Full information about statistical significance levels is shown in the tables in Appendix 2.

Skills improved

Men

In total, statistically significant differences (usually at $p<.05$ or better) were found for 15 age 34 statuses for literacy and 13 statuses for numeracy.

Socio-economic

In comparison with men who had a consistently poor grasp of literacy or numeracy, men who had improved their literacy or numeracy by age 34 were:

- more likely to own their home (78 per cent 'improvers' to 40 per cent 'poor' – literacy);
- less likely to live in rented accommodation (14 per cent to 44 per cent – literacy);
- more likely to have investments (32 per cent to 12 per cent – literacy, 33 per cent to 15 per cent – numeracy);
- less likely to have borrowed money from a friend, family member or other source (eg, pawnbroker) (20 per cent to 39 per cent – literacy);
- less likely to be living on state benefits or to be part of a non-working household (6 per cent to 19 per cent – literacy);
- more likely to be in full-time employment;
- more likely to use a PC at their place of work (65 per cent to 48 per cent – numeracy);
- more likely to have received work-related training from their employer (36 per cent to 19 per cent – numeracy);
- less likely to have not gained some kind of formal qualification (8 per cent to 21 per cent – numeracy, 16 per cent to 35 per cent – literacy).

Family life and civic participation

Literacy improvers were:

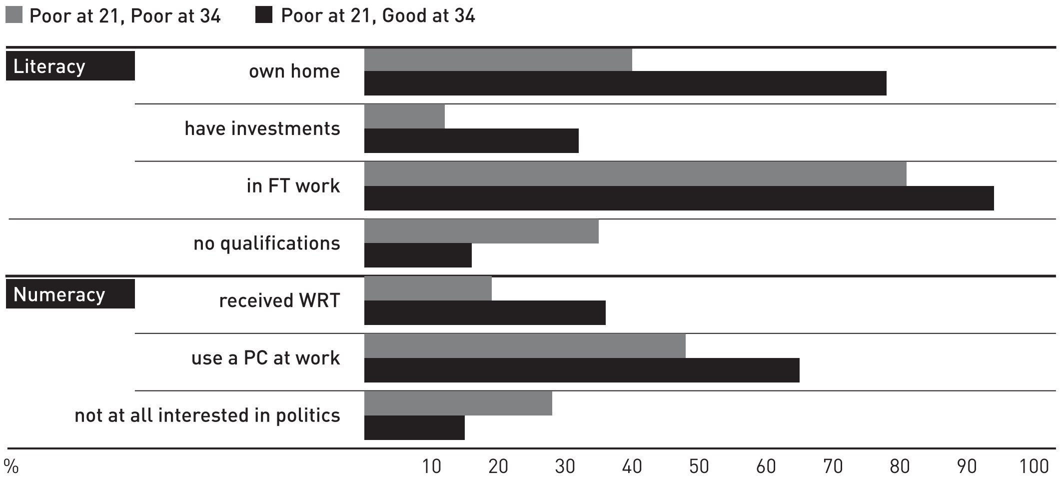
- more likely than the consistently poor group ('non-movers') to be married at age 34 or to be currently cohabiting, and/or to have had children (36 per cent improvers were living alone with no children compared with 65 per cent non movers – literacy);
- more likely than the non-movers to have had some contact with a government or other official (16 per cent to 0 per cent – literacy);
- less likely to report that they had not voted in the 2001 General Election (11 per cent to 21 per cent – numeracy);

- less likely to say that they were 'not at all' interested in politics (15 per cent to 28 per cent – literacy).

Health and wellbeing

There were no differences in reported smoking, poor health or long-term health problems. However, fewer improvers reported that 'whatever I do has no effect on what happens to me' (2 per cent to 13 per cent – literacy). Men with improved skills at age 34 were also less likely to report that 'I never really get what I want out of life' (23 per cent to 34 per cent – numeracy).

Figure 4.4a **Selected differences in outcomes at age 34 for men with poor literacy or numeracy at age 21 and either poor or good literacy or numeracy at age 34**



Women

In total, statistically significant differences (usually p<.05 or better) were found for eight age 34 statuses for literacy and 20 age 34 statuses for numeracy.

Socio-economic

Much the same picture was found for women (Figure 4.4b) with improvement in literacy and numeracy again appearing to be associated with positive outcomes at age 34. Although the improvers were no more likely than the non-movers to own their own homes they were:

- more likely to be generally better off;
- less likely to be living in overcrowded accommodation (5 per cent to 16 per cent – literacy);
- more likely to have savings and investments (37 per cent to 18 per cent – numeracy);
- less likely to receive state benefits (council tax, housing benefit) or to have borrowed money from a family member, friend or other source (eg, pawn broker).

With respect to employment the improvers, especially in numeracy, were:

- more likely to be in a full-time job at 34 (43 per cent to 27 per cent – numeracy);
- far less likely to lack formal qualifications (3 per cent to 20 per cent – numeracy, 11 per cent to 30 per cent – literacy);
- more likely to have used a computer at work (73 per cent to 42 per cent – literacy, 80 per cent to 61 per cent – numeracy);
- more likely to have access to a computer at home (69 per cent to 83 per cent – numeracy).

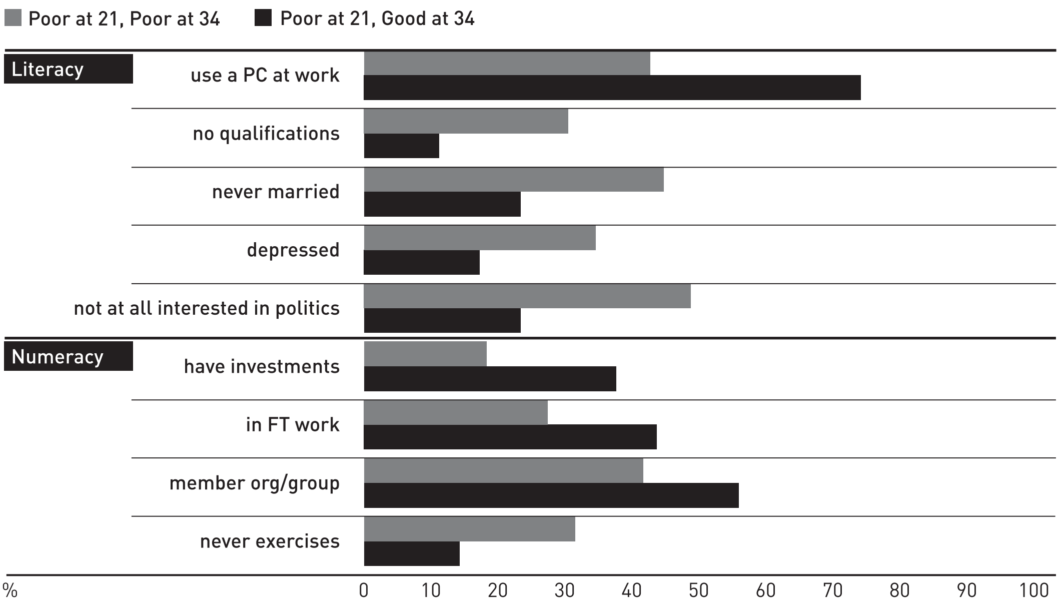
Family life and civic participation
Improvers were:

- less likely than non-movers to have never married (23 per cent to 44 per cent – literacy), though similar percentages were currently cohabiting and had children (this may explain the heightened experience of lone parenthood among those with poor skills at age 34);
- more likely to have signed a petition or been on a rally or demonstration (31 per cent to 17 per cent – numeracy);
- no more likely to have voted in the 2001 General Election, though slightly more reported that they intended to vote in the future, and fewer said they were 'not at all' interested in politics (23 per cent to 48 per cent – literacy);
- more likely to be involved in social or community organisations (55 per cent to 41 per cent – numeracy).

Health and wellbeing
There were no statistically differences between the improvers and the others in relation to smoking. However the improvers were:

- less likely to have symptoms associated with depression on the Malaise scale (17 per cent to 34 per cent – literacy);
- less likely to report that they never get what they wanted out of life (12 per cent to 20 per cent – numeracy);
- less likely to report that they 'never' exercised (14 per cent to 31 per cent – numeracy);
- less likely to report that they had poor health or long-term health problems (25 per cent to 38 per cent – literacy).

Figure 4.4b **Selected differences in outcomes at age 34 for women with poor literacy or numeracy at age 21 and either poor or good literacy or numeracy at age 34**



Skills deteriorated

There were fewer differences in outcomes at age 34 between the two groups of men and women who had had 'good' numeracy skills at age 21 (ie, the 'deteriorators') versus the 'non-mover' group, particularly among the men. The differences that did exist tended only partly to mirror those for the 'improvers'.

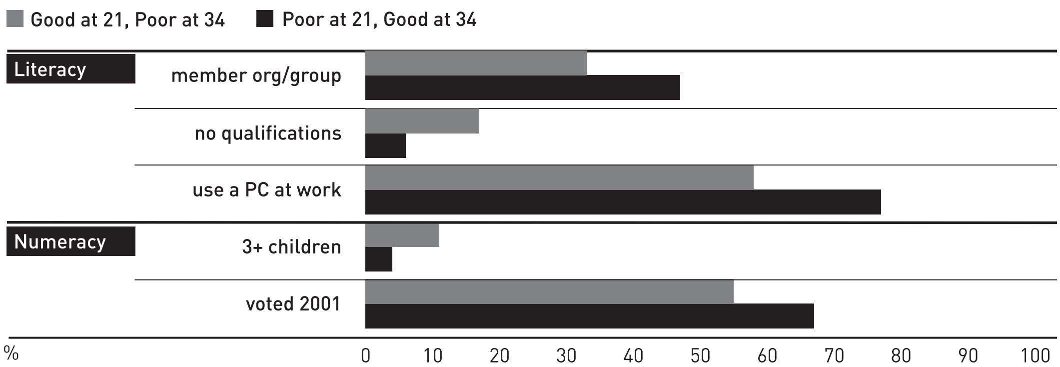
In total, statistically significant differences (usually p<.05 or better) were found for just five age 34 statuses for literacy and four age 34 statuses for numeracy.

Men

Figure 4.5a compares some selected outcomes for men who had a good grasp of literacy or numeracy at age 21 and at age 34 (the non-movers) against men whose skills had deteriorated. The deteriorators were:

- more likely to have no formal qualifications (17 per cent to 6 per cent – literacy);
- less likely to have been using a PC at work (58 per cent to 77 per cent – literacy);
- less likely to have voted in 2001 (55 per cent to 67 per cent – numeracy, 57 per cent to 67 per cent – literacy);
- less likely to have been involved with a club or organisation (33 per cent to 47 per cent – literacy, 39 per cent to 51 per cent – numeracy);
- more likely to be a parent with three or more children (11 per cent to 4 per cent).

Figure 4.5a **Selected differences in outcomes at age 34 for men with good literacy or numeracy at age 21 and either poor or good literacy or numeracy at age 34**



Women

There were more associations – always in a negative direction – with deterioration of literacy for women. Statistically significant differences (usually p<.05 or better) were found for 18 age 34 statuses for literacy and five age 34 statuses for numeracy.

Figure 4.5b compares some outcomes for women who had a consistently good grasp of literacy or numeracy with outcomes for women whose skills had deteriorated. The 'deteriorators' were:

- more likely to live in rented accommodation (25 per cent to 14 per cent – literacy);
- less likely to have savings or investments (15 per cent to 42 per cent – literacy);
- more likely to receive housing benefit (17 per cent to 4 per cent – literacy);
- less likely to be in full-time work (27 per cent to 47 per cent – literacy; 35 per cent to 50 per cent – numeracy);
- less likely to use a PC at work (70 per cent to 88 per cent – numeracy), or to have one at home (68 per cent to 87 per cent – literacy);
- less likely to have received work-related training (6 per cent to 23 per cent – literacy);
- more likely to be single parents (25 per cent to 11 per cent – literacy);

- less likely to belong to a group or organisation (47 per cent to 59 per cent – literacy);
- more likely to have no interest in politics (26 per cent to 14 per cent – literacy).

Figure 4.5b **Selected differences in outcomes at age 34 for women with good literacy or numeracy at age 21 and either poor or good literacy or numeracy at age 34**

Conclusions

To enable change in cohort members' skills to be investigated longitudinally, short functional literacy and numeracy tests were constructed comprising a selection of items at different levels of difficulty – seven for literacy and six for numeracy – all presented in the open-response (OR) mode. With the exception of one numeracy item, the percentages of the cohorts giving incorrect answers was remarkably consistent from one survey to the next and in the sample that participated on both occasions. Similarly, the distribution of test scores was comparable across surveys and for the sample who took part in both surveys.

However, at the individual level, improvement and deterioration in performance was found for a substantial minority of cohort members. Most 'movement' in performance was associated with numeracy, highlighting the more fluid and less ingrained nature of numerical skills. Further analysis will help shed light on which experiences bring about skills deterioration or improvement.

Although these associations need to be interpreted with caution, they do suggest that, for men, improvement of poor skills between ages 21 and 34 might have a wider and more extensive influence on quality of life at age 34 than the deterioration of good skills across the same age period. For women, the picture is more complex. Deterioration of good literacy skills and improvement of poor numeracy skills seems to have a wider range of associations with outcomes at age 34, acting as a 'mirror image' of each other. Higher work and family economic status was associated with improved numerical skills and declined alongside deteriorating literacy skills. Much more robust analysis will be necessary to confirm and understand such relationships. However, it does appear that skills enhancement may have the potential to open up opportunities and improve self-confidence, while deterioration of literacy skills among women is associated with the opposite effect. This can be taken to support the Moser targets and the *Skills for Life* strategy of skills enhancement to support economic wellbeing and social inclusion.

Chapter 5
Is dyslexia an added difficulty?

Measuring symptoms of dyslexia

The final part of the adult assessment was to measure the prevalence of some of the symptoms associated with dyslexia. The word 'dyslexia' is Greek in origin and means 'difficulty with words'. Though the precise origins and meaning of the syndrome has attracted controversy[48], it is generally believed that dyslexia arises from a variation in the brain area that processes language-based information and affects the underlying skills that are needed for learning to read, write and spell. Symptoms are found in people from all socio-economic and education groups, from those who cannot read to those with higher education awards[49]. It is estimated that about 4 per cent of the population is severely dyslexic, with a further 6 per cent having mild to moderate problems[50].

BCS70 cohort members had symptoms of dyslexia assessed when they were 10 years old, when three short individual measures from the Bangor Dyslexia Test[51] were administered, in conjunction with other cognitive assessments, to more than 12,000 cohort members. Analysis of the data has estimated that between 2 and 4 per cent of cohort members were dyslexic to some degree[52]. By re-assessing the cohort members at age 34, we have a unique opportunity to:

- obtain a true estimate of the distribution of dyslexic symptoms in a representative adult population of 34-year-olds;
- analyse the relationship between dyslexia, literacy and numeracy scores;
- compare past experiences and adult outcomes for dyslexic adults with those of their non-dyslexic peers;
- see what, if any, symptoms are lost, persist or emerge over time – between ages 10 and 34.

The Dyslexia Adult Screening Test

After much advice and consultation, the Dyslexia Adult Screening Test (DAST)[53] was chosen as the preferred instrument for use in the 2004 survey. Cohort members had been assessed for symptoms of dyslexia when they were age 10 but, although the DAST does not measure precisely the same symptoms as were measured by the Bangor Dyslexia Test at age 10, its

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48 Rice, M., and Brooks, G. (2004). *Developmental dyslexia in adults: a research review*. London: National Research and Development Centre for Adult Literacy and Numeracy.
49 This information is taken from the websites detailed. For further information refer to the British Dyslexia Association (www.bda-dyslexia.org.uk), the Bangor Dyslexia Unit (www.dyslexia.bangor.ac.uk) and the Dyslexia Institute (www.dyslexia-inst.org.uk).
50 These estimates are obtained primarily from school populations but, as dyslexia has neurological origins, the occurrence in adults will be essentially the same.
51 The Bangor Dyslexia Test contains ten items. The three selected measures were the Left-Right Test (involving naming body parts), and the Months Forward and Months Reversed tests (sequential recall of months of the year). See Miles, T.R., (1982/1997). *The Bangor Dyslexia Test*. Wisbech: Cambs: Learning Development Aids.
52 Miles, T. R., and Haslum, M. N. (1986). 'Dyslexia: Anomaly or normal variation?' *Annals of Dyslexia*, 36, 103–117. Miles, T. R., Wheeler, T. J. and Haslum, M. N. (2003). 'The Existence of Dyslexia without Severe Literacy Problems'. *Annals of Dyslexia*, 53, 340–349.
53 Fawcett, A. and Nicolson, R. (1998). *The Dyslexia Adult Screening Test (DAST).* London: The Psychological Association.

use was supported by Professor Tim Miles (who devised the Bangor test) as offering good continuity with the earlier assessment[54]. The DAST is based on the Dyslexia Screening Test (DST), a battery of 11 tests used to identify children 'at risk' of dyslexia[55]. These tests were modified to support adult screening and led to the publication of the DAST in 1998. The DAST comprises a battery of 11 tests, of which three are educational attainment measures and eight are diagnostic measures directed at identifying dyslexia symptoms[56]. There are some similarities between these measures and those used in the 1992 and 1993 US National Adult Literacy Survey (NALS), which offers another basis for comparison[57].

Four of the 11 exercises were selected; details are given below. The four selected exercises were felt to be the best combination of exercises, given the time restriction of just ten minutes of survey time. The four exercises were:

- 1-minute Reading
- 2-minute Spelling (revised to 1-minute)
- Spoonerisms
- Nonsense Passage Reading

Reading and Spelling were particularly strong candidates for selection, given their obvious relationship with basic literacy skills. Spoonerisms provided a relatively complex measure of phonemic segmentation (the ability to split words into their constituent parts), was quick to administer, and was enjoyed by the great majority of respondents who took part in the pilot studies for the 2004 survey. The Nonsense Passage Reading exercise, although demanding, was included as it seemed particularly good at identifying difficulties among adults who had performed well on the other DAST exercises. The four exercises are detailed below, together with some findings based on initial analysis of BCS70 cohort members' performance.

The DAST exercises included in the 2004 survey

The DAST dataset contained all the responses from cohort members for the four DAST exercises included in the 2004 survey: 1-minute Reading, 1-minute Spelling (revised), Spoonerisms and Nonsense Passage Reading. All four of these exercises were completed by 8,804 BCS70 cohort members. The number of cohort members completing each of the four exercises is detailed below[58].

54 At the 6th BDA International Conference, Allyson G. Harrison and Eva Nichols presented *A Validation Of The Dyslexia Adult Screening Test (DAST) In A Post Secondary Population in Canada.* The DAST was administered to 116 students with Specific Learning Disabilities (SLD) and 122 volunteer control subjects. The DAST correctly identified 74 per cent of the students with a SLD at risk for dyslexia. However, the DAST misidentified 26 per cent of SLD students as not being at risk for dyslexia, and 16 per cent of the control group as being at risk for dyslexia, even though almost all control group students reported no history of any learning or reading problems. Despite this, the DAST does have a higher than acceptable false positive rate. Suggestions were offered for recalculation of the data and a clustering of the subtests to maximize differentiation between subject groups.
55 For further details see Fawcett, A.J., Nicolson, R.I. and Dean, P. (1996). 'Impaired performance of children with dyslexia on a range of cerebellar tasks'. *Annals of Dyslexia,* 46, 259–283.
56 Details of all 11 exercises and the rationale for selection are discussed in Parsons, S. and Bynner, J. (2005). *Measuring Basic Skills for Longitudinal Study: the design and development of instruments for use with cohort members in the age 34 follow-up of the 1970 British Cohort Study (BCS70)*. NRDC Report. Alternatively, see the DAST manual for full details.
57 In the 1992 survey, respondents self-reported if they had a 'learning disability'. In 1993, respondents who scored at low levels of functional literacy also performed exercises that had some overlap with the selected DAST exercises.
58 Numbers may change when final cleaning of the DAST dataset has been completed.

DAST 1-minute Reading exercise

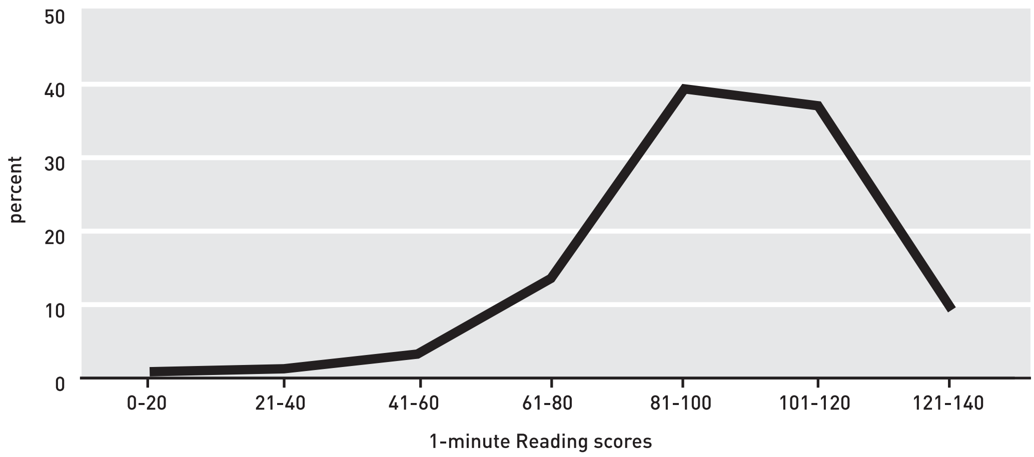
An adult experiencing some of the symptoms associated with dyslexia, who may be regarded as successful, can still have greater problems when reading under time constraints. The exercise comprised a list of 120 words, graded in difficulty, which the respondent had to read aloud as fast and as accurately as they could in one minute.

Each of the 120 words could be read 'correctly', 'incorrectly' or 'passed' (either the respondent did not attempt to read the word and said 'pass', or they inadvertently missed it out). One point was awarded for each word read correctly. If all the words were read aloud in less than one minute (even if a respondent had passed on one or two words), an additional point was awarded for each second left on the timer. For example, if a respondent finished in 57 seconds, three points would be awarded.

Figure 5.1 shows the distribution of cohort members by their score in the 1-minute Reading exercise (n=9,404). We can see that the exercise distinguished between those who completed the exercise without difficulty and the substantial minority who struggled. These are shown on the graph by the 'tail' towards the low scores in the distribution.

Figure 5.1 **Distribution of scores in the 1-minute Reading exercise**

● BCS70 2004



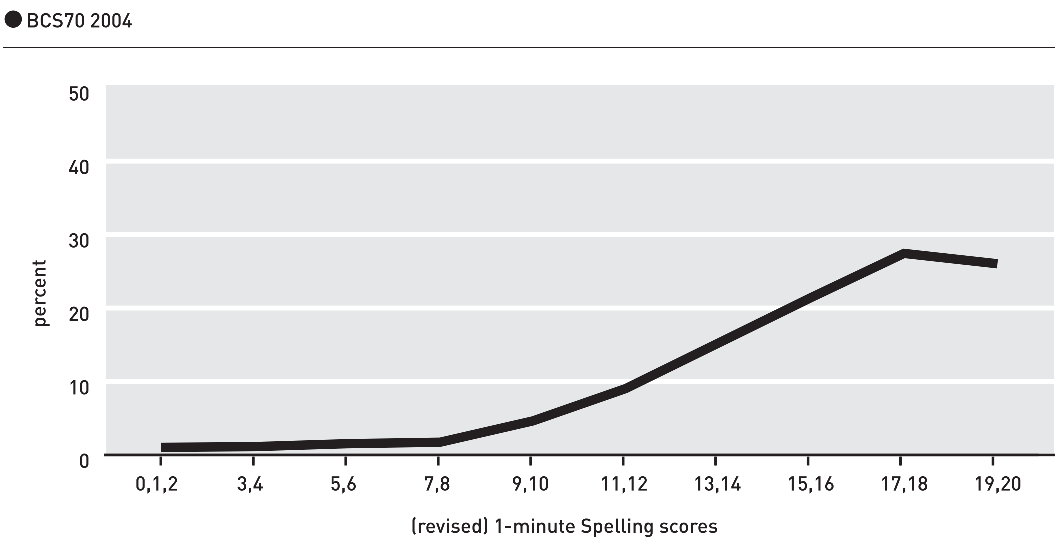
DAST (revised) 1-minute Spelling exercise

Time pressures can increase spelling errors for anybody but this is particularly so for adults experiencing dyslexic symptoms. Dyslexic adults often have poor spelling, with their grasp of spelling usually worse than their reading skills. The original exercise consisted of 32 words, increasing in difficulty. If a respondent spelt two of the first four words incorrectly, the interviewer read out eight additional easier words, making a total of 40 words. Time restrictions led to the exercise being reduced to one minute and comprising 16 words, with four additional easier words making a total of 20 words.

Words could be spelt correctly, spelt incorrectly, or passed (the respondent does not attempt to spell the word and says 'pass'). One point was awarded for each correct spelling. Four points were added to the final score if the respondent had not made early errors and had not moved on to try the additional easier spellings.

Interviewers read out one word at a time, starting to dictate the next word when the respondent had finished writing the previous word. At the end of the exercise, the interviewer recorded which hand the respondent wrote with and checked that they could read what the respondent had written down. If not, they asked the respondent how they had spelt a particular word, and wrote this down next to the word in question. This was very important. If the interviewer was not clear how a word was spelt, a coder entering the information into a dataset at a later date would probably not know either, and the information would be lost[59]. Figure 5.2 shows the distribution of cohort members by their score in the (revised) 1-minute Spelling exercise (n=9,289). As with the Reading exercise, this exercise distinguished between those who completed the exercise without difficulty and the minority who struggled. These are shown on the graph by the 'tail' towards the low scores in the distribution.

Figure 5.2 **Distribution of scores in the (revised) 1-minute Spelling exercise**



DAST Spoonerisms exercise

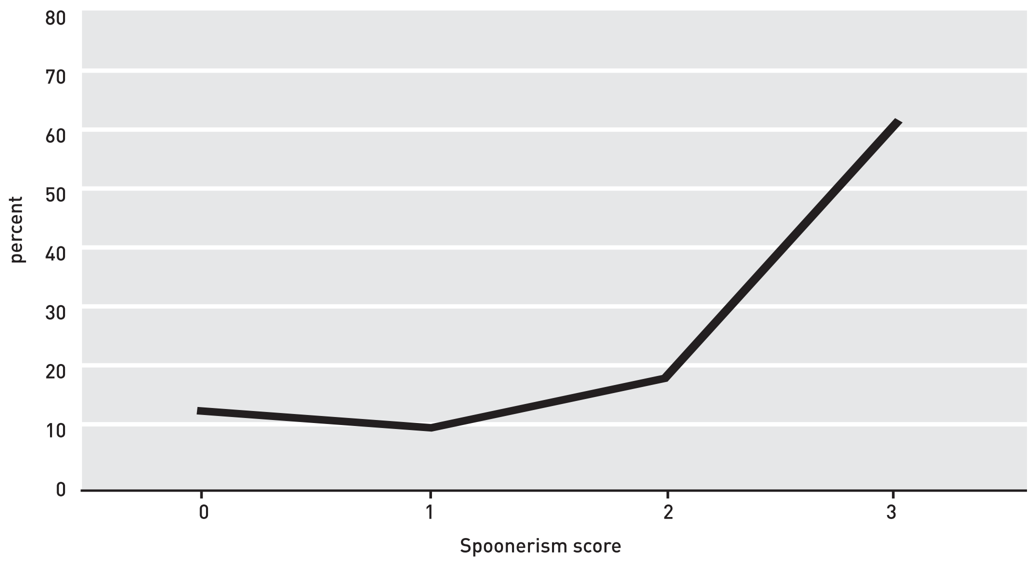
There is solid evidence that children with dyslexic symptoms are developmentally slow to detect rhymes, and that this is one of the reasons behind their struggles when learning to read. This type of phonological difficulty may persist into adulthood, and 'phonemic segmentation' – the ability to split words into their constituent sounds – is a sensitive index of these skills. Spoonerisms are a relatively complex measure of segmentation ability.

Interviewers explained to respondents that this was an exercise to play around with the sounds of words. Essentially, the interviewer read out two words and the respondents had to swap round the sounds at the beginning of each word. *'........ so if I say 'Car Park' you would say 'Par Cark', and so on.......'.* The spoonerisms used in the exercise were the names of three famous people.

Responses were given '1' point for a correct answer, and '0' points for an incorrect response or a pass. The Spoonerisms exercise was not timed. In Figure 5.3 we can see that approximately three fifths of BCS70 cohort members completing this exercise (n=9,218) could resolve all three Spoonerisms without difficulty but, again, the exercise identified a substantial minority who struggled with the task.

59 Interviewers raised initial concerns about doing this but, once they were reminded of the old adage of never being able to read a doctor's handwriting, they were comfortable with this procedure. Importantly, after the basic skills pilot study, they did not feed back any difficulties in doing this.

Figure 5.3 **Distribution of Spoonerism scores**



DAST Nonsense Passage Reading exercise

Adults with symptoms of dyslexia find it especially difficult to read words that they have never seen before. This can be readily explored by creating a passage of text containing 'made up' or 'nonsense' words. A well-known example of such is 'Jabberwocky' from 'Through the Looking Glass'.

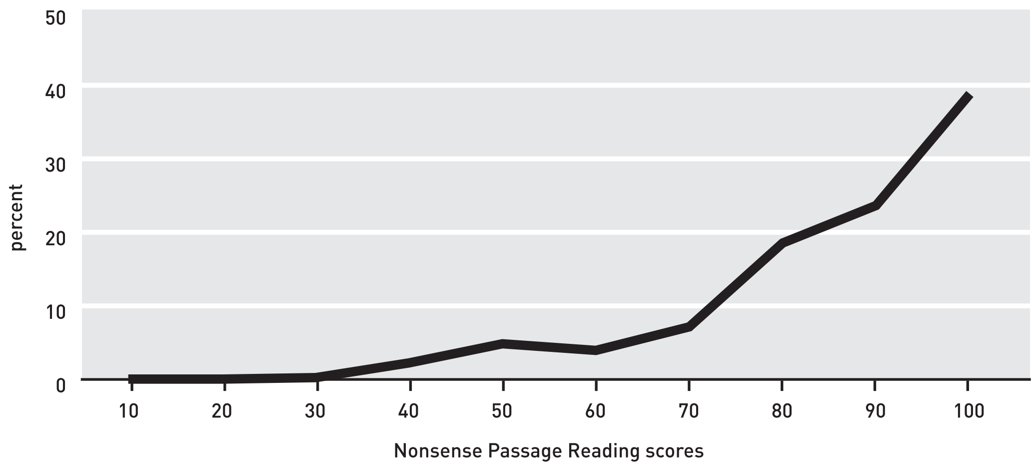
As for the Spoonerisms exercise, the short practice for this exercise was retained. Respondents were encouraged to try each word, but could 'pass' if they felt unable to attempt one of the words. After the practice, any mistakes were highlighted and correct answers were given. Respondents then moved to the main exercise. The timer was set to three minutes for completion of the task. Although some respondents were awarded extra points for a quick time, the time limit was more a strategy for bringing the exercise to a close for the respondents who were really struggling but would not admit defeat.

As in the practice exercise, respondents could 'pass' on a word, but were discouraged from not even trying to read the nonsense words. The exercise was stopped if the respondent made five consecutive mistakes, gave up, or was still going after three minutes. Scoring was more complex than for the other exercises; the number of words read and whether or not they were nonsense words were both taken into account, together with how long the respondent took. In summary, '1' point was given for each of the 59 normal words read correctly; '2' points were given for a correct (plausible) reading of each of the 15 'nonsense' words, and '1' point for a 'close try'. After the difficulties encountered in the pilot study, a 'close try' was defined as a pronunciation which had one sound or syllable different, one sound or syllable omitted, or one sound or syllable added. For example:

- **'rinsomely'** is correctly broken down to have three syllables: **'rin-some-ly';**
- a semi-correct or close try could be **'rinG-some-ly'** or **'rEn-some-ly';**
- an incorrect attempt could be **'rinG-ER-some-ly'** or **'rinG-ER-some-ER-ly.**

The maximum score for a perfect reading of all 'normal' and 'nonsense' words was 89, as shown in Figure 5.4. Points for completing the task in a fast time were awarded to many of the cohort members completing this exercise (n=9,184), extending the score range up to 99. Once again the 'tail' of the distribution towards the low scores indicates the exercise was successful at identifying cohort members who struggled with the task.

Figure 5.4 **Distribution of scores for the Nonsense Passage Reading exercise**



Relationship between performance in the individual DAST exercises and performance in the literacy and numeracy assessments

The relationship between having dyslexia and a poor grasp of literacy and/or numeracy is well established[60]; although many adults with symptoms associated with dyslexia have no associated literacy difficulties and can be high academic achievers[61]. Table 5.1 gives the correlations between performance in the literacy and numeracy assessments and the four individual DAST exercises. Statistically significant positive correlations were recorded between performance in all four of the individual DAST exercises and the literacy and numeracy assessments, being strongest with performance in the Spelling exercise. The correlations were consistently stronger for literacy than for numeracy performance. They were also stronger with performance in the multiple-choice (MC) compared with the open-response (OR) part of the literacy and numeracy assessments. As shown in Chapters 3 and 4, the correlations between the literacy and numeracy assessments were stronger than those recorded here between the literacy and numeracy assessments and the DAST tests, with the exception of performance in the literacy multiple-choice assessment and the Spelling exercise. This suggests that different aspects of literacy difficulties have been captured by the DAST tests.

60 Orton, S.T. (1937/1989) *Reading, Writing and Speech problems in children: selected papers*. Austin TX: PRO-ED. Miles, T. R. (1993). *Dyslexia: The Pattern of difficulties* (2nd Ed.) London: Whurr.
61 Miles, T., Wheeler, T. and Haslam, M. (2003) The Existence of Dyslexia without Severe Literacy Problems. Annals of Dyslexia, 53.

Table 5.1 Correlations between literacy, numeracy and DAST exercises

	DAST Reading	DAST Spelling	DAST Spoonerisms	DAST Nonsense
Literacy (MC)	**.41** (n=9,392)	**.52** (n=9,278)	**.37** (n=9,208)	**.38** (n=9,174)
Literacy (OR)	**.30** (n=9,379)	**.36** (n=9,267)	**.32** (n=9,197)	**.25** (n=9,164)
Literacy (All).42 (n=9,379)	**.42** (n=9,379)	**.54** (n=9,267)	**.40** (n=9,197)	**.39** (n=9,164)
Numeracy (MC)	**.35** (n=9,390)	**.44** (n=9,277)	**.35** (n=9,207)	**.31** (n=9,173)
Numeracy (OR)	**.27** (n=9,376)	**.36** (n=9,264)	**.31** (n=9,194)	**.22** (n=9,161)
Numeracy (All)	**.36** (n=9,376)	**.46** (n=9,264)	**.37** (n=9,194)	**.32** (n=9,161)

*all correlations were significant at the p<.001 level

Introduction of 'at risk' indicator

The purpose of the DAST is to screen for risk of dyslexia and other reading difficulties. Five categories of risk based on percentile scores of the original DAST sample population were defined (as in the DAST manual). 'Norms' were developed for each exercise for adults of all ages so that performance in any of the exercises can easily be allocated a standardised score[62]. A composite 'at risk' score can be determined by combining the 'at risk' scores for the individual exercises. In DAST this is achieved by taking a weighted mean of the individual 'at risk' scores, ignoring those scores which were not indicating risk. This was done by scoring '3' for very high risk scores, '2' for high risk scores, '1' for risk scores and '0' for all other scores, as shown below. The percentile range corresponding to the different levels of risk in each text is as follows:

Percentile range	Risk of dyslexia	Risk score
1–4%:	Very high risk	3
5–11%:	High risk	2
12–22%:	Risk	1
23–77%:	Normal	0
78–100%:	Above average performance	0

All these 'at risk' scores for the individual exercises were then added together and divided by the total number of exercises administered to obtain a mean 'at risk' score or 'at risk quotient' (ARQ). When 'at risk' scores from all 11 DAST exercises were combined, 14 per cent of the sample came out with a strong risk of dyslexia, ie, an ARQ of '1' or more. This is much higher than the estimated 4 per cent of the population that is dyslexic, but not unreasonable given that adults with literacy difficulties are also identified by the DAST exercises, whether or not they are dyslexic.

Calculating the DAST 'at risk quotient' score (ARQ) for BCS70

An 'at risk quotient' score (ARQ) for the BCS70 cohort was derived from performance in the

62 It was necessary to establish norms for performance on each of the tests, so that each subject's performance could be compared with that expected of a subject of that age. Norms were derived for each test for each age, so that any specific score could be assigned to a percentile point on the performance distribution. This means that one can establish, for instance, that an adult's performance in the Word Reading exercise fell on the 61st percentile for that age (ie, the adult did better on that test than 60 adults out of 100). To determine the norms for the general population, a standardised sample was derived equivalent to that for the Wechsler Adult Intelligence Scale (Revised) WAIS-R, with 600 adults in total, with 32 per cent in the age range 18 to 24, 44 per cent 25 to 54, and 24 per cent 55 to 74, with approximately 50 per cent male and 50 per cent female.

four DAST exercises. Cohort members were assigned a score of 0, 1, 2 or 3 for their performance in each exercise. For example, a cohort member who scored '0' in the Spoonerism exercise had a 'very high risk' of being dyslexic and was accordingly awarded three points; a cohort member who scored between 76 and 84 in the 1-minute Reading exercise was 'at risk' of being dyslexic and awarded one point[63]. The total score for the four DAST exercises was then divided by four to obtain an average score for performance in the four exercises – the 'at risk quotient' (ARQ) score.

Cohort members were then grouped into four 'risk' groups depending on their ARQ score: 'no risk' (0), 'low risk' (> 0 and < 1), 'high risk' (≥ 1 and < 2), 'very high risk' (≥ 2). Table 5.2 gives the distribution of the 8,804 men and women who completed the four DAST exercises across these four 'risk' groups. We can see that 5 per cent of men and 3 per cent of women had a very high risk of being dyslexic. This is in line with estimates that 4 per cent of any population are severely dyslexic and that, within school populations, more boys (men) than girls (women) are identified as being dyslexic[64]. This is confirmed by the percentages of men and women in the different risk groups, with the small tendency for more men to be in the 'high risk' and 'very high risk' groups.

Table 5.2 Distribution of BCS70 cohort members by ARQ groups

	Men %	Women %	All %
No risk	38	44	41
Low risk	42	41	41
High risk	16	12	14
Very high risk	5	3	4
N=	*4,169*	*4,635*	*8,804*

Association of being 'at risk' of dyslexia with lifestyle attributes at 34

We now take a first look at the lifestyles of men and women who are 'at risk' of having dyslexia and see what, if any, attributes at age 34 have an association with their risk status of dyslexia. We look specifically at the relationship with cohort members' literacy and numeracy, employment, economic status, health, wellbeing and social participation. We also see if any relationship exists between risk of dyslexia and the cognitive performance of cohort members' children.

63 In comparison with the DAST 'norms' for 25–34 year olds, BCS70 cohort members had lower average scores in the 1-minute Reading and the Nonsense Passage Reading exercises. Accordingly, if we had used the DAST scoring ranges for computing the ARQ, far more of the BCS70 cohort would have been identified by the individual exercises as being 'at risk' of dyslexia. For this preliminary analysis of the BCS70 DAST data, the percentile range not the score range of that which identifies the DAST risk groups was adopted. Later work in conjunction with Angela Fawcett will help to determine more sensitive ways of defining cohort members by their level of risk.

64 This estimate is taken from earlier analysis of BCS70 data when cohort members were aged 10 (See Miles, T.R., Haslam, M.N. and Wheeler, T.J. (1998) 'Gender Ratio in Dyslexia'. *Annals of Dyslexia*, 36, pg 103–117). Badian (1984) suggested that, in the Western world, dyslexia was thought to be four times more common in males than females and severely affected 4 per cent of the population, regardless of socio-economic status, race or level of intelligence (Badian, N. A. (1984) 'Reading disability in an epidemiological context: incidence and environmental correlates'. *Journal of Learning Disability*: Mar; 17(3):129–36. However, Everatt and Zabell (2000) suggest that the gender ratio is more equal (Everatt, J. and Zabell, C. (2000) 'Gender differences in dyslexia', in Smythe, I. (ed.) *The Dyslexia Handbook*. Reading: British Dyslexia Association). Many studies of the incidence of dyslexia have produced varying figures because they have used different criteria.

Literacy and numeracy

As indicated by correlations between literacy and numeracy scores and scores in the individual DAST exercises (see page 69), there is a clear link between risk of dyslexia and poor performance in the literacy and numeracy assessments. Table 5.3 gives the correlations between cohort members' ARQ score and their scores in both the multiple-choice (MC) and open response (OR) literacy and numeracy assessments. All correlations were statistically significant and negative, indicating that a high score in the assessments was associated with a low ARQ score, ie, less risk of dyslexia. The correlations were marginally stronger with performance in the MC part of the assessments for both literacy and numeracy. Correlations between ARQ scores and MC assessment scores were also marginally stronger among men; correlations between ARQ scores and OR assessment scores were marginally stronger among women.

Table 5.3 Correlations between literacy, numeracy and DAST ARQ score

	Men %	Women %	All %
Literacy (MC)	**-.52** (n=4,165)	**-.50** (n=4,632)	**-.50** (n=8,797)
Literacy (OR)	**-.36** (n=4,160)	**-.40** (n=4,628)	**-.37** (n=8,788)
Numeracy (MC)	**-.46** (n=4,165)	**-.42** (n=4,632)	**-.41** (n=8,797)
Numeracy (OR)	**-.35** (n=4,157)	**-.37** (n=4,628)	-**.34** (n=8,785)

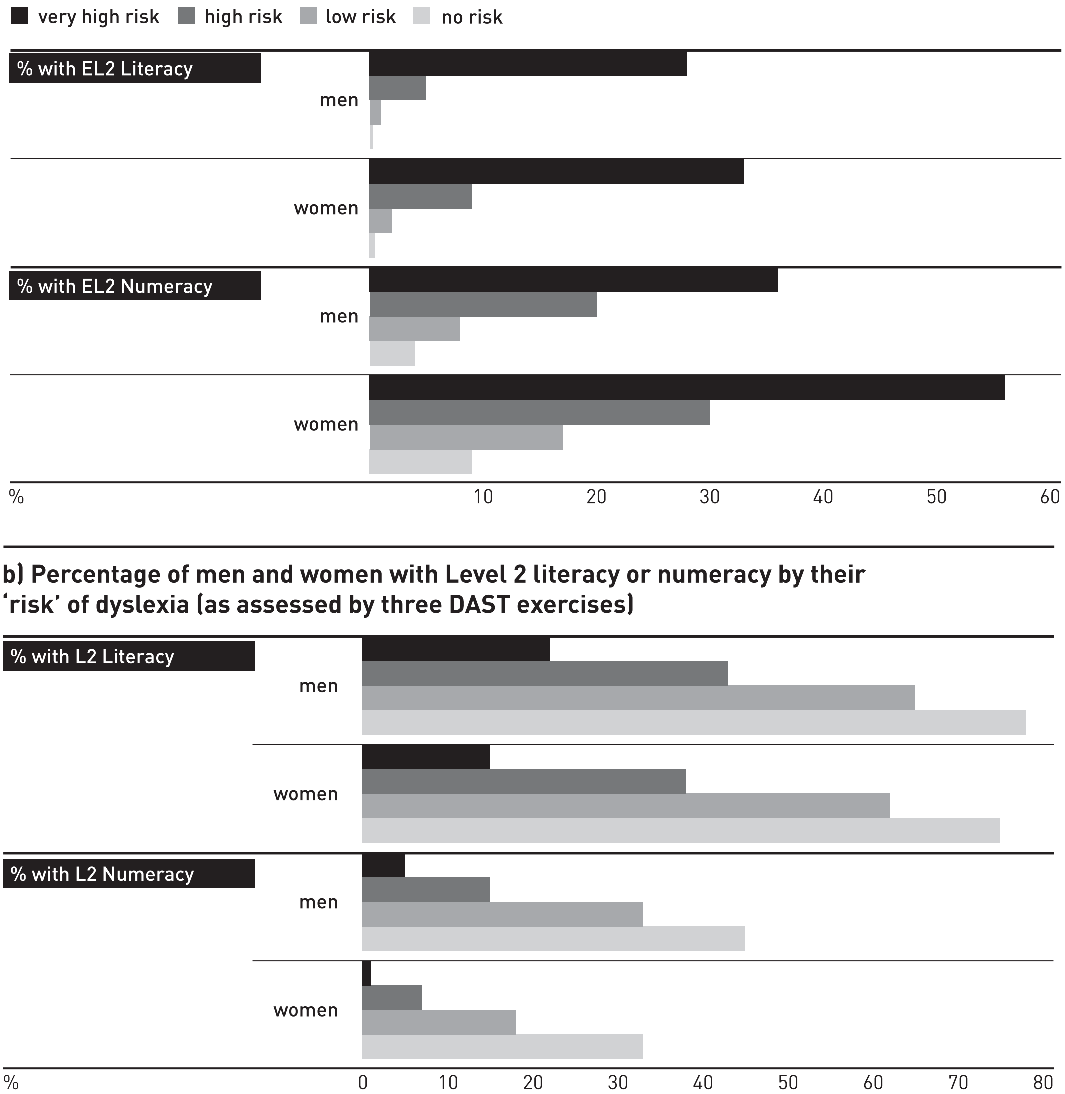
*all correlations were significant at the $p<.001$ level.

The link between risk of dyslexia and poor performance in the literacy and numeracy assessments becomes clearer when looking at the percentage of each 'at risk' group who were assessed with Entry Level 2 literacy or numeracy. Figure 5.5a shows that, whereas less than 1 per cent of men and women with 'no risk' of dyslexia (ARQ = 0) had Entry Level 2 literacy in the MC assessment, this increased to 28 per cent of men and 33 per cent of women with a 'very high risk' of dyslexia (ARQ ≥ 2). Similarly, for the numeracy MC assessment, 4 per cent of men and 9 per cent of women with 'no risk' of dyslexia had Entry Level 2 numeracy, whereas this increased to 36 per cent of men and 56 per cent of women with a 'very high risk' of dyslexia. The same large variations in the percentages were evident with low scores on the open-response (OR) part of the literacy and numeracy assessment.

Figure 5.5b shows that differences at the other end of the ability spectrum (the percentages of cohort members assessed with having Level 2 literacy or numeracy from the MC assessment, by their risk of dyslexia) were equally if not more striking, especially for literacy, ie, it is not just that those with 'no risk' of dyslexia did not have Entry Level 2 literacy or numeracy, but that nearly three-quarters had Level 2 literacy compared with 22 per cent of men and just 15 per cent of women with a 'very high risk' of dyslexia.

Figure 5.5 **Relationship between being 'at risk' of dyslexia and a poor grasp of literacy and numeracy**

a) Percentage of men and women with Entry Level 2 literacy or numeracy by their 'risk' of dyslexia (as assessed by three DAST exercises)



Self-awareness of literacy and numeracy difficulties

Reading

Among those with a 'very high risk' of dyslexia:

- one in three women and one in two men reported that they never read books;
- 34 per cent of men and 27 per cent of women reported difficulties with reading compared with 17 per cent of men and 16 per cent of women with a 'high risk' of dyslexia and just 3 per cent of men and 2 per cent of women with 'no risk' of dyslexia. Most of these difficulties were associated with understanding paperwork;
- 22 per cent of men and 17 per cent of women wanted to improve their reading skills, even though only 4 per cent of these men and women had been on a course to help tackle these difficulties.

Writing

Among those with a 'very high risk' of dyslexia:

- three in four men and two in three women reported difficulties with writing. Spelling difficulties and 'ability to put down in words what I want to say' were the difficulties most widely felt, particularly by men;
- 18 per cent of men reported that their poor handwriting was a problem;
- 34 per cent of men and 31 per cent of women said they would like to improve their writing; 5 per cent of men and 4 per cent of women had been on a course to help them do so.

Numbers

Not surprisingly, the link with risk of dyslexia was weaker with self-reported numbers and mathematical calculation difficulties. However, the association was stronger among women, whereas the association between risk of dyslexia and reading and writing difficulties was stronger among men.

- 19 per cent of men and 29 per cent of women with a 'very high risk' of dyslexia reported difficulties with numbers, compared with 5 per cent of men and 8 per cent of women with no risk of dyslexia.
- Difficulties with multiplication and division were the most widely reported difficulties.
- 17 per cent of men and 20 per cent of women with a 'very high risk' of dyslexia said that they would like to improve their numerical skills, compared with 6 per cent of men and 11 per cent of women without risk.
- Less than 2 per cent of men in all 'risk' groups had been on a course to help with their writing. 5 per cent of women with a 'very high risk' of dyslexia had been on a course, compared with 1 per cent of women with no risk of dyslexia.

Qualifications

Men and women at most risk of dyslexia were the least likely to have attained any qualifications by age 34.

- 32 per cent of men and 37 per cent of women with a very high risk of dyslexia were without any formal qualification, compared with 16 per cent of men and 17 per cent of women classified with a 'high risk', 7 per cent of men and 6 per cent of women with 'low risk', and 3 per cent of men and 4 per cent of women with 'no risk'.

In an attempt to isolate the impact of dyslexic symptoms from that of poor literacy and numeracy skills on having attained a formal qualification by age 34, and other such binary (dichotomous) outcomes, simple logistic regression analyses were performed. Each of a range of outcomes at age 34 was first predicted, for men and women separately, by membership of each of the four 'risk of dyslexia' groups alone. Secondly, the prediction model was estimated for the four 'risk of dyslexia' groups plus the two variables, literacy and numeracy level, as assessed by the multiple-choice part of the adult assessment. If the impact on the age 34 outcomes was largely borne by poor literacy and numeracy performance rather than dyslexia, then we would expect the odds ratios for dyslexia to be much reduced.

The logistic regression model used here involved the estimation of a binary outcome variable, eg, 'no qualifications at age 34'/'qualifications at age 34' from the predictor variables. The results are reported as relative odds or odds ratios (OR) for each category of each predictor variable, compared with the odds ratio for a reference category, eg, no dyslexia risk, which, for convenience in this analysis, is fixed at '1'. Odds ratios greater than '1' signify a positive relationship between category membership and the outcome; odds ratios less than '1' signify a negative relationship. Thus for the prediction of 'having qualifications at age 34' from the four-category 'dyslexia risk' variable, with the reference category defined as 'no risk', we might expect the category 'very high risk' to have an odds ratio substantially less than '1'. In our example, if an odds ratio of 0.25 for 'having qualifications' was found for men in the 'very high risk' group, it would mean that their relative chances of having qualifications were only one quarter that of the relative chances for the 'no risk' group. To assess the statistical significance of the difference between a given odds ratio and '1', three levels of statistical significance are reported: $p<.001$, $p<.01$, $p<.05$.

Logistic regression results on impact of risk of dyslexia on outcomes at age 34

In this initial analysis, outcomes at age 34 comprised employment and other economic status measures, qualifications, employment-related training, social participation, health and wellbeing.

In Tables 5.4a and 5.4b we can see that, for both men and women, a 'very high risk' of dyslexia has a significant negative association with all the outcomes examined. A high risk of dyslexia is similarly associated with all outcomes for women, and all bar one for men. Even a 'risk' (as opposed to 'high risk') of dyslexia has a negative association with most outcomes for both men and women. However, once grasp of literacy and numeracy is taken into account, the association between dyslexia and these outcomes is much reduced. In other words, the relationship between dyslexia and the age 34 attributes is overshadowed by literacy and numeracy performance.

However, 'risk of dyslexia' did maintain an independent association over and above literacy and numeracy in some important areas of adult life. For both men and women these were:

- attaining qualifications;
- being in employment that requires the use of a computer;
- social and political engagement;
- dissatisfaction, or 'never seem to get what I want out of life'.

In addition to these attributes, both men and women with a 'high risk' of dyslexia were less likely to have received work-related training. Women with a 'very high risk' of dyslexia were also significantly less likely to be employed and more likely to be part of a non-working household.

Table 5.4a **Predicting adult outcomes for men at risk of dyslexia**

PREDICTORS	DAST ARQ				DAST ARQ + Numeracy and literacy			
	Very high Risk	High Risk	Risk	No Risk	Very high Risk	High risk	Risk	No risk
Education								
Any formal qualifications	**0.07**[1]	**0.17**[1]	**0.37**[1]	1.00	**0.22**[1]	**0.35**[1]	**0.47**[1]	1.00
Employment								
Not employed at 34	**2.76**[1]	**1.48**[3]	1.13	1.00	1.23	1.03	1.01	1.00
Employment-related								
Work-related training●	**0.42**[1]	**0.62**[1]	**0.81**[2]	1.00	0.68[4]	**0.71**[3]	0.79[4]	1.00
Use a computer at work●	**0.10**[1]	**0.22**[1]	**0.46**[1]	1.00	**0.24**[1]	**0.38**[1]	**0.55**[1]	1.00
Other economic								
Home owner	**0.43**[1]	**0.58**[1]	**0.85**[3]	1.00	0.77	**0.77**[3]	0.93	1.00
Non-working household	**3.52**[1]	**1.75**[2]	1.18	1.00	1.29	1.09	1.02	1.00
Social participation								
Member of a group/organisation	**0.43**[1]	**0.57**[1]	**0.84**[3]	1.00	**0.59**[3]	**0.69**[1]	0.90	1.00
Not at all interested in politics	**3.32**[1]	**2.21**[1]	1.22[4]	1.00	**2.05**[1]	**1.65**[1]	1.11	1.00
Health + wellbeing								
Depressed	**2.01**[1]	1.18	0.96	1.00	1.09	0.87	0.87	1.00
Never get what want out of life	**2.34**[1]	**1.74**[1]	**1.46**[1]	1.00	1.26	1.25[4]	**1.31**[2]	1.00
n(100%)	*204*	*646*	*1,731*	*1,583*	*203*	*644*	*1,730*	*1,583*

Table 5.4b Predicting adult outcomes for women at risk of dyslexia

PREDICTORS	DAST ARQ				DAST ARQ + Numeracy and literacy			
	Very high Risk	High Risk	Risk	No Risk	Very high Risk	High risk	Risk	No risk
Education								
Any formal qualifications	**0.07**[1]	**0.19**[1]	**0.57**[1]	1.00	**0.22**[1]	**0.38**[1]	0.79	1.00
Employment								
Not employed at 34	**2.53**[1]	**1.45**[2]	1.05	1.00	**1.53**[3]	1.11	0.96	1.00
Employment-related								
Work-related training●	**0.44**[2]	**0.56**[1]	0.88[4]	1.00	0.67	**0.71**[3]	0.98	1.00
Use a computer at work●	**0.10**[1]	**0.20**[1]	**0.54**[1]	1.00	**0.27**[1]	**0.33**[1]	**0.68**[1]	1.00
Other economic								
Home owner	**0.38**[1]	**0.50**[1]	**0.83**[2]	1.00	0.76	**0.74**[2]	0.99	1.00
Non-working household	**5.85**[1]	**2.38**[1]	**1.47**[2]	1.00	**2.21**[1]	1.40[4]	1.19	1.00
Social participation								
Member of a group/organisation	**0.54**[1]	**0.54**[1]	**0.78**[3]	1.00	0.88	**0.69**[1]	**0.86**[3]	1.00
Not at all interested in politics	**1.85**[2]	**2.10**[1]	**1.24**[2]	1.00	1.03	**1.42**[2]	1.04	1.00
Health + wellbeing								
Depressed	**1.89**[2]	**1.58**[1]	**1.23**[3]	1.00	1.05	1.14	1.08	1.00
Never get what want out of life	**2.04**[1]	**2.47**[1]	**1.52**[1]	1.00	1.14	**1.75**[1]	**1.30**[2]	1.00
n(100%)	*146*	*544*	*1,899*	*2,024*	*146*	*544*	*1,897*	*2,024*

Key: [1]p<.001, [2]p<.01, [3]p<.05, [4]p<.1; ● sample restricted to those currently employed

Conclusions

The distribution of scores for the four DAST exercises showed the different kinds of dyslexia symptoms and clearly identified a significant minority of cohort members who were 'at risk' of dyslexia. Being 'at risk' of dyslexia was positively correlated with poor literacy and/or numeracy. There was also a relatively high degree of awareness of reading and writing difficulties among those with the highest 'risk' of dyslexia, coupled with a desire to improve these skills.

From the logistic regression analyses, it is clear that much of the association between having a high risk of dyslexia and other age 34 attributes is overshadowed once literacy and numeracy scores are taken into account. However, risk of dyslexia retains an independent relationship with gaining qualifications, being employed (women), and being employed in modern (ICT-based) jobs, on social and political participation, and on satisfaction with one's own life.

What might be the reason for this?

Formal qualifications are usually acquired in an examination setting with some time restrictions. We know that dyslexic symptoms become more pronounced in a timed environment, so performance would be impaired. Perhaps more importantly, if dyslexia has not been identified early on in an individual's life then (a) they are unlikely to have been given the help needed over their school years and (b) the time allowances often available in an examination setting for sufferers of dyslexia would not have been granted.

Following from this, the qualifications necessary for modern, ICT-based employment are often lacking among those with symptoms of dyslexia, particularly women. Without the qualifications and with the associated poor literacy and numeracy, risk of dyslexia further appears to exclude men and women from this kind of work. This may be because of the fast pace of such work and the need to grasp ever-changing demands, including new computer-based packages, and associated information.

The connection between dyslexia risk and social participation is interesting in pointing to a further degree of social isolation of people with poor literacy and numeracy, this time compounded by the learning difficulties identified with dyslexia. This is further illuminated by the association between risk of dyslexia and the self-appraisal 'I never get what I want out of life'.

These findings signal the need for policy-makers and practitioners to recognise and adopt appropriate remediation for the added component of literacy and numeracy learning difficulties that dyslexia presents. They also raise important research questions about the precise ways in which such difficulties are made manifest and the ways in which they affect functioning in adult life.

Chapter 6
Intergenerational transfers

An additional purpose of the BCS70 2004 survey was to gather information on a representative sample of cohort members and their resident natural or adopted children, and to assess the children's cognitive skills. This 'Parent and Child Survey' largely replicated a similar intergenerational study, the 'Mother and Child Survey', which was carried out in 1991 on a representative sample of the NCDS cohort, when they were age 33.

The comparable age of the BCS70 cohort in 2004 (34) to that of the NCDS cohort in 1991 (33) offered the opportunity to compare cognitive development at similar parental ages across the twelve years separating the births of the two cohorts. This identified the first of a number of requirements for the BCS70 child assessments:

- cognitive development measures comparable to those used in the NCDS age 33 survey;
- continuity from, and comparability with, the assessment of cohort members' own cognitive development and educational performance when they were children, and with the measures of their adult literacy and numeracy;
- applicability across the full anticipated age range expected for the cohort members' children. This and other attributes of the children could only be effectively established by the interviewer when arranging the main interview;
- ability to be administered in the 20 minutes available for each child's assessment in the survey. (This was partly on the grounds of survey cost and partly on the grounds of minimising 'respondent burden'.)

The British Ability Scales Second Edition (BAS II) was found to be the most appropriate instrument to meet the survey's purposes and was adopted[65]. The main reasons were as follows.

- Using the BAS II would offer intergenerational comparison opportunities as BCS70 cohort members were assessed using aspects of the BAS in 1980, when age 10.
- MCS[66] cohort members were assessed with an individual BAS II scale when 3 years old.
- BAS II contains modules designed to capture a measure of a child's literacy and numeracy development. By using such subscales, the extent to which education and skills problems and attainments are repeated across the generations within families and the modifying influences on them could be investigated, in line with the *Skills for Life* Survey (2003).
- BAS II was among the few major assessment tools available that offered assessment of children aged 3 to16 years.

65 Other assessments considered were *The Stanford-Binet intelligence scale:* Terman, L. M. and Merrill, M. A. (l96l). Stanford-Binet Intelligence Scale, 3rd ed. Harrap. *The Wechsler pre-school and primary scale of intelligence***:** Wechsler, D. (1999). Wechsler Abbreviated Scale of Intelligence (WASI). Psychological Corporation, U.K. Wechsler, D. (1976). Wechsler Intelligence Scale for Children – Revised (WISC-R). NFER-NELSON, 2nd (British) ed. *The Snijders-Oomen non-verbal intelligence scales:* Snijders, J. Th. and Snijders-Oomen, N. (c. 1987). Snijders-Oomen Non-Verbal Intelligence Scale. Netherlands: Wolters-Noordhoff. Ages 2:6 – 7 years. Snijders, J. Th., Tellegen, P. J. and Laros J. A. (1989, 1996). Snijders-Oomen Non-Verbal Intelligence Scale (SON-R). Netherlands: Walters-Noordhoff (Manual) and Swets and Zeitlinger. Ages: 5.6 years to 17 years. *The Peabody Individual Achievement Test (PIAT) and the Peabody Picture Vocabulary Test – Revised (PPVT-R):* Dunn, L. and Dunn, L. (1981) PPVT-R Manual. Circle Pines, MN: American Guidance Service. Dunn, L. and Markwardt, Jr. C. (1970) Peabody Individual Achievement Test Manual. Circle Pines, MN: American Guidance Service. *The Bracken test:* Bracken, B. A. (1998). *Bracken Basic Concept Scale – Revised (BBCS-R)*. Psychological Corporation.

66 The Millennium Cohort Study (MCS) is the fourth British cohort study, which began collecting information on more than 18,000 babies born over a 12 month period from September 2000.

- Appropriate BAS II scales were estimated to take 20 minutes (on average) to complete. This was in line with the project requirements to minimise burden on the children and with the overall time the interviewer had available to spend in the household.

Introduction to The British Ability Scales II

The British Ability Scales Second Edition (BAS II) is a battery of individually administered tests of cognitive abilities and educational achievement, published by the NFER-NELSON Publishing Company Ltd[67].

The BAS II consists of two elements: the cognitive element and the achievement element. It is suitable for use with children and adolescents aged from 2 years 6 months to 17 years 11 months, and is organised into two age-specific batteries: the Early Years Battery for pre-school children and the School Years Battery for children of school age.

- The Early Years Battery is composed entirely of cognitive scales and is generally used for children under 6 years old (but can be used for children from 6 to 7 years 11 months who will have difficulty with the School Age Battery). Several of the subscales can be used from age 2 years 6 months (2:6) upwards; others start from age 3, 3 years 6 months or 4 years. These scales use appealing artwork and manipulable objects to assess reasoning, perception and memory, together with an understanding of basic quantitative concepts.
- The School Years Battery comprises both cognitive and achievement scales that have been normed from 5 to 17 years 11 months (some of the scales will prove demanding for 5 and 6 year olds). The cognitive scales have been designed to assess reasoning, perception, processing speed and memory, using verbal, numerical and figurative materials. The achievement element comprises scales measuring word reading, spelling and number skills.

Selection of particular subscales

In line with the *Skills for Life* Survey (2003), it was necessary to use subscales that supplied a measure (direct or indirect) of a child's literacy and numeracy. After consultation with experts from the London Institute of Education and NFER-NELSON, the 'Naming Vocabulary' and 'Early Number Concepts' tests were selected from the Early Years Battery for children age 3 to 5 years 11 months. For children age 6 to 16 years 11 months the achievement element of the School Years Battery was selected, ie, Word Reading, Spelling and Number Skills subscales. In addition, younger children (age 3 to 5 years 11 months) also completed the 'Copying Designs' task that had been used previously in BCS70[68]. The abilities measured by all these assessments

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67 The initial research that led to the publication of the original BAS in 1979 started in 1965, and has developed fairly continuously since. A revised version, the BAS-R, was published in 1983. The battery of individual scales that make up the BAS II, published in 1997, therefore has more than 30 years of development behind it. The BAS was initially developed to provide professionals in a number of different clinical settings, and who assessed children with a wide range of learning and developmental needs, with a tool that gave information at a finer yet broader level of detail than could be attained from an IQ score. As such, various theoretical perspectives have been drawn on and accommodated in the development of BAS II. However, educational application remains the principal goal of BAS II, primarily to evaluate children who, in the broadest sense, demonstrate learning difficulties. The battery of individual scales that make up the BAS II objectively, reliably and economically measure a child's strengths and weaknesses, providing a comprehensive assessment of their current intellectual functioning and basic educational progress. Generalisation is the key feature upon which all tests are based. Much of human behaviour is not specific to a particular setting and more lasting and general characteristics of a child can therefore be interpreted from an achieved score in an individual test. For example, vocabulary testing is an index of general language skills.

68 Copying skills are a strong predictor of literacy and numeracy competence in adult life (see Bynner and Steedman, 1994; Parsons and Bynner, 1998). For the assessment itself see: Osborn, A.F., Butler, N. R. and Morris, A. C. (1984). *The Social Life of Britain's Five Year Olds. A report of the Child Health and Education Study*. London: Routledge and Kegan Paul.

or scales are detailed in Table 6.1. A problem to bear in mind with the selected assessments is their datedness. As the BAS II was last revised in 1997, some of the images and pictures included in the Early Years Battery are showing their age. A picture of a telephone looks particularly outmoded. Some of the children in the survey will have only ever seen a mobile phone, not a push-button landline. Perhaps of more concern is the inability of such an assessment to keep pace with the (evolving) national curriculum. This was particularly apparent for the Number Skills scale of the School Years Battery. However, a definite advantage of using the BAS II scales is that these tests have been widely used and scores have been standardised on large populations. This means that the results obtained in the BCS70 follow-up survey can be benchmarked, and if necessary standardised, against the BAS test norms.

Table 6.1 **Selected BAS II subscales**

Age 3 to 5 years 11 months (Early Years Battery)	
Scale	**Abilities measured**
Naming Vocabulary	Expressive language; knowledge of names
Early Number Concepts	Knowledge of, and problem-solving using, pre-numerical and numerical concepts
Copying Designs*	Visual-perceptual matching and fine-motor coordination in copying line drawings

Age 6 to 16 years 11 months (School Years Battery)	
Scale	**Abilities measured**
Number Skills	Recognition of printed numbers and performance of arithmetic operations
Spelling	Knowledge and recall of spellings
Word Reading	Recognition (decoding) of printed words

* Not a BAS II assessment

Results from the child assessments

Of the 9,665 cohort members in the Core dataset, 4,792 (49.6 per cent) had been randomly selected into the 'Parent and Child' elements of the survey. Of these, 2,846 (59 per cent) had at least one child. As expected, female cohort members were more likely to have a child by age 34 and they made up 61 per cent of the 'Parent and Child' dataset. In total, information was gathered on 5,207 own or adopted children of cohort members who were aged between 0 and 16 years 11 months[69]. The average (mean) age of the children was 6 years and 4 months, and each of the 2,846 cohort members had on average 1.8 children. Female cohort members were more likely to have had two or more children by age 34. Figure 6.1 gives the distribution of cohort members by the number of children they had at age 34; Figure 6.2 gives the distribution of the 5,207 children by their own age. We can see that the great majority were two- or one-child families, though of course the majority of the one-child families would probably go on to have more children after age 34, ie, family composition was not complete.

It can be seen from Figure 6.2 that the median[70] age of children was between 5 and 6 years (more precisely, 5 years 10 months). In NCDS in 1991, when cohort members were age 33, the median age was 7 years. This reflects the dramatic rise in postponing parenthood that

69 In the similar NCDS Mother and Child Survey in 1991, 2,544 female cohort members gave information on 4,204 own or adopted children between age 0 and 18. Each mother had an average of 1.7 children.
70 The median is the midpoint in a sample distribution for a given variable; half the data values are above the median, and half are below.

occurred across the 12 years separating the 1958 and 1970 cohorts. The 'bunching' of BCS70 cohort members' children at the younger ages provides researchers with substantial numbers of children at all ages up to age 10, offering much potential for analysis.

Figure 6.1 **Distribution of BCS70 cohort members in the Parent and Child survey, by number of own or adopted children at age 34**

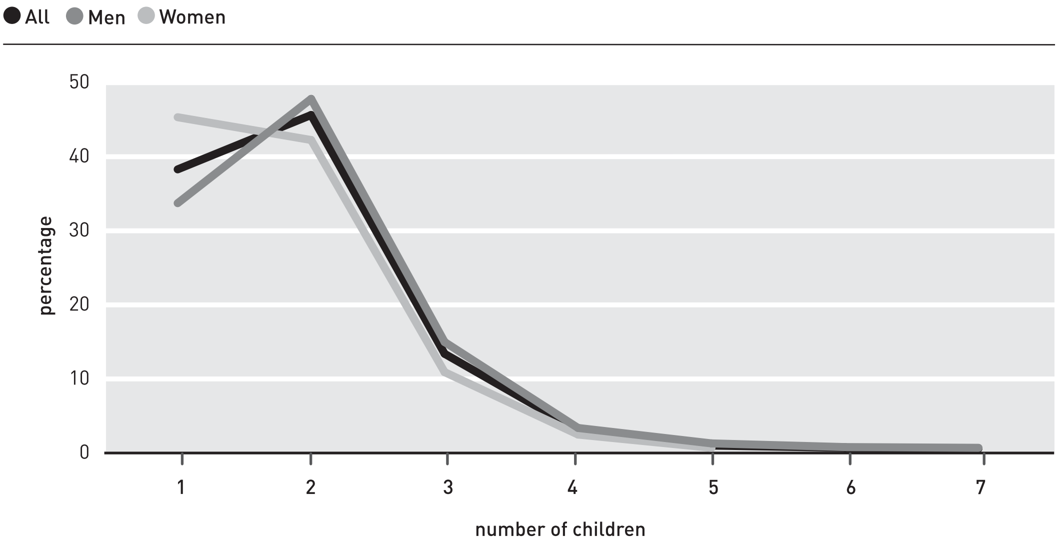
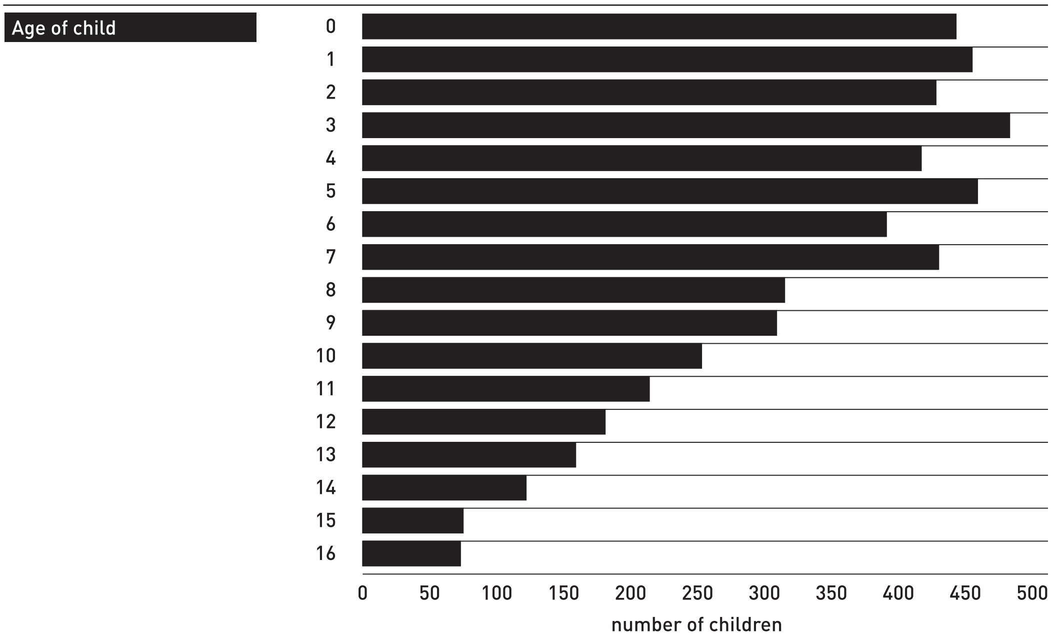


Figure 6.2 **Distribution of cohort members' children in the Parent and Child survey, by child's age**



How many children did the assessments?

Of the 5,207 children about whom cohort members provided information in the Parent and Child interview:

- 25.5 per cent (1,326) were aged between 0 and 2 years 11 months and were not eligible for assessment;
- 26.1 per cent (1,359) were aged between 3 and 5 years 11 months and were eligible for two BAS Early Years assessments and the Copying Designs assessment. Of the 1,359, 92 per cent (1,249) completed at least one of the three assessments. Four year olds were slightly less likely (89 per cent) to have participated;
- 48.4 per cent (2,522) were aged between 6 and 16 years 11 months and were eligible for three BAS School Age assessments. Of the 2,522, 89 per cent (2,248) completed at least one of these assessments. Unsurprisingly, 15 and 16 year olds were the least likely to have taken part (77 per cent).

BAS Early Years assessments

Information was available for only two BAS II assessments – Naming Vocabulary and Early Number Concepts. The Copying Designs task that had been used previously in BCS70 required the child to copy eight drawings twice on two consecutive pages of a specially produced booklet. Although each drawing has a score of either '0' or '1', the score is calculated from a number of different criteria and cannot be assessed by an interviewer *in situ* (details of the exercise are provided in Appendix 3). The assessment will be scored by specially trained personnel, for use in the next stage of the analysis.

The two BAS II assessments were completed by 1,359 children aged between 3 and 5 years 11 months. As children take different sets of items, their raw scores cannot be compared directly. Raw scores are converted to an ability score, which is an estimate of a child's level on the ability being measured by an individual scale. The ability score reflects both the raw score and the difficulty of the items being administered. A given raw score on a set of easy items (suitable for younger children) will yield a lower ability score than will the same raw score on a set of more difficult items (suitable for older children). The ability scores for each scale start with a value of 10, which reflects a raw score of 0 on the easiest possible set of items in a scale. The upper limit of ability scores varies from scale to scale; consequently comparing ability scores across them is not meaningful. We show the average ability scores for children in the 2004 survey by age and compare these with the age-equivalent ability scores provided in the BAS II Administration and Scoring Manual (Figures 6.5 and 6.8). In line with the BAS II, the youngest children had the lowest mean (average) scores and the oldest children had the highest mean (average) scores in both the Naming Vocabulary and Early Number Concepts exercise. Although lower than the correlation between the adult multiple-choice literacy and numeracy scores, even after controlling for age, a reasonably strong correlation between performance in the two BAS exercises (0.44, $p<.001$) was found.

Naming Vocabulary

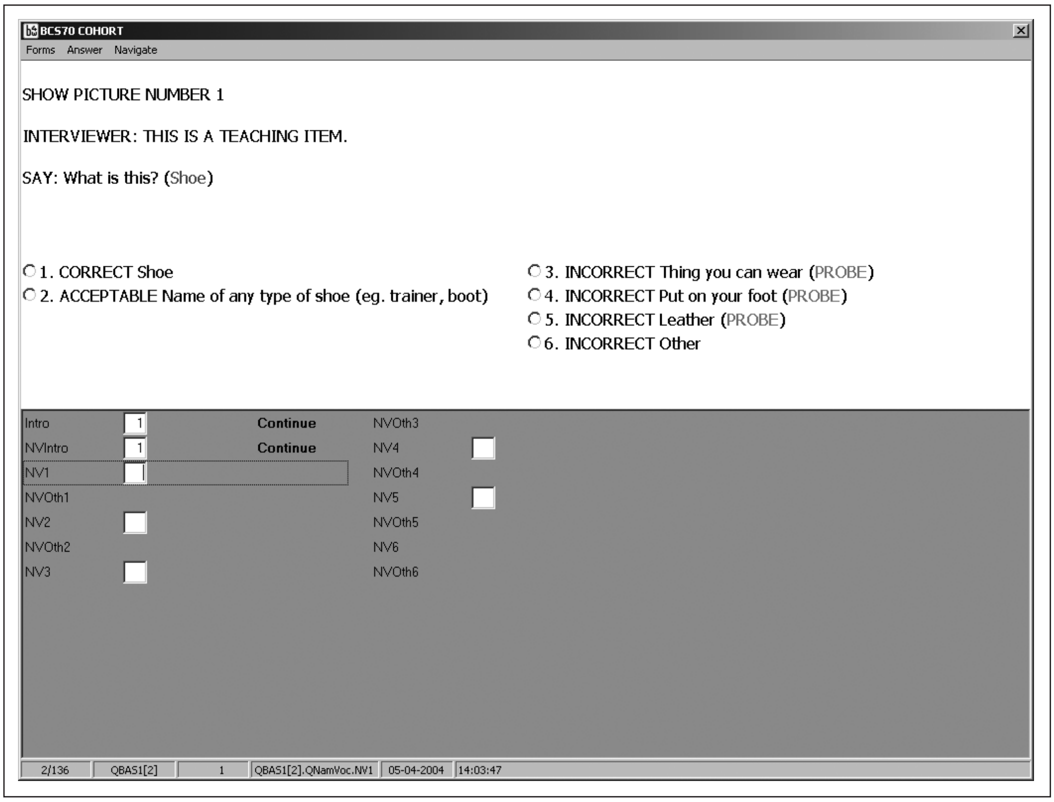
Rules and administration
For this exercise, the child was shown a series of pictures presented in the stimulus booklet

and asked to say what it was, eg, a picture of a shoe, chair or pair of scissors. There were 36 pictures in total, but the number of items a child answered depended on his/her performance. There were different starting and stopping points depending on age and performance but, on the whole, the better the children did, the more items they were given. All alternative answers a child might give that were included in the BAS II manual were also presented for interviewers on the CAPI screen. In this exercise a child's answer was either:

- 'correct' – the standard name of the pictured object, eg, 'shoe';
- 'acceptable' – responses other than the standard name of a pictured object, such as overly specific names, eg, 'trout' for 'fish';
- 'incorrect (probe further)' – such responses included the description of the function, materials or parts of the object pictured (eg, 'put on your foot' for 'shoe'), too general responses (eg, 'animal' for 'horse'), and names of related objects (eg, 'stool' instead of 'chair');
- 'incorrect (other)' – responses that were just plain wrong, eg, 'tree' for 'shoe'. Interviewers had to write the child's response verbatim into the CAPI.

Figure 6.3 gives an example of a BAS II Naming Vocabulary image and the corresponding information that is shown on the CAPI screen for interviewers.

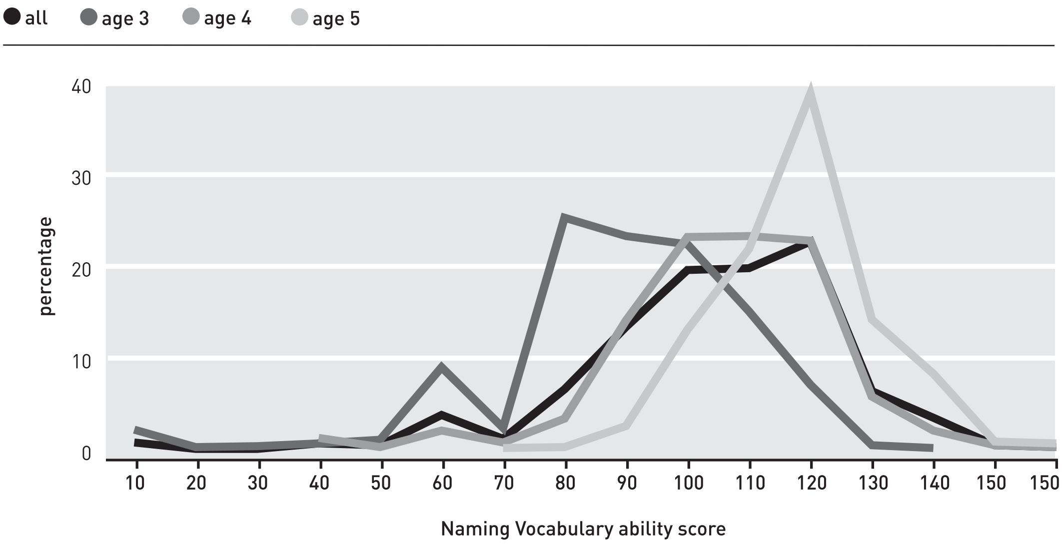
Figure 6.3: **BAS II Naming Vocabulary, image and CAPI screen**[71]



71 © NFER-NELSON. This example from the BAS II Naming Vocabulary scale has been reproduced with the kind permission of NFER-NELSON.

Figure 6.4 shows the distribution of children's scores for each age group from 3 to 5 years. As we can see, the distribution of the scores in each age group is roughly 'normal' or 'bell-shaped', with the distributions incorporating higher scores as the children's average age increases. The exercise successfully distinguished between children with different capabilities as revealed by the test, providing opportunities to compare them.

Figure 6.4 **Distribution of ability scores for children completing the BAS Naming Vocabulary exercise**



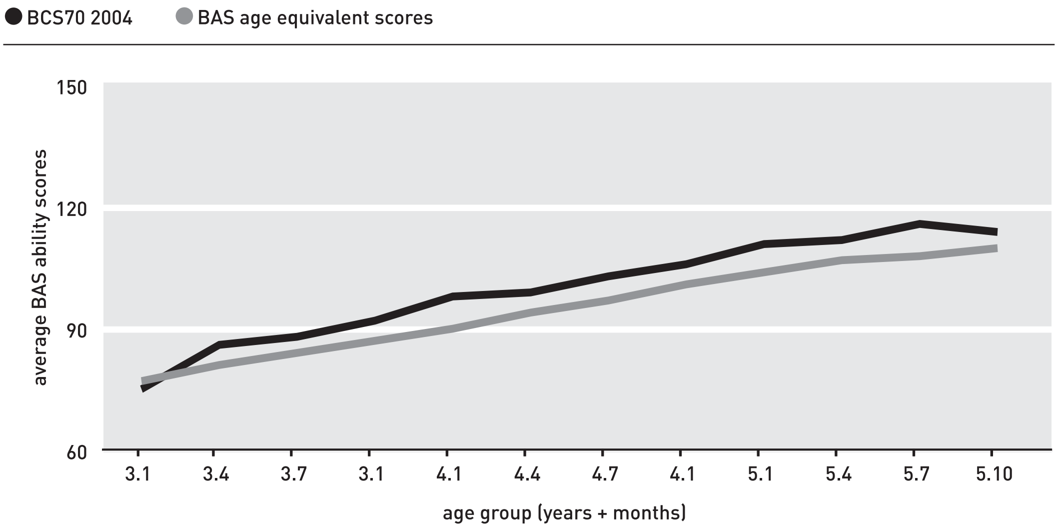
In the BAS II Administration and Scoring Manual age-equivalent ability scores for children age 3, 4 or 5 years are spaced at three-month intervals. For example, for children age 3 years these are:

- 3:1 (for children age 3 years 0 months to 3 years 2 months);
- 3:4 (for children age 3 years 3 months to 3 years 5 months);
- 3:7 (for children age 3 years 6 months to 3 years 8 months);
- 3:10 (for children age 3 years 9 months to 3 years 11 months).

To be able to compare ability scores achieved by the children of cohort members with BAS II age-equivalent ability scores, we grouped the children of cohort members in accordance with these age groups. In Figure 6.5 we can see that average scores in the Naming Vocabulary scale increased with age and that cohort members' children had marginally higher scores than the BAS II age-equivalents[72] in every age group (bar the very youngest). This reflects the fact that these younger children of cohort members had older and, most likely, more educated parents than the average 3 to 5 year 11 month old in the wider population.

72 It is usual that, for each age group, the BAS II age-equivalent ability scores fell across a narrow score range. For example, for children in the age group 3:7, the age-equivalent ability score range for the Naming Vocabulary scale was 82–84 and, for the Early Number Concepts scale, 95–100. The mid-point of each score range was plotted in all figures. See Table 5.7 on page 477–78 of the BAS II Administration and Scoring Manual.

Figure 6.5 **Comparing BCS70 cohort members' children's average ability scores in the BAS II Naming Vocabulary scale with BAS II age-equivalent ability scores**



Early Number Concepts

Rules and administration

For this exercise, the child answered questions about number, size, or other numerical concepts. Stimuli used for the exercises included ten green plastic tiles and a series of pictures presented in the same easel as for the Naming Vocabulary scale. There were 30 questions in total, but there was no standard number of items for a child to try to answer. As for Naming Vocabulary, there were different starting and stopping points depending on age and performance. A number of questions were asked for each of the pictures. For example, three questions went with the 'ladybirds' displayed in Figure 6.6. The interviewer would indicate the yellow ladybirds, point to one in particular, and then ask the child to point to all the red ladybirds that had the same number of spots as the particular yellow one, ie, two, four, or six spots. Interviewers could not provide anything but neutral encouragement to a child during the task, except for the designated teaching items where the interviewer provided specific feedback, eg, 'yes, that's right', but they also gave the correct response if the child had not answered correctly or had not understood the question. For this exercise, interviewers had to code a child's answer as 1 'correct' or 2 'incorrect' on the CAPI screen[73].

73 The exception to this was Item 3. See previous report (Parsons and Bynner, 2005) or BAS II manual for details.

Figure 6.6: **BAS II Early Number Concepts image**[74]

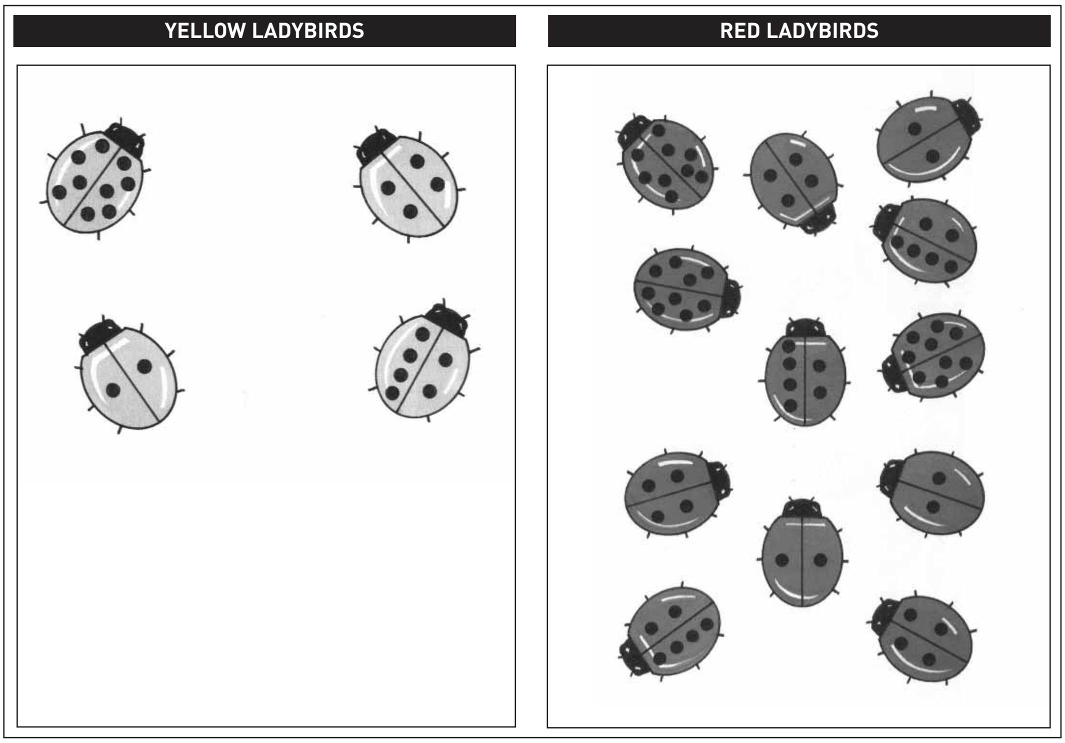
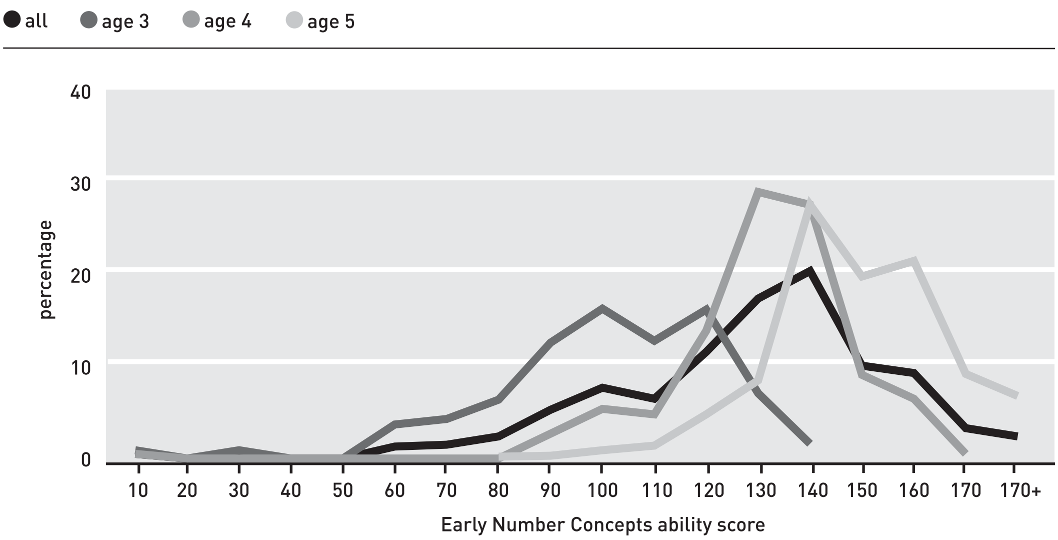


Figure 6.7 shows the distribution of scores for children in each age group taking part in the main survey. As found with the Naming Vocabulary scores, the distribution of the scores in each age group is roughly 'normal'. The exercise successfully distinguished between children with different abilities as revealed by the test, providing opportunities to compare those with high and low ability scores.

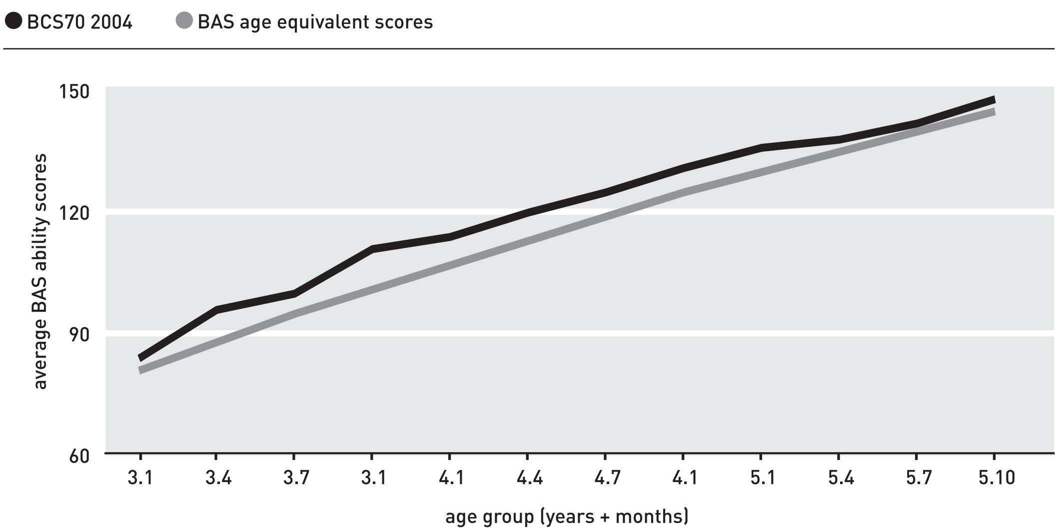
Figure 6.7 **Distribution of ability scores for children completing the BAS II Early Number Concepts exercise**



74 © NFER-NELSON. This example from the BAS II Early Number Concepts Scale has been reproduced with the kind permission of NFER-NELSON.

We again compare ability scores achieved by the children of cohort members with BAS II age-equivalent ability scores. From Figure 6.8 we can see that average Early Number Concepts scores increased with age and, like the results for Naming Vocabulary cohort members' children, had marginally higher scores than the BAS II age-equivalents in every age group.

Figure 6.8 **Comparing BCS70 cohort members' children's average ability scores in the BAS II Early Number Concepts scale with BAS II age-equivalent ability scores**



BAS School Age Assessments: Word Reading, Spelling, Number Skills

These three assessments were completed by 2,248 children aged between 6 and 16 years 11 months. As for the younger children, to be able to compare performance of children of different ages with BAS average age-equivalent ability scores, raw scores were converted into ability scores (Figures 6.11 and 6.16). However, as the Spelling exercise was modified, this comparison was not possible (details of the revisions made to the Spelling assessment are provided on page 90). However, as children of different ages were required to spell a different number of words and to enable comparison of these scores, they were re-scaled so that all fell within the range 0 to 100. For example, if a child spelt ten out of 20 words correctly, the revised score would be 50 out of 100.

In both Reading and Number Skills the youngest children (age 6) had the lowest mean scores. The oldest children (age 15 to 16) had the highest mean Reading scores but, in the Number Skills task, children age 14 recorded the best performance. In the revised Spelling task, performance was minimally related to age. Even when age was controlled, there was a strong correlation between performance in the Reading and Spelling exercises (0.76, $p<.001$) that was larger than the correlation between the Reading and Number Skills tasks (0.58, $p<.001$). Correlations were lower again between performances in the Spelling and Number Skills tasks (0.48). Interestingly, the relationship between 'literacy' and 'numeracy' skills (as shown by the correlation coefficients) was stronger for the school age children (0.58) than for the younger children (0.44), but slightly lower than for literacy and numeracy recorded for their parents (0.64).

For the exercises in the School Age Battery for older children, no teaching items were included and no interviewer feedback, other than neutral encouragement, was allowed. The order in which the three scales were administered was: Word Reading, Spelling and Number Skills.

Word Reading

Rules and administration

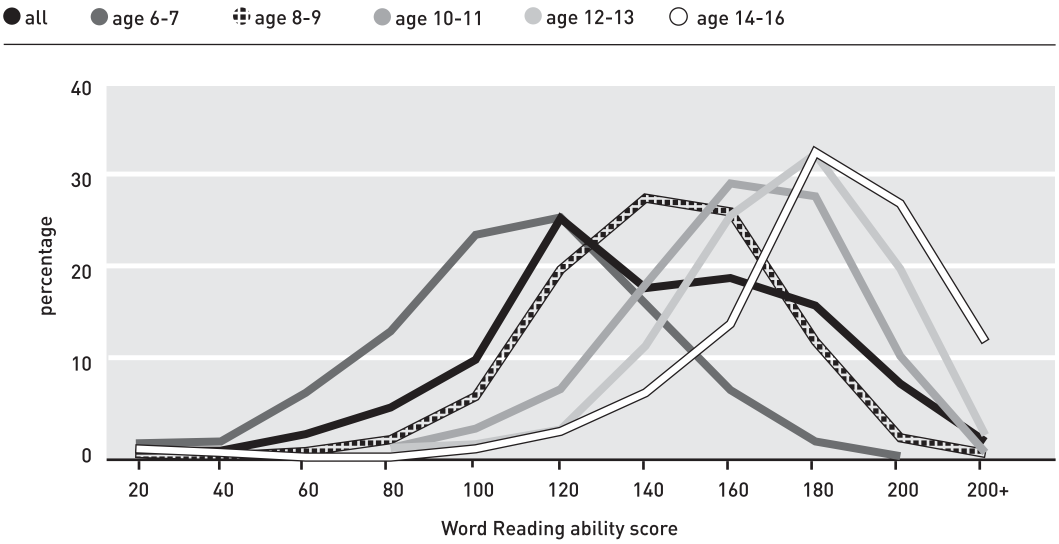
In this exercise, the child read aloud a series of words presented on a card. The child had to pronounce correctly words according to locally accepted standards, with emphasis on the correct syllable or syllables. There were 90 words on the card, arranged in nine blocks of ten words each, but there was no standard number a child had to answer – the total number read out by the child depended on his/her performance. On the whole, the better they did, the more words they read. The words ranged in difficulty from such words as 'up', 'he', and 'you', to 'mnemonic' and 'facetious'. For the interviewers, the CAPI screen showed in turn each of the words the child was to read out. As in the original BAS II interviewer booklet, the screen included a phonetic pronunciation of the word. The symbol '/' and '//' within words was used to indicate individual phonemes and syllables, respectively, with the accented syllables in bold. For example:

Cup	light	chaos
k/uh/p	l/iy/t	**k/ay**//os

Interviewers had the option to code the word as '1' (correct) or '2' (incorrect). As stated, words read with a regional accent or any type of speech impediment, eg, a lisp, were coded as correct. Whether the child understood the word or had seen it before did not matter in terms of coding a correct or incorrect pronunciation. However, the word was to be coded as correct only if the child read the word fluently, ie, it was not just broken down into separate syllables or constituent parts.

Figure 6.9 shows the distribution of scores by each age group for the children of BCS70 cohort members between age 6 and 16 years 11 months taking part in the main fieldwork. For each age band, the distribution is normal, though forming a wider 'bell' shape than the scores provided by the younger children.

Figure 6.9 **Distribution of ability scores for children completing the BAS II Word Reading exercise**



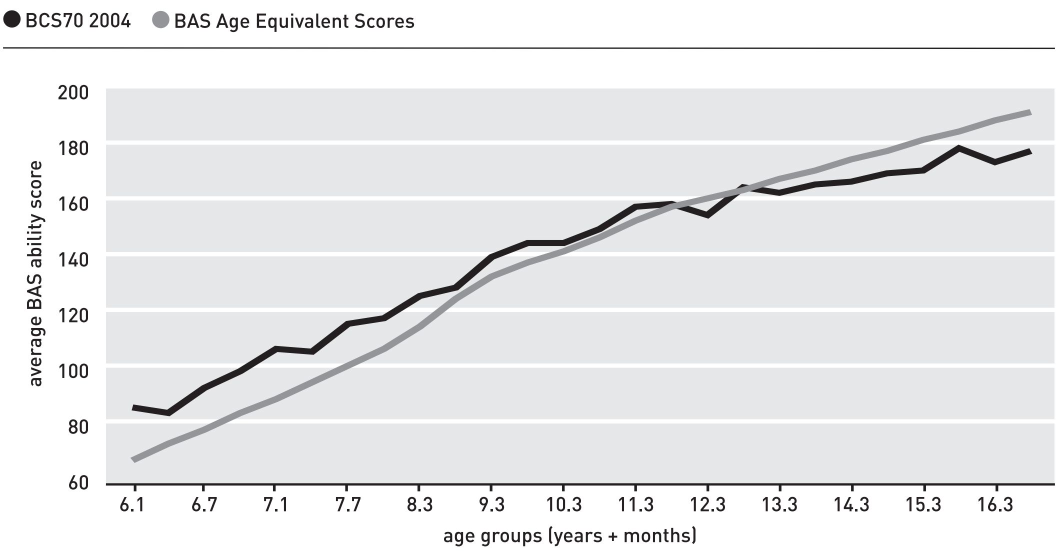
In the BAS II Administration and Scoring Manual the age-equivalent ability scores for children age 6 and 7 are spaced at three-month intervals (as for the Early Years Scales) and the age-equivalent ability scores for children age 8 to 16 are spaced at six-month intervals. For example, for children age 10 years these are:

- 10:3 (for children age 10 years to10 years 5 months);
- 10:9 (for children age 10 years 6 months to 10 years 11 months).

To be able to compare ability scores achieved by the children of cohort members with BAS II age-equivalent ability scores (as for the children who completed the two scales from the Early Years Battery of assessments), we grouped the children of cohort members in accordance with these age groups.

In Figure 6.10 we can see that the average scores increased with age, but that differences between average scores achieved by cohort members' children and the BAS II age-equivalents reversed as the age of the children increased. For younger children, those aged between 6 and 9, cohort members' children had higher average ability scores than the BAS II age-equivalents, whereas for older children, those aged between 12 and 16, cohort members' children had lower average scores than the BAS II age-equivalents. However, less confidence and reliability can be attached to the performance of older children as there were fewer than 200 in each age group from age 12, dropping to just over 70 at age 15 or 16 (see Figure 6.2). It was only for children around age 10 or 11 that scores were nearly identical to the mid-point of the expected range of the BAS II age-equivalent scores[75]. These results suggest that our sample of children is not biased, but rather reflect the fact that older children in our sample are a product of young motherhood, and young mothers are more likely to have less education and associated qualifications – hence the reduction in the older children's test scores.

Figure 6.10 **Comparing BCS70 cohort members' children's average ability scores in the BAS II Word Reading scale with BAS II age-equivalent ability scores**



75 It is usual that for each age group the BAS II age-equivalent ability scores fell across a narrow score range. For example, for children in the age group 10.3, the age-equivalent ability score range for the Word Reading scale was 139–143 and, for the Number Skills scale, 112–119. The mid-point of each score range was plotted in all figures. See Table 5.7 on page 478 of the BAS II Administration and Scoring Manual.

Spelling

Rules and administration

This exercise was a modified version of the original BAS II Spelling exercise. In the original exercise, there are 75 words arranged in eight blocks of ten words and one block of five words[76]. The exercise was modified so that all children within a defined age band received a fixed number of words. The first step involved reducing the total number of words in the revised assessment by half: the first five words within each block of ten were selected, with three words from the final block of five. In order to minimise stress and to avoid disappointment if too many words were failed, a stopping rule of five failures in a row was applied. The interviewer read the word, then a sentence with the word in it (slightly stressing the target word), and then the word alone for a second time. For example:

> "*On*...[pause]...I lie *on* the grass...[pause]...*on*".

> "*Was*...[pause]...It *was* my birthday on Saturday...[pause]...*was*".

The words to be written by the child appeared on the CAPI screen one at a time. After attempting to spell a word, a child read out their answer to the interviewer who then entered '1' (correct) or '2' (incorrect) into the CAPI. The number and range of words varied in difficulty for children within the different age ranges. For example:

- Children aged 6 to 6 years 11 months would be asked to spell 15 words, eg, 'on'….'work'….'bird';
- Children aged 7 to 8 years 11 months would be asked to spell 20 words, eg, 'was'….'work'….'flight';
- Children aged 9 to 10 years 11 months would be asked to spell 20 words, eg, 'work'….'obtain'….'occasion';
- Children aged 11 to 16 years 11 months would be asked to spell 28 words, eg, 'work'….'obtain'….'occasion'….'hypochondriac'.

Figure 6.11 shows that the scores from the revised assessment had a close resemblance to scores achieved by cohort members in the adult literacy and numeracy assessments, ie, with a long 'tail', rather than a normal 'bell' shape. Essentially, more children attained a good rather than a poor score in the spelling exercise, particularly older children. But the distribution was still adequate to differentiate among the high-and the low-performing children. As the test had been revised, we were not able to convert raw scores into BAS II ability scores and compare with the expected age-equivalent ability scores. As such, Figure 6.12 displays the average rescaled raw scores (range 0 to 100) achieved by children at each age from 6 to 16 years. Unlike the BAS II Word Reading ability scores, the average scores of older children were not so distinctively higher than the average scores of the younger children, possibly because of the slight restriction at the upper end of the performance range.

---

76 Interviewers taking part in Pilot 1b reported that children who performed poorly and had been directed back to easier words seemed uncomfortable about it because of the way the spelling sheet was designed. It was obvious that they were trying easier words as they had to go back to write in boxes higher up the page. Most interviewers also found it very difficult to assess the children's spelling immediately after they had finished writing each word, as children either sat in a way that 'hid' the page on which they were writing or their handwriting was illegible. This made the assessment longer as, to route the CAPI programme correctly, interviewers had to ask the child how they had spelt a word.

Figure 6.11 **Distribution of (rescaled) raw scores for children completing the revised BAS Spelling exercise, by age**

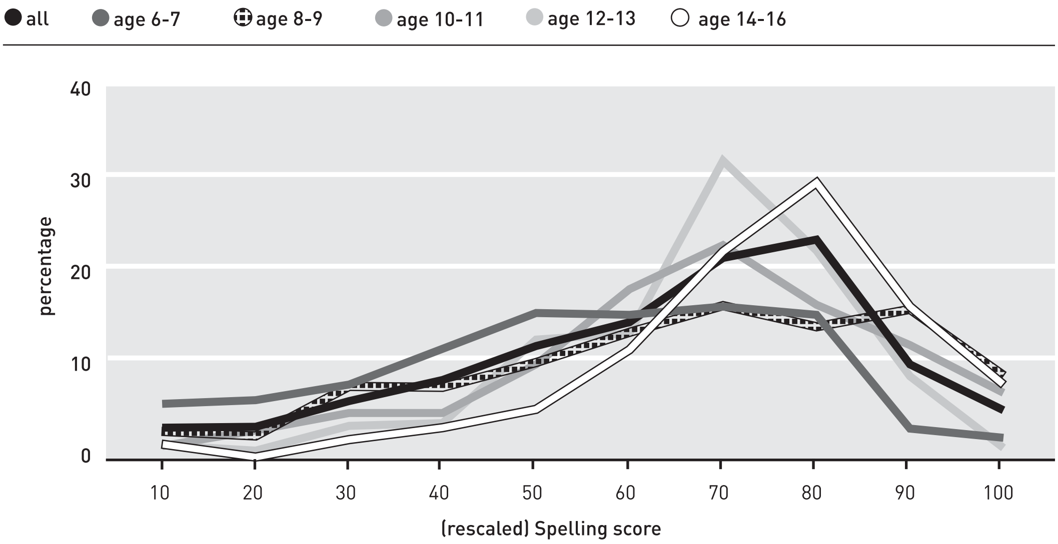
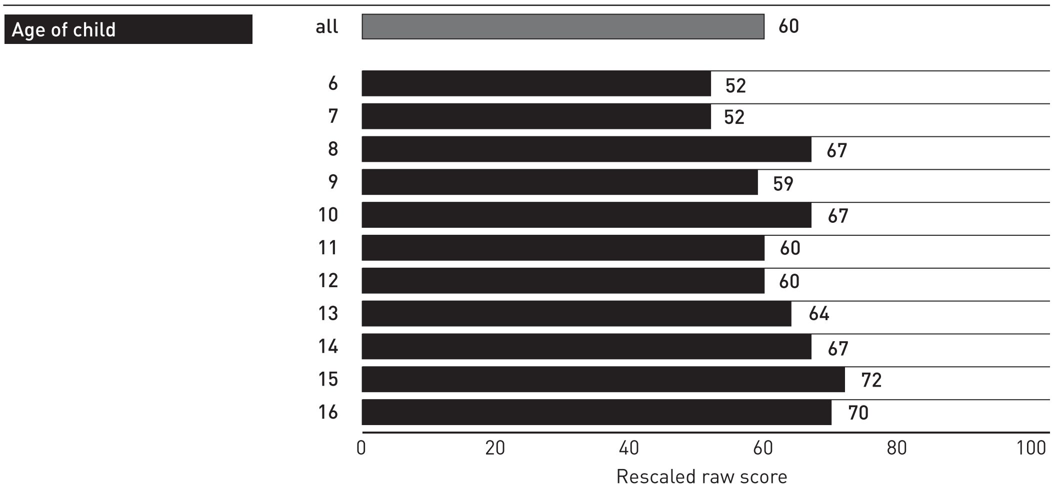


Figure 6.12 **Average (rescaled) raw scores for children completing the revised BAS Spelling exercise, by age**



Number Skills

Rules and administration

In this exercise, the child performed various number-based tasks, such as pointing to numbers presented orally, naming numbers presented visually, and performing written calculations. There were 46 items in total, arranged in six blocks. As with the other scales, the number of blocks a child attempted depended on the child's performance in the previous block. The numerical tasks were presented in the specially designed answer booklet[77]. The CAPI screen showed the question and the correct answer for each question. Interviewers had the option to code the child's answer as '1' (correct) or '2' (incorrect).

77 Feedback from the pilot studies revealed that some children were not familiar with the way some of the sums were written. For example, younger children often learn to do sums in a 'horizontal format', but in the BAS II they were set out in 'vertical format'. Older children had similar problems with the long division sign. Through consultation with education professionals it was established that the curriculum had changed since the latest version of the BAS II had been produced. To make a fair assessment of what the children actually knew, the symbols and layout were changed.

Figure 6.13 provides some examples of the diversity of the BAS II questions from each block. This exercise took the longest of the three exercises to complete, especially for children whose performance was poor.

Figure 6.13: **Examples of diversity of BAS II Number Skills questions from each block**[78]

A

$2 + 3 =$ $4 - 1 =$

B

$2 \times 4 =$

$$\begin{array}{r} 38 \\ +57 \\ \hline \end{array}$$

C

$12 \times 3 =$

$$\begin{array}{r} 45.01 \\ +57.89 \\ \hline \end{array}$$

$96 \div 3 =$

D

Write as a percentage:

$\frac{3}{4} =$ _______ %

$$\begin{array}{r} 77 \\ \times 15 \\ \hline \end{array}$$

$\frac{2}{3} - \frac{1}{3} =$

E

Write as a decimal:

$2\frac{2}{5} =$

Estimate the answer to the following calculation, to the nearest whole number. Do **not** work out the exact sum.

351.892 ÷ 69.871 is approximately

____

$10^3 \div 2^2 =$

F

The price of a chair is £160. If you get a discount of 12 %, how much would you pay?

£ _______________

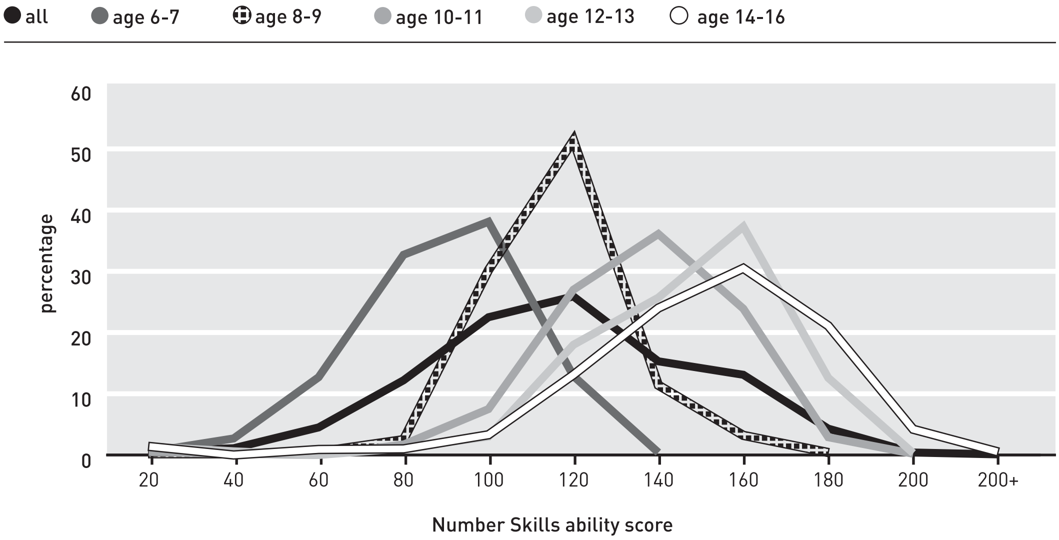
$\frac{1}{2} \times \frac{2}{3} =$

$$\begin{array}{r} 13.9 \\ \times \quad 1.2 \\ \hline \end{array}$$

Figure 6.14 shows the distribution of the scores for each age band for the children of BCS70 cohort members age 6 to 16 years 11 months who completed the Number Skills exercise. As for the Word Reading exercise, the distribution was normal but, unlike the distribution of scores in the Word Reading exercise where the 'tail' of the scores was in the direction of low scores, scores in the Number Skills exercise 'tailed' slightly towards high scores. This reflects the fact that more children, like adults, have difficulties with numbers than they do with reading.

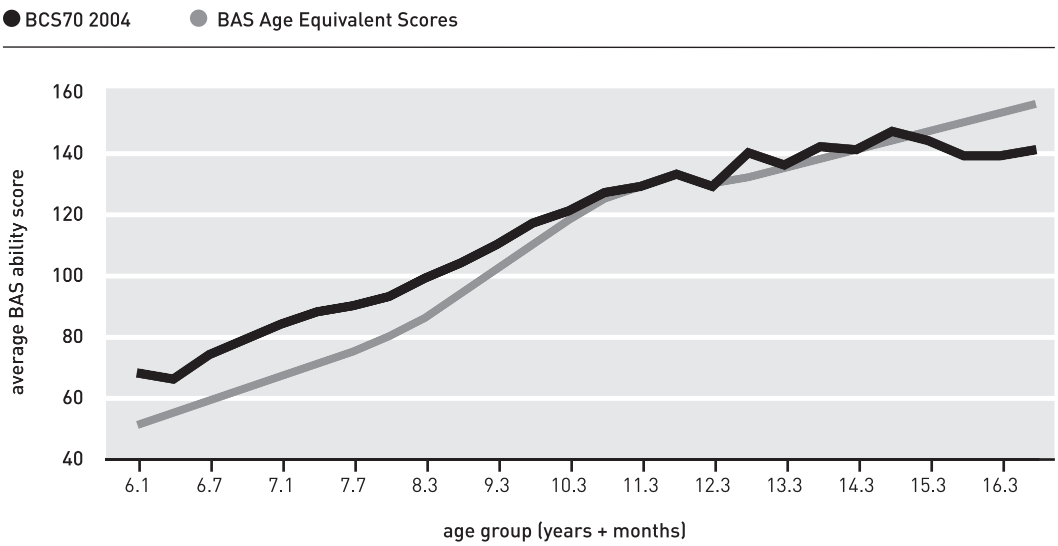
78 © NFER-NELSON. Examples from the BAS II Number Skills exercise were reproduced with the kind permission of NFER-NELSON.

Figure 6.14 **Distribution of ability scores for children completing the BAS Number Skills exercise**



In Figure 6.15 we can see that, once again, the average scores increased with age and, as for the Word Reading scale, differences between average scores achieved by cohort members' children and the BAS II age-equivalents reversed as the children's age increased. The younger children, aged between 6 and 10, had higher scores than the BAS II age-equivalents whereas older children, aged 15 to16 years, had lower scores than the BAS II age-equivalent scores. Children between 11 and 14 years had scores that fell on or around the mid-point of the expected range of the BAS II age-equivalent scores. It is important to remember that older children in our sample are a product of young motherhood, and young mothers are more likely to have less education and associated qualifications. However, the smaller samples of less than n = 200 for the oldest age groups (age 12 and upwards), and only just over 70 for children at age 15 and 16 (see Figure 6.2), also need to be taken into account. This is shown by the observation that the smooth line of average scores becomes increasingly jagged as average scores are calculated from the performance of fewer children. This was not so apparent from the children's performance in the Word Reading scale, perhaps reflecting the greater diversity in an individual's grasp of numbers and mathematics compared to a grasp of reading. However, the overall impression is that cohort members' children aged between 15 and 16 had lower average scores than the BAS II age-equivalents, reflecting the younger than average age at which their (generally less educated) mothers gave birth to them.

Figure 6.15 **Comparing BCS70 cohort members' children's average ability scores in the BAS II Number Skills scale with BAS II age-equivalent ability scores**



Relationship between a parent's grasp of literacy and numeracy and their child's cognitive performance

The next step was to examine the relationship between the children's cognitive performance and that of their parent (the cohort member). Table 6.2 gives the correlation coefficients between cohort members' performance in the literacy and numeracy assessments (multiple-choice and open-response questions) and the performance of their children in the various cognitive assessments, controlling for children's age. We can see that all the correlations, though statistically significant (p<.001), were relatively weak, rarely exceeding 0.2.

Table 6.2 **Correlation coefficients between a cohort member's literacy and numeracy scores and their child's cognitive performance (BAS II ability scores), controlling for age**

	Children age 3 to 5 years 11 months		Children age 6 to 16 years 11 months		
	Naming Vocabulary	Early Number Concepts	Word Reading	(Revised) Spelling	Number Skills
Literacy MC	.19	.18	.25	.20	.22
Literacy OR	.16	.16	.23	.17	.21
Literacy (all)	.20	.19	.28	.22	.24
Numeracy MC	.19	.18	.20	.15	.19
Numeracy OR	.20	.17	.17	.12	.20
Numeracy (all)	.21	.20	.21	.16	.21

The correlations in performance were strongest between cohort members' literacy scores and their children's performance in the Word Reading task, and lowest between cohort members' numeracy scores and their children's performance in the (revised) Spelling exercise.

The fact that children's performance correlated relatively weakly with their parents' performance suggest that there is much scope for teaching interventions to enhance children's development in these areas. While it is perhaps an encouraging sign that a child's performance is not highly correlated with their parent's performance, other important measures like age of mother at birth and gender of child need to be taken into account before firm conclusions can be drawn about the connection with parents' literacy and numeracy. None the less, there is much scope for development for those involved with these children's education.

However, the modest correlations do provide some evidence of a relationship between poor adult literacy and numeracy performance and poor child test performance. To help establish a clearer understanding of this relationship, we examined the average ability scores achieved by children in different age bands compared across parents' literacy and numeracy levels, as obtained from the multiple-choice assessments: Entry Level 2 (or lower), Entry Level 3, Level 1 and Level 2 (or higher). Tables 6.3a to 6.3d show that children of parents with Entry Level 2 (or lower) literacy or numeracy had substantially the lowest average ability scores in all the cognitive assessments. Differences in children's performance (as indicated by the average scores) by parents' own literacy and numeracy levels were most marked for parents' assessed literacy level. Analysis of Variance (ANOVA) shows that the differences between the average scores of the children across the parents' performance levels were in almost all cases statistically significant[79]. The exceptions were for the performance of children aged 5 in the Early Number Concepts assessment by their parents' literacy or numeracy, and all three assessment scores achieved by the very oldest children, age 14 to 16, and their parents' numeracy. T-tests confirmed that it was the average scores attained by children of parents with Entry Level 2 skills that differed significantly from those achieved by children of parents with skills at higher levels, especially Level 2 (and sometimes Level 1) skills. These results were also achieved, albeit less consistently, between average scores achieved by children of parents with Entry Level 3 skills.

Table 6.3a **Average scores by children age 3 to 5 years 11 months in child cognitive assessments, by cohort members' literacy**

	Naming Vocabulary				Early Number Concepts			
Literacy	**All**	**age 3**	**age 4**	**age 5**	**All**	**age 3**	**age 4**	**age 5**
Entry Level 2	**85**	**69**	**87**	**104**	**112**	**82**	**116**	142
Entry Level 3	**91**	**72**	96	**107**	**114**	**81**	123	142
Level 1	98	82	98	112	124	100	124	145
Level 2	101	88	103	114	125	105	129	145
Overall	99	85	101	113	124	102	126	145
F-value	11.40[1]	8.68[1]	6.10[1]	3.74[2]	5.62[1]	9.56[1]	3.66[2]	0.33
n(100%)	***1,242***	***443***	***377***	***422***	***1,227***	***434***	***372***	***421***

Significance: 1p<.001, 2p<.01, 3p<.05, 4p<.1
Numbers in bold indicate a significant difference in average scores between i) EL2 and L2 and/or L1 groups ii) EL3 and L2 and/or L1 groups were achieved with t-test analysis.

79 Analysis of Variance (ANOVA) supplies a test of statistical significance of variation across a set of mean values. The statistic F is calculated, which is the ratio of the between group variance (for which the means are calculated) which is then compared with the expected value of 1 at given probability levels, p< .05 etc. T-tests are subsequently used to establish the pairs of groups where the statistically significant differences lie.

Table 6.3b **Average scores by children age 3 to 5 years 11 months in child cognitive assessments, by cohort members' numeracy**

	Naming Vocabulary				Early Number Concepts			
Numeracy	**All**	**age 3**	**age 4**	**age 5**	**All**	**age 3**	**age 4**	**age 5**
Entry Level 2	**94**	**79**	**96**	**108**	**117**	**92**	**120**	142
Entry Level 3	99	85	**97**	**113**	124	**100**	**124**	145
Level 1	100	85	103	112	125	103	127	145
Level 2	102	89	103	116	127	109	130	146
Overall	99	85	101	113	124	102	126	145
F-value	6.31^{1}	3.04^{3}	3.55^{3}	6.43^{1}	6.02^{1}	8.18^{1}	4.14^{2}	0.93
n(100%)	*1,242*	*443*	*377*	*422*	*1,227*	*434*	*372*	*421*

Significance: 1p<.001, 2p<.01, 3p<.05, 4p<.
Numbers in bold indicate that significant differences in average scores were achieved between i) EL2 and L2 and/or L1 groups ii) EL3 and L2 and/or L1 groups.

Table 6.3c **Average scores by children age 6 to 16 years 11 months in child cognitive assessments, by cohort members' literacy**

						BAS II Word Reading scale
Literacy	**All**	**age 6-7**	**age8-9**	**age 10-11**	**age 12-13**	**age14-16**
Entry Level 2	**122**	**77**	**115**	**137**	**145**	**157**
Entry Level 3	**126**	**94**	**121**	**136**	**141**	**160**
Level 1	133	100	133	150	164	169
Level 2	136	104	139	156	166	179
Overall	133	101	134	152	162	171
F-value	7.40^{1}	9.32^{1}	10.83^{1}	7.89^{1}	12.66^{1}	4.52^{2}
n(100%)	*2,235*	*755*	*561*	*411*	*296*	*212*

						BAS II (revised) Spelling scale
Literacy	**All**	**age 6-7**	**age8-9**	**age 10-11**	**age 12-13**	**age14-16**
Entry Level 2	**50**	**34**	**50**	**56**	**51**	**65**
Entry Level 3	**54**	50	**56**	**51**	**55**	**61**
Level 1	59	50	63	63	64	68
Level 2	62	55	65	67	64	73
Overall	63	52	63	64	62	69
F-value	17.21^{1}	9.93^{1}	5.07^{2}	6.05^{1}	6.93^{1}	4.10^{2}
n(100%)	*2,235*	*755*	*561*	*411*	*296*	*212*

						BAS II Number Skills scale
Literacy	**All**	**age 6-7**	**age8-9**	**age 10-11**	**age 12-13**	**age14-16**
Entry Level 2	**100**	**62**	**96**	**112**	**121**	**131**
Entry Level 3	107	79	106	**112**	**120**	**132**
Level 1	107	78	103	123	139	136
Level 2	108	81	108	129	137	147
Overall	108	79	105	125	135	140
F-value	2.52^{4}	9.74^{1}	6.57^{1}	8.59^{1}	6.13^{1}	3.16^{3}
n(100%)	*2,228*	*755*	*558*	*410*	*294*	*211*

Significance: 1p<.001, 2p<.01, 3p<.05, 4p<.1
Numbers in bold indicate a significant difference in average scores were achieved with t-test analysis between i) EL2 and L2 and/or L1 groups ii) EL3 and L2 and/or L1 groups.

Table 6.3d **Average scores by children age 6 to 16 years 11 months in child cognitive assessments, by cohort members' numeracy**

						BAS II Word Reading scale
Numeracy	**All**	**age 6–7**	**age 8–9**	**age 10–11**	**age 12–13**	**age 14–16**
Entry Level 2	**130**	**92**	**125**	**145**	**152**	170
Entry Level 3	133	**98**	**131**	**152**	166	167
Level 1	134	102	138	150	161	177
Level 2	136	109	141	160	171	177
Overall	133	101	134	152	162	171
F-value	2.62[3]	9.55[1]	7.97[1]	6.06[1]	6.89[1]	1.52
n(100%)	*2,235*	*755*	*561*	*411*	*296*	*212*

						BAS II (revised) Spelling scale
Numeracy	**All**	**age 6–7**	**age 8–9**	**age 10–11**	**age 12–13**	**age 14–16**
Entry Level 2	**56**	**47**	**56**	**60**	**57**	68
Entry Level 3	**59**	**51**	**61**	**63**	66	**67**
Level 1	61	52	67	64	61	72
Level 2	64	57	66	69	66	75
Overall	60	52	63	64	62	69
F-value	9.88[1]	6.24[1]	5.77[1]	2.94[3]	5.03[2]	2.06
n(100%)	*2,235*	*755*	*561*	*411*	*296*	*212*

						BAS II Number Skills scale
Numeracy	**All**	**age 6–7**	**age 8–9**	**age 10–11**	**age 12–13**	**age 14–16**
Entry Level 2	105	**74**	**100**	**118**	**127**	139
Entry Level 3	108	**78**	**105**	**124**	**136**	139
Level 1	107	80	107	127	135	140
Level 2	109	83	109	133	151	148
Overall	107	79	105	125	135	140
F-value	0.97	5.77[1]	5.59[1]	7.61[1]	6.93[1]	0.63
n(100%)	*2,228*	*755*	*558*	*410*	*294*	*211*

Significance: 1p<.001, 2p<.01, 3p<.05, 4p<.1
Numbers in bold indicate a significant difference in average scores were achieved with t-test analysis between i) EL2 and L2 and/or L1 groups ii) EL3 and L2 and/or L1 groups.

Which has the stronger relationship with a child's cognitive performance: a parent's grasp of literacy and numeracy, or their general education?

In an attempt to isolate the impact of a parent's grasp of literacy and numeracy on a child's cognitive development from the impact of a parent's general level of education and associated qualifications, we again used simple logistic regression analysis. As average ability scores increase with a child's age, we collapsed the full range of scores for each assessment by children in each one-year age-band (ie, all children age 6, all children age 7, etc up to all children age 16) into two groups: the bottom 20 per cent (poor performers) and 'all other scores'. Having a child with performance in the bottom 20 per cent was predicted first by parents' grasp of literacy and numeracy as indicated by their performance in the MC assessment: Entry Level 2, Entry Level 3, Level 1 and Level 2. Secondly, the prediction model was estimated for the four literacy and numeracy groups plus the highest qualification that the cohort member had achieved. This measure was collapsed into five groups: no qualifications, NQF level 1 (equivalent) qualifications, NQF level 2 (equivalent) qualifications, NQF level 3 (equivalent) qualifications, NQF level 4 and higher (equivalent) qualifications.

As before, the logistic regression analysis used here involved the estimation of a binary outcome variable (eg, 'bottom 20 per cent of scores'/'all other scores') from the predictor variables. The results are reported as relative odds or odds ratios (OR) for each category of each predictor variable, compared with the odds ratio for a reference category signifying absence of the attribute that the variable is measuring, which in this analysis is by definition '1'. Odds ratios greater than 1 signify a positive relationship between category membership and the outcome and odds ratios less than 1 signify a negative relationship. Thus for the prediction of a child having an assessment score in the bottom 20 per cent of scores from the four-category literacy and numeracy variables, with the reference category defined as Level 2, we might expect the category 'Entry Level 2' to have an odds ratio substantially higher than 1. In our example here, if an odds ratio of 2.5 for being in the bottom 20 per cent of scores was found for children of parents with Entry Level 2 literacy, it would mean that their relative chance of being at risk of this status was two-and-a-half times that of a child whose parent had Level 2 literacy skills. To assess the statistical significance of the difference between a given odds ratio and 1, three levels of statistical significance are reported: $p<.001$, $p<.01$, $p<.05$[80].

The results in Tables 6.4a and 6.4b provide important confirmation of the earlier picture. At Entry Level 2 or Entry Level 3, parents' poor grasp of literacy and numeracy was strongly predictive of the cognitive development of their children even when their highest level of qualification was taken into account. Surprisingly, the highest qualification held by parents had a very weak relationship with the cognitive performance of their children. Statistical significance was occasionally associated with a difference in risk of performing in the bottom 20 per cent for children of parents with Level 1 skills, but the actual size of the increased risk was slight. The most important results are detailed below and highlighted in bold in Tables 6.4a and 6.4b.

For younger children (3 to 5 years 11 months):

- Children of parents with Entry Level 2 literacy had more than three-and-a-half times the relative risk of performing poorly in the Naming Vocabulary assessment as children of parents with Level 2 literacy.
- Children of cohort members with Entry Level 2 numeracy had more than twice the relative risk as children of parents with Level 2 numeracy to be in the bottom 20 per cent in the Early Number Concepts assessment.
- Children of parents with Entry Level 3 literacy had around twice the level of relative risk of performing poorly in the Naming Vocabulary and Early Number Concepts assessments as children of parents with Level 2 literacy.

For school age children (6 to 16 years 11 months):

- Children of parents with Entry Level 2 literacy had more than two-and-a-half times the relative risk of children of parents with Level 2 literacy of performing poorly in the Reading assessment and more than 1.7 times the relative risk of falling in the bottom 20 per cent in the Spelling and Number Skills assessments.

80 The p-value of $p<.01$ indicates the observed relationship would occur by chance in less than 1 per cent of cases; a p-value of $p<.05$ indicates the observed relationship would occur by chance in less than 5 per cent of cases.

- Children of parents with Entry Level 3 literacy had a relative risk of around twice that of children of parents with Level 2 literacy of performing poorly in the Word Reading assessments.
- Children of parents with Entry Level 2 numeracy had twice the relative risk of performing poorly in the Number Skills assessment and more than 1.7 times the relative risk of performing poorly in the Reading and Spelling assessments, in comparison with children of parents with Level 2 numeracy.

Table 6.4a **Predicting cognitive performance of children age 3 to 5 years 11 months by their parents' qualifications and grasp of literacy and numeracy; bottom 20 per cent of performers at each age**

Early Years assessments	Literacy				Numeracy				Highest qualification				
	EL2	EL3	L1	L2	EL2	EL3	L1	L2	none	NQF1	NQF2	NQF3	NQF4+
1) ENC	1.38	**2.15**	1.23	1.00	**2.48**[1]	1.24	1.19	1.00					
2) ENC	1.27	**1.95**[3]	1.16	1.00	**2.21**[3]	1.10	1.14	1.00	1.58	**1.69**[3]	1.46[4]	1.37	1.00
1) NV	**3.63**[1]	**2.11**[3]	1.32[4]	1.00	1.55[4]	1.39	1.16	1.00					
2) NV	**3.54**[1]	1.92[4]	1.25	1.00	1.35	1.24	1.10	1.00	1.15	1.57[4]	1.44[4]	0.95	1.00
N(100%)	*39*	*44*	*394*	*747*	*179*	*314*	*401*	*330*	*79*	*216*	*439*	*213*	*277*

Key: 1p<.001, 2p<.01, 3p<.05, 4p<.1; ENC = Early Number Concepts, NV = Naming Vocabulary; NQF = National Qualification Framework levels where NQF4 = higher education qualification

Table 6.4b **Predicting cognitive performance of children age 6 to 16 years 11 months by their parents' qualifications and grasp of literacy and numeracy; bottom 20 per cent of performers at each age**

School Years assessments	Literacy				Numeracy				Highest qualification				
	EL2	EL3	L1	L2	EL2	EL3	L1	L2	none	NQF1	NQF2	NQF3	NQF4+
1) Spell	**1.90**[2]	1.32	1.09	1.00	**1.97**[1]	**1.49**[2]	1.37[4]	1.00					
2) Spell	**1.71**[3]	1.24	1.06	1.00	**1.82**[1]	1.38[4]	1.30	1.00	**1.87**[2]	1.33	1.45[4]	1.35	1.00
1) Read	**2.99**[1]	**2.13**[1]	1.30[3]	1.00	**1.91**[1]	**1.49**[3]	1.24	1.00					
2) Read	**2.55**[1]	**1.95**[1]	1.24[4]	1.00	**1.71**[2]	1.34[4]	1.18	1.00	**1.77**[3]	1.30	1.22	0.91	1.00
1) Num	**1.80**[2]	1.46[4]	1.08	1.00	**2.03**[1]	1.38[3]	1.36[3]	1.00					
2) Num	**1.77**[2]	1.47[4]	1.08	1.00	**2.04**[1]	1.39[3]	1.38[3]	1.00	0.95	0.95	0.86	0.90	1.00
N(100%)	*130*	*136*	*763*	*1204*	*440*	*669*	*681*	*443*	*287*	*472*	*903*	*307*	*264*

Key: 1p<.001, 2p<.01, 3p<.05, 4p<.1; Spell = Spelling, Read = Word Reading, Num = Number Skills; NQF = National Qualification Framework levels where NQF4 = higher education qualification

Conclusions

The preliminary results presented in this chapter point to the considerable research potential of the intergenerational data collected in the survey. Through careful selection and field testing of subtests from the BAS II, a set of measures is available that appears to tap very well into the key dimensions of literacy and numeracy development in children. The survey demonstrates that the performance data for these tests collected from cohort members' children stands up very well against the national standards established for the BAS II.

The validity of the tests is further assured by the notable relative reduction in the scores obtained by the older children compared with national BAS II norms and the relative increase in the scores at the younger ages. This reflects the fact that cohort members at age 34 with older children will tend to have had them at relatively young ages, reflecting a typically lower level of education. In contrast, many of the parents of the younger children are likely to have postponed child-bearing in favour of staying in education to gain qualifications and establish a career. As the cohort members get older and complete their family formation, it is very likely that their children's scores and the BAS II national norms would coincide.

Preliminary examination of the relationship between parents' literacy and numeracy scores and their children's BAS II scores showed weaker correlations, and therefore less intergenerational continuity, than might have been expected. The highest was for parents' literacy and the older children's Word Reading. However, closer investigation revealed a sharp cut-off between parents at Entry Level 2 literacy or numeracy, and to a lesser extent Entry Level 3 literacy, and higher levels. Children in families with parents at the very lowest literacy and numeracy levels appeared to be at a substantial disadvantage in relation to their own reading and maths development relative to those with parents at higher levels. To determine whether this relationship held when parents' general educational level was taken into account, logistic regression was used to set their literacy and numeracy against the highest qualification they had obtained. Somewhat against expectation, the relationship between literacy and numeracy and children's cognitive achievement was barely affected when the highest qualification variable was introduced into the analysis. Though much more penetrating analysis will be needed to understand fully the nature of the intergenerational transfers involved, the results point to parents' literacy and numeracy as key components of parental influence on children's educational achievements. The intergenerational relationship between the performance of children and parents at Entry Level 2 literacy or numeracy, and to a lesser extent Entry Level 3 literacy, was clear to see.

Overall, the results offer immediate messages for policy-makers in pointing to the importance of parents' literacy and numeracy in the educational progress of their children. They also give many pointers to the research agenda that is needed to refine the picture further. There is much scope, for example, for investigating in much greater depth the differential effects of parents' literacy, as opposed to numeracy, on children's skills acquisition.

Chapter 7
Summary and conclusions

This first report on the findings for the literacy and numeracy assessments in the age 34 follow-up of the 1970 British Cohort Study (BCS) should be viewed as an introduction to the research possibilities that this exceptionally rich dataset contains. Its companion volume is the earlier report which set out in detail the development of and field testing of each of the assessment instruments employed[81]. We have demonstrated the properties of the assessment variables and shown, mainly descriptively, their relationships with other key variables. This has included some limited longitudinal analysis to pinpoint some possible consequences of changes in literacy and numeracy between the age 21 (10 per cent sample) and age 34 surveys. The report has also explored features of intergenerational continuities and discontinuities through the test data collected for half the children of all cohort members.

The core of the new 2004 dataset is the specially developed adult literacy and numeracy tests, which both capitalise on the development of new national baseline literacy and numeracy assessment instruments and also draw on tests used earlier in the life of the cohort.

The new adult tests, comprising a selection of items at different levels in multiple-choice format, enable the BCS70 results to be mapped onto national standards. The major innovation in the report has been the presentation of results in terms of the same levels as the *Skills for Life* Survey (2003). These match national standards as specified in the *Skills for Life* strategy documents and are therefore organised in a way which is of most direct value to policy.

By also incorporating in the tests literacy and numeracy test items used in the age 21 10 per cent sample survey, we have the opportunity for longitudinal investigation of changes in literacy and numeracy that are of great importance to policy, though this study is of course restricted to the cohort members in the 10 per cent who took part in the earlier survey who also took part in the new one.

Two important extensions to the research are the dyslexia measures used for the first time in the cohort studies during adulthood. One of the attractive features is the decision taken when the 1970 cohort was aged 10 to include an assessment of dyslexia using exercises from the Bangor Dyslexia Test. This gives an unparalleled opportunity to trace the continuities and discontinuities in this condition and what might mitigate the learning difficulties involved. In this report the inclusion of exercises from the Dyslexia Adult Screening Test (DAST) also offered the opportunity for a preliminary examination of the relationship of dyslexia risk to functioning in adult life and to demonstrate the extent of its independence from general literacy and numeracy difficulties as identified through the other tests.

Another enhancement of the BCS70 resource was the inclusion of measurement of the cohort members' children cognitive development, replicating the comparable study of cohort members' children in the NCDS 1958 cohort at age 33 in 1991. One third of NCDS cohort members and their children were included in the sub-study in 1991. In recognition of the

81 Parsons, S. and Bynner, J. (2005) *Measuring Basic Skills for Longitudinal Study: The design and development of instruments for use with cohort members in the age 34 follow-up in the 1970 British Cohort Study (BCS70).* London: National Research and Development Centre for Adult Literacy and Numeracy.

delayed child-bearing and consequently smaller families of the 34-year-olds in BCS70, half the cohort members and their children were included in the sub-study. The tests used covered similar ground to those used to assess the parents' literacy and numeracy, but this time were selected from the British Ability Scales II (BAS II) battery and focused more specifically on literacy and numeracy acquisition than on general cognitive development. The BAS II has the advantage of being widely used in Britain as well as fully covering the age range of cohort members' children.

The findings reported relate both to methodology and to substance. It was important to establish the reliability and validity of the different instruments employed so some attention has been given to analysis that bears on that. The main conclusion was that the extensive development period for the study paid off. Without exception, the instruments for adults and for the children worked well, showing all the properties required of them. Thus acceptable levels of reliability (upwards of 0.8) were achieved for the multiple-choice (MC) test and, although the open-response (OR) test, because of its shorter length, did not reach this level, the reliabilities around 0.6 are perfectly acceptable for purposes of survey analysis.

The main evidence on test validity came from the benchmarking of the BCS70 (MC items), the age 21 literacy and numeracy tests (OR items), and the BAS II tests. This was done by comparing different features of the distributions of the various tests (much more detail is supplied in the assessment design report referred to on page 101). Without exception, strong matches were obtained and, where there were differences, these were fully explicable in terms of the distinctive features of the BCS70 sample. The test score distributions between Wales, England and Scotland that show the poorer performance of the Welsh cohort members (which maps in with other national comparisons) merit further investigation.

In relation to the findings in this report, the distributions of key socio-demographic variables were compared with those in the original (1970) birth sample and the age 30 (2000) sample. They were remarkably close. The only notable difference was a slight bias towards the more educated and away from such labour market experiences as unemployment. For a report of this kind, such biases actually have an advantage, because they suggest that the quite striking findings about the penalties attached to poor literacy and numeracy are on the conservative side.

Policy messages

The findings from these preliminary analyses convey some potent messages for *Skills for Life* policy and throw up numerous questions for further research.

Acknowledging difficulties

In every cohort study survey since the NCDS 1958 and the BCS1970 cohorts reached adulthood, starting with the 1981 age 23 NCDS survey, the prevalence of self-reported literacy, numeracy and writing problems has remained remarkably constant, barely exceeding 5 per cent and, if anything, reducing slightly. For the current survey a different approach was adopted from that used previously, by asking all cohort members about a range of specific difficulties in different situations from reading to a child to filling in a complex form. The previous approach had involved starting with a catch-all (filter) question asking whether the respondent had any difficulties in a given general area like reading and then, if any difficulties were reported, probing what the difficulties were. The new approach raised the prevalences somewhat, especially for spelling, but there was still a marked gap between the self-reported figures and what the objective tests revealed. This was particularly evident for numeracy, where possibly up to four times as many people were shown to have poor skills as those who acknowledged difficulties.

It seems likely that most adults with poor skills have learned how to cope, drawing on local family and community resources to deal with literacy and numeracy challenges that they could not handle themselves. This means that, unless something happens to disrupt the normal course of their lives leading to a reappraisal, such as having a child or facing unemployment, they are not going to have much incentive to take advantage of educational provision to improve their skills. From the policy angle, it is particularly notable that those who acknowledged skills problems were far more likely to express the desire to improve their skills than those who did not whereas, among those who were classified objectively, the relationship between having a problem and wanting to improve was very much weaker. This argues that a major challenge for policy is to find the means of raising awareness of the skills problem and the need for improvement. Without such awareness, the take-up of courses among those who need them most, and meeting *Skills for Life* targets, will remain difficult, if not impossible, to achieve.

The research agenda that follows from this is to use the cohort study data to unpack in much more detail the antecedents in terms of life history and the consequences for the acknowledgement of skill problems, the desire to improve skills, and participation in courses. More action-orientated work is also required to test out different approaches to the awareness problem, how best to shape educational provision, and how to promote it most effectively to the target group

The challenge of Entry Level 2

The multiple-choice part of the assessment located cohort members at four levels of the national framework: Entry Level 2 or below, Entry Level 3, Level 1, and Level 2 or above. Entry Level 1 had too few people located in it to make it worth retaining as a separate category. The test for literacy revealed 4 per cent at Entry Level 2 and 4 per cent at Entry Level 3; the numeracy test revealed 15 per cent at Entry Level 2 and 25 per cent at Entry Level 3. As explained on page 16, these percentages are likely to underestimate the prevalence of poor skills in the total population, because of the slight biases towards the better educated in the BCS70 sample.

As we might expect from earlier studies, the different levels were strongly correlated with socio-economic and other personal attributes, with major economic disadvantage, poor psychological well-being, and lack of civic participation, all concentrated at the lowest levels. But particularly notable was the marked gap in some of these features of disadvantage between respondents at Entry Level 2 or below and those at higher levels. This was particularly evident for literacy but also applied in some cases to the much larger group with Entry Level 2 numeracy. It would seem that the likelihood of social exclusion, as government defines it, is particularly high in this group.

This makes the case both for a major focus of attention on the Entry Level 2 group, which not only involves encouraging participation in courses but also acknowledges, as these findings reveal, the highly disadvantaged contexts in which many of the targeted adults live.

The research agenda following from this operates on both qualitative and quantitative fronts.

The qualitative work will need to be pursued through case study of cohort members identified as being at Entry Level 2 (by the quantitative analysis) in different contexts. The further quantitative work will focus on modelling the role of literacy and numeracy problems in the life-courses of those whose age 34 outcome statuses exhibit the various attributes identified with social exclusion. A further extension will be to use the new literacy and numeracy data, and the data collected earlier in the cohort members' lives, to forecast the likely impact of *Skills for Life* and the literacy and numeracy strategy in schools.

Continuities and discontinuities

Capitalising on the collection of literacy and numeracy performance data at age 21 in which open-response (OR) measures were used and carried through into the age 34 survey, we were able to construct a fourfold typology in which 'improvers' and 'deteriorators' could be set against those with 'no change' in their level of skill. Substantial relationships were evident between movement, socio-economic statuses, and other personal attributes at age 34. For men, these were stronger and more widespread for improvement of skills than for deterioration of skills but, for women, differences in personal outcomes were stronger and more widespread for improvement of numeracy skills than for deterioration in literacy skills.

Clearly there are difficulties in separating cause and effect in these simple (bivariate) relationships. There is no way of being certain whether the socio-economic change of, for example, getting a job produced the literacy and numeracy improvement or whether the literacy and numeracy improvement enhanced the chances of getting a job. Probably both are happening, with the changes mutually reinforcing each other. The important point is that there are clear indications of virtuous (and vicious) circles in process, in which literacy or numeracy enhancement (or loss) play a crucial part. For policy therefore the message is clear: understanding the socio-economic and relational context in which learners are located, and how it is changing, is crucial to understanding how best to meet their learning needs.

Future analysis will involve using the full range of longitudinal information – including learning experience and the full occupational and partnership and family formation histories going back to age 16 – to tease out the main direction and strength of effects. In addition, qualitative case study needs to be undertaken of cohort members in the 'mover' groups to illuminate further the role of literacy and numeracy in the accompanying life changes.

Is dyslexia an added problem?

The use of the Dyslexia Adult Screening Test (DAST) with all cohort members in the survey enabled us to illuminate both the role of this complex syndrome of difficulties with processing the written and spoken word by calculating the Adult Risk Quotient (ARQ) and also to highlight the more specific kind of learning difficulty that the different DAST subtests identify. The test data mapped very well onto national figures for the prevalence of dyslexia as a diagnosed condition and reasonably well onto the published norms for the DAST.

A fairly strong relationship between the ARQ and the multiple-choice literacy and numeracy scores was apparent, with a massive concentration of dyslexia risk at Entry Level 2. In the case of numeracy, there was a more steady gradient with the risk going up as skill level decreased. But, notably, by far the highest concentration of dyslexia risk was among women at Entry Level 2 numeracy. In some ways even more striking were the substantial minorities at Level 2 literacy and numeracy and above who also showed symptoms of dyslexia as revealed by the ARQ. In other words, dyslexia may be strongly identified with poor literacy and numeracy, but many adults showing the condition are apparently able to overcome their difficulties and gain the skills they need for high achievement.

This phenomenon was confirmed to a certain extent by the exploratory logistic regression analysis which showed that, when the literacy and numeracy levels (as determined by the multiple choice tests) were taken into account, the strength of the relationships between the ARQ and a range of socio-economic and personal outcomes was much reduced. But in three areas – gaining qualifications, using computers at work, and social and political engagement – the relationship was sustained at a statistically significant level. This points to a degree of independence of dyslexia from poor literacy and numeracy skills as measured by the multiple-choice test.

The significance of these results is that they point to a separate learning difficulties component in literacy and numeracy test performance that needs to be taken into account in the design of educational provision and the pedagogical approaches to learners at every level. This is particularly necessary for those at Entry Level 2 or below. This group contains the highest proportion 'at risk' of dyslexia and consequently of learning difficulties of the kind identified with dyslexia. Tutors need to be aware that such difficulties may lie behind a learner's poor acquisition of literacy and numeracy skills, rather than the more recognisable social and sometimes health factors that typically lead to falling behind at school. There is a case for routine screening for dyslexia, using tests such as DAST, when preparing adult learners for literacy and numeracy courses. At the very least, use could be made of the 20 simple 'yes-no' self-report questions that make up the Vinegrad Dyslexia Checklist[82].

The research programme that follows from this is threefold.

- First, to capitalise on the earlier dyslexia measures taken at age 10 in BCS70, a programme of longitudinal analysis is needed to investigate the continuities and discontinuities in dyslexia risk over the age period 10 to 34 and to model the influences that affect it.
- The second line of research would attempt to unpack, both quantitatively and qualitatively, the life histories of dyslexic individuals with a particular focus on how those who were successful in adult life overcame their difficulties.
- The third strand of research would investigate the somewhat puzzling finding of high levels of dyslexia risk among those, especially women, at the lowest numeracy levels. Although this phenomenon has been identified before[83], it demands much better understanding. This is not least because involvement of dyslexia in poor performance indicates learning difficulties that are typically identified with reading also having a potentially damaging effect on the acquisition of the skills involved in the apparently quite different sphere of adult numeracy.

Intergenerational transfers

The child assessment data were shown to be valid and reliable in matching the requirements of BAS II. The data therefore supply a good basis for investigating intergenerational transmission of literacy and numeracy skills. This was pursued initially by computing the correlations of the parents' literacy and numeracy scores with the BAS II scores of their children, controlling for the age of the children. The relatively low levels of correlation, all below 0.3, are in one sense encouraging, because they point to much fluidity in children's cognitive development, which teachers are therefore in a strong position to influence.

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82 Vinegrad, M. (1994) 'A Revised Adult Dyslexia Checklist'. *Educare, No*. 48, pp. 21–23.
83 Miles, T. R., Haslum, M. N. and Wheeler, T. J. (2001). 'The Mathematical Abilities of Dyslexic 10-Year-Olds'. *Annals of Dyslexia*, 51, 299–321.

Correlations relate sample variability in two variables across the whole range of the scale of each and can mask effects that are restricted to certain parts of the scale. This was strongly evident when the children's mean BAS II scores were compared using Analysis of Variance (ANOVA) across the different (adult) literacy and numeracy levels. There was substantial discontinuity between Entry Level 2 (and occasionally Entry Level 3) and higher levels of adult skill. There were signs that children in families with parents at Entry Level 2 literacy and Entry Level 2 numeracy were quite seriously disadvantaged and likely to fall behind their peers.

The policy implications of this finding come in the form of strong endorsement for government initiatives with young children and parents such as Sure Start and the various provisions advocated in Every Child Matters, such as Family Learning, and for maintaining strong literacy and numeracy provision throughout the school career. An added point from our findings is the significance of poor parental literacy and numeracy as a key component of the problem faced by many of the targeted children. This makes the case for adult education to enhance the literacy and numeracy skills of those lacking them as being critical to the success of these initiatives.

Another line of research will be to uncover the mediating factors in skill transmission from parents to children, where it exists. We demonstrated that parents' general educational level, as measured by highest qualification, had little effect on the relationship. In the next stage of the analysis it will be possible to bring many more factors into the picture, including pre-school activities and parents' interest in, and engagement with, their children's education when they enter school, not to mention their own participation in adult learning.

In general

The preliminary research reported here has demonstrated effectively the great potential of the new BCS70 data for the investigation of the consequences of poor literacy and numeracy acquisition in adulthood, and the transmission of literacy and numeracy skills across the generations. The main message from the work completed so far is the central significance of Entry Level performance in limiting, for a substantial minority of people, full participation in mainstream adult life. This applies not only to their own disadvantaged statuses in adulthood, but in the extent to which their difficulties are passed on to their children. Clearly the major policy and research challenge is to find the means of motivating these adults to enhance their skills and to develop curricula that will best match their needs, thereby helping to turn their life chances round.

Appendix 1
Handwriting

Collecting samples of handwriting has a long history in cohort study research. In 1969, when NCDS cohort members were age 11, they were given 30 minutes to write a short essay on 'Imagine that you are now 25 years old. Write about the life you are leading, your interests, your home life and your work at the age of 25'. In 1980, when BCS70 cohort members were age 10, they each copied out the sentence 'The quick brown fox jumps over the lazy dog'. As adults, a sample of handwriting was collected from the 10 per cent of cohort members who took part in the literacy and numeracy assessments. In 1991, when age 21, BCS70 cohort members were asked to write down how they had found the skills assessment. In 1995, when age 37, NCDS cohort members were asked to complete a job application form as part of the literacy assessment.

As all BCS70 cohort members taking part in 2004 attempted the multiple-choice and open-response literacy assessment questions, it was essential to collect a sample of handwriting to complete the picture of their literacy. Cohort members in the main fieldwork were asked to write a couple of sentences on what they had liked or disliked about being a part of BCS70 over the previous 34 years. A sample of handwriting was obtained, revealing competence in spelling, grammar and punctuation, together with layout and presentation of writing. Methods of coding such writing data in terms of these dimensions have been developed in the previous surveys and will be applied to the new data. This will supply data for comparison not only from childhood to adulthood but, in the case of the sub-sample studies, in adulthood as well.

Importantly, the writing task will also enable us to gain from cohort members' insights into what it has been like to be part of a national longitudinal survey from the day they were born, including any thoughts they have about the assessment elements of it. Analysis of cohort members' positive and negative experiences of being part of BCS70 is also an important source of information for the development of the cohort studies programme in its own right. A couple of examples are given in Figure App1.1.

Figure App1.1: **Examples of cohort members' handwriting**

Thank-you for taking part in this latest stage of the study. Your contributions over the years have proved invaluable to researchers and policy makers the world over. **But what is it like for you to take part?**

Please write a few sentences in the space below about what you have liked and disliked most about being part of BCS70 over the years.

I feel we would be encouraged more with an incentive ie not just the odd birthday card!! Possibly a card with some vouchers in it please.

I understand the importance of the study, and am more than willing to continue in the future.

Appendix 2
Open-response literacy and numeracy assessments

Table App2.1 **Outcomes at age 34 for men and women with poor literacy at 21, poor or good literacy at 34**

	Men		Women	
	Poor 21	**Poor 21**	**Poor 21**	**Poor 21**
	Poor 34	**Good 34**	**Poor 34**	**Good 34**
Family life	**%**	**%**	**%**	**%**
Never been married	**62**	**42**[4]	**44**	**23**[1]
Living as a couple with children	27	44	60	63
Living as a couple with no children	**0**	**18**[3]	6	8
Living alone with no children	**65**	**36**[2]	18	14
Living alone with children	8	2	16	15
3+ children	4	8	16	8
Socio-economic				
Own home	**40**	**78**[1]	74	78
Rent home	**44**	**14**[2]	20	22
Overcrowded home	12	8	**16**	**5**[3]
Has savings	46	56	58	52
Has investments	**12**	**32**[3]	24	28
CM or partner receives income support	**15**	**4**[4]	12	11
CM or partner receives council tax benefit	**12**	**0**[3]	8	8
CM or partner receives housing benefit	**12**	**2**[4]	10	8
Borrowed money	**39**	**20**[4]	24	19
Non-working household	**19**	**6**[4]	18	15
Employment-related				
In full-time work	**81**	**94**[4]	28	28
In part-time work	-	-	34	34
Unemployed	4	2	2	3
In full-time home-care role	8	2	24	32
Received work-related training	15	24	10	11
Uses PC at work*	33	47	**42**	**73**[2]
Education and learning				
Has a PC at home	81	66	66	75
Been on a course for self-interest	8	12	14	20
Has no formal qualifications	**35**	**16**[4]	**30**	**11**[1]
Been on a reading course	4	0	2	2
Been on a writing course	0	0	2	3
Like to improve reading skills	**23**	**4**[2]	6	2
Like to improve writing skills	35	20	8	5

Health and wellbeing	**%**	**%**	**%**	**%**
Depressed (on Malaise scale)	19	10	**34**	**17**[3]
Never exercises	31	22	32	25
Reports 'poor' physical health	4	2	**14**	**3**[3]
Reports long-term illness	23	32	38	25
Smokes daily	31	28	26	20
Never gets what wants out of life	32	26	14	19
No effect on what happens in life	**13**	**2**[4]	8	11
Finds life all a bit too much	8	6	6	6
Social participation				
Involved with any group/club	35	44	42	40
Contact with government/public figure	**0**	**16**[3]	4	12
Been on rally/demo, signed a petition	8	20	12	23
Voted in 2001	50	54	56	51
Would not vote in the future	27	20	**26**	**12**[4]
'Not at all' interested in politics	39	26	**48**	**23**[2]
n=	*26*	*50*	*50*	*65*
*Reduced sample**	**21*	**47*	**31*	**40*

Significance from 11: 1p<.001, 2p<.01, 3p<.05, 4p<.1

Table App2.2 **Outcomes at age 34 for men and women with poor numeracy at 21, poor or good numeracy at 34**

		Men		Women
	Poor 21	Poor 21	Poor 21	Poor 21
	Poor 34	Good 34	Poor 34	Good 34
Family life	**%**	**%**	**%**	**%**
Never married	48	44	42	31
Living as a couple with children	40	46	58	58
Living as a couple with no children	**11**	**21**[4]	8	14
Living alone with no children	44	33	15	14
Living alone with children	**5**	**0**[3]	18	15
3+ children	11	6	13	10
Socio-economic				
Own home	67	78	**70**	**79**[4]
Rent home	**23**	**13**[4]	**27**	**18**[4]
Overcrowded home	10	5	11	7
Has savings	60	60	**50**	**61**[4]
Has investments	**15**	**33**[2]	**18**	**37**[1]
CM or partner receives income support	6	3	**13**	**6**[3]
CM or partner receives council tax benefit	5	3	**13**	**7**[4]
CM or partner receives housing benefit	6	1	**15**	**6**[2]
Borrowed money	**24**	**14**[4]	**25**	**14**[2]
Non-working household	10	5	**18**	**8**[3]

Employment-related	%	%	%	%
In full-time work	**88**	**96**[3]	**27**	**43**[2]
In part-time work	1	0	32	30
Unemployed	3	3	4	0
In full-time home-care role	5	0	29	23
Received work-related training	**19**	**36**[2]	**9**	**18**[3]
Uses PC at work*	**48**	**65**[3]	**61**	**80**[2]
Education and learning				
Has a PC at home	76	82	**69**	**83**[2]
Been on a course for self-interest	13	14	16	19
Has no formal qualifications	**21**	**8**[2]	**20**	**3**[1]
Been on a maths/number course	0	2	4	3
Like to improve maths/number skills	16	12	22	17
Health and wellbeing				
Depressed (on Malaise scale)	14	13	22	17
Never exercises	26	22	**31**	**14**[1]
Reports 'poor' physical health	9	5	6	7
Reports long-term illness	23	31	29	29
Smokes daily	25	30	23	23
Never gets what wants out of life	**34**	**23**[4]	**20**	**12**[3]
No effect on what happens in life	**10**	**3**[3]	9	7
Finds life all a bit too much	5	4	8	5
Social participation				
Involved with any group/club	39	37	**41**	**55**[2]
Contact with government/public figure	6	9	11	11
Been on rally/demo, signed a petition	14	21	**17**	**31**[1]
Voted in 2001	59	63	59	62
Would not vote in the future	**21**	**11**[3]	**19**	**12**[4]
'Not at all' interested in politics	**28**	**15**[3]	**31**	**20**[3]
n=	*80*	*112*	*143*	*176*
*Reduced sample**	**71*	**107*	**85*	**126*

Significance from 11: 1p<.001, 2p<.01, 3p<.05, 4p<.1

Table App2.3 **Outcomes at age 34 for men and women with good literacy at 21, poor or good literacy at 34**

	Men		Women	
	Poor 21	Poor 21	Poor 21	Poor 21
	Poor 34	Good 34	Poor 34	Good 34
Family life	%	%	%	%
Never married	41	42	33	31
Living as a couple with children	52	45	56	56
Living as a couple with no children	24	20	10	15
Living alone with no children	24	32	**10**	**18**[4]
Living alone with children	0	3	**25**	**11**[1]
3+ children	12	6	7	10
Socio-economic				
Own home	69	77	**72**	**81**[4]
Rent home	12	15	**25**	**14**[2]
Overcrowded home	5	5	7	7
Has savings	57	67	**51**	**67**[2]
Has investments	43	43	**15**	**42**[1]
CM or partner receives income support	**7**	**1**[1]	**16**	**3**[1]
CM or partner receives council tax benefit	5	2	**17**	**5**[1]
CM or partner receives housing benefit	**7**	**1**[2]	**17**	**4**[1]
Borrowed money	10	16	**22**	**14**[3]
Non-working household	10	2	18	7
Employment-related				
In full-time work	90	95	**27**	**47**[1]
In part-time work	0	0	39	29
Unemployed	2	2	4	1
In full-time home-care role	0	1	25	18
Received work-related training	21	30	**6**	**23**[1]
Uses PC at work*	**58**	**77**[3]	**69**	**84**[2]
Education and learning				
Has a PC at home	83	86	**68**	**87**[1]
Been on a course for self-interest	12	15	15	18
Has no formal qualifications	**17**	**6**[2]	**7**	**3**[4]
Been on a reading course	0	0	1	0
Been on a writing course	0	2	0	1
Like to improve reading skills	5	5	5	2
Like to improve writing skills	17	13	5	6
Health and wellbeing				
Depressed (on Malaise scale)	7	11	16	16
Never exercises	17	21	19	19
Reports 'poor' physical health	12	4	6	5
Reports long-term illness	21	28	30	27
Smokes daily	31	22	25	19
Never gets what wants out of life	19	18	15	13
No effect on what happens in life	5	4	**10**	**4**[3]
Finds life all a bit too much	5	3	9	5

Social participation	%	%	%	%
Involved with any group/club	**33**	**47**[4]	**47**	**59**[3]
Contact with government/public figure	12	17	14	14
Been on rally/demo, signed a petition	33	25	27	30
Voted in 2001	60	66	63	69
Would not vote in the future	7	9	12	9
'Not at all' interested in politics	12	13	**26**	**14**[2]
n=	*42*	*412*	*81*	*460*
*Reduced sample**	**38*	**397*	**52*	**352*

Significance from 11: 1p<.001, 1p<.01, 1p<.05, 4p<.1

Table App2.4 **Outcomes at age 34 for men and women with good numeracy at 21, poor or good numeracy at 34**

		Men		Women
	Poor 21	Poor 21	Poor 21	Poor 21
	Poor 34	Good 34	Poor 34	Good 34
Family life	%	%	%	%
Never married	40	42	26	27
Living as a couple with children	52	43	**64**	**53**[4]
Living as a couple with no children	20	20	10	16
Living alone with no children	23	34	**11**	**22**[3]
Living alone with children	5	3	15	9
3+ children	**11**	**4**[3]	8	8
Socio-economic				
Own home	75	75	81	83
Rent home/live with parents	19	14	13	11
Overcrowded home	9	3	6	6
Has savings	62	67	66	69
Has investments	49	49	38	45
CM or partner receives income support	3	1	4	3
CM or partner receives council tax benefit	2	2	6	4
CM or partner receives housing benefit	0	2	4	2
Borrowed money	20	16	13	13
Non-working household	2	3	6	7
Employment-related				
In full-time work	95	95	**35**	**50**[3]
In part-time work	0	0	39	30
Unemployed	0	2	0	2
In full-time home-care role	2	0	20	14
Received work-related training	22	30	16	25
Uses PC at work*	**69**	**79**[4]	**70**	**88**[1]

Education and learning	**%**	**%**	**%**	**%**
Has a PC at home	82	86	89	87
Been on a course for self-interest	12	14	14	20
Has no formal qualifications	8	6	5	1
Been on a maths course	2	1	1	0
Like to improve maths skills	11	9	**16**	**7**[3]
Health and wellbeing				
Depressed (on Malaise scale)	8	10	13	18
Never exercises	20	19	16	21
Reports 'poor' physical health	3	4	9	4
Reports long-term illness	26	28	31	27
Smokes daily	29	20	23	16
Never gets what wants out of life	15	15	11	12
No effect on what happens in life	0	4	4	4
Finds life all a bit too much	3	3	3	6
Social participation				
Involved with any group/club	**39**	**51**[4]	56	60
Contact with government/public figure	17	22	16	15
Been on rally/demo, signed a petition	29	28	36	29
Voted in 2001	**55**	**67**[4]	69	70
Would not vote in the future	14	7	5	7
'Not at all' interested in politics	12	13	14	14
n=	*65*	*272*	*80*	*256*
*Reduced sample**	**62*	**261*	**59*	**205*

Significance from 11: 1p<.001, 2p<.01, 3p<.05, 4p<.1

Appendix 3
Copying Designs exercise

Children between age 3 and 5 years 11 months completed the Copying Designs task that had been completed by BCS70 cohort members themselves when they were age 5[84]. The test required the child to copy eight drawings twice on two consecutive pages of a specially produced booklet. Figure App3.1 gives an example of a completed booklet from a three year old and a five year old (the designs that the child had to copy are in the left-hand column of each page).

The instructions for this task appeared on the CAPI screen. The interviewers were directed to point to each design in turn and ask the child 'see if you can make one just like this – here', at the same time pointing to the space beside the design. Interviewers have reported that a few children could not be persuaded to make two attempts, and some were tired before they reached the end of the exercise. As there were no discontinuation rules, interviewers were asked to encourage the child to attempt all eight designs, but to stop if the child was distressed or if he/she stopped attempting to copy.

Scoring the Copying Designs task

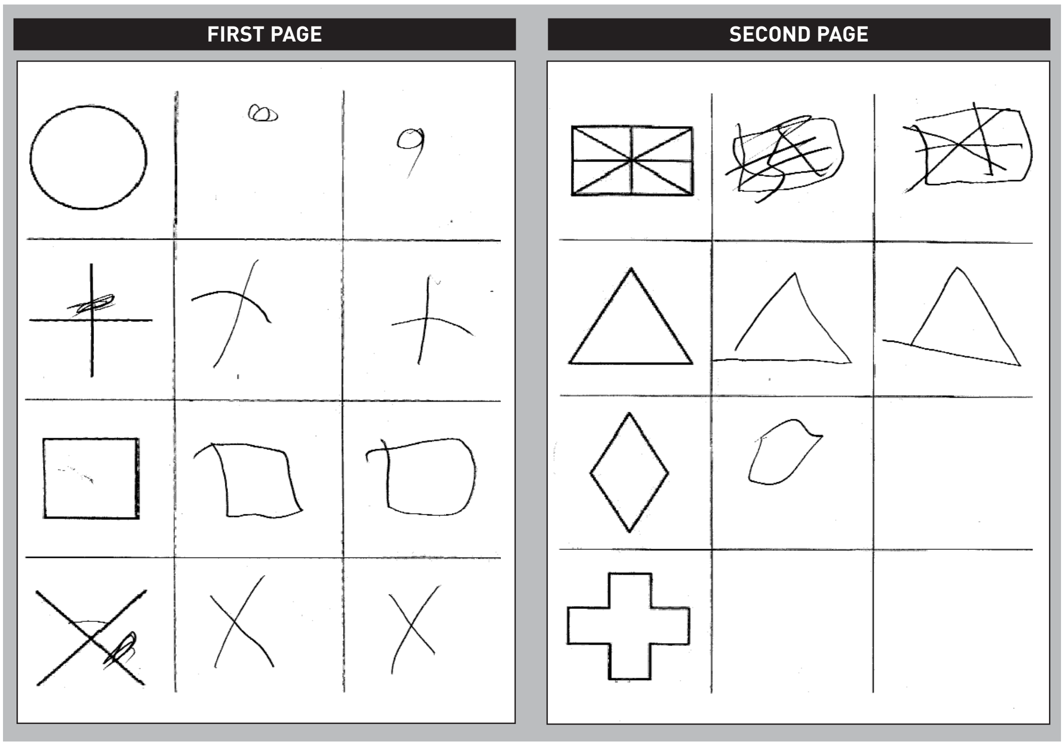
The child is asked to make two copies of each shape. No time limit is given. For each drawing a score of '0' or '1' is allocated. As not all children complete two copies, a score of '1' is allocated if at least one good copy is made of a given design. The total score is the sum of the scores for the individual drawings. The test is used to assess the child's ability to reproduce shapes and the neatness of the drawing is therefore irrelevant. The following principles apply for all the drawings.

- The drawing must have the right general shape and look like what it is supposed to be.
- It should be approximately symmetrical.
- Angles should not be rotated.
- The drawing should not be rotated, eg, the point of the triangle should be uppermost.
- Angles must be approximately opposite each other (except for the triangle).
- Slight bowing or irregularity of lines is allowed.
- As long as the other criteria are met, neatness is not important.
- Lines should meet approximately but, as long as other criteria are met, small gaps in junctions are acceptable.
- Slight crossing and overlapping of lines is permitted.

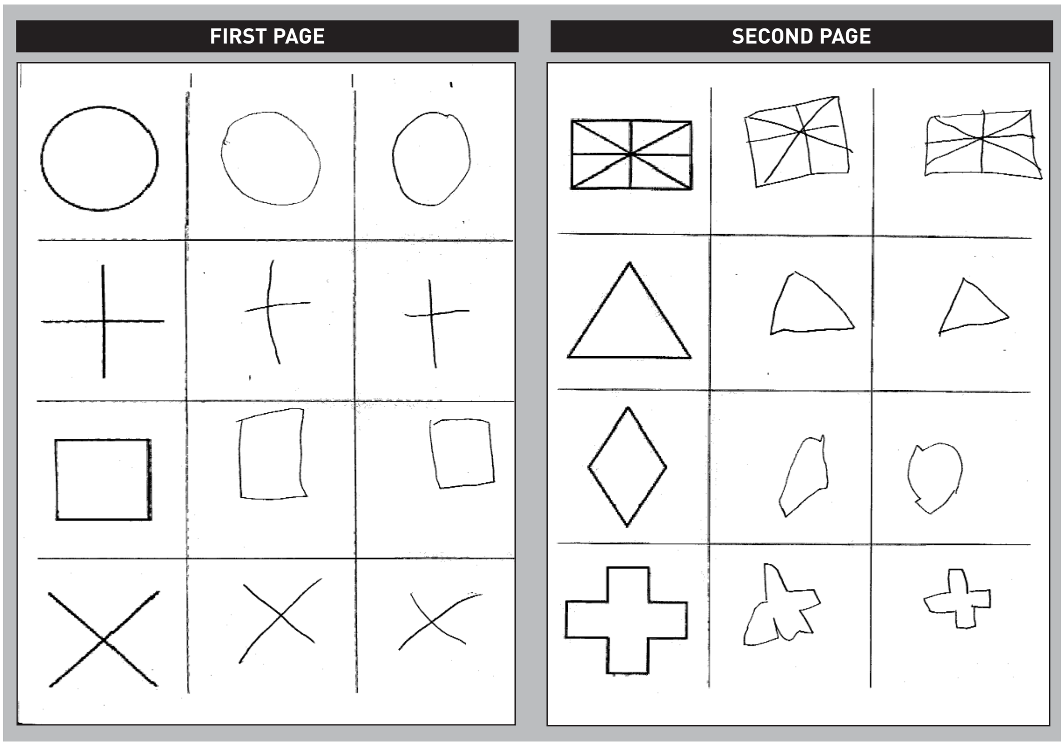
Once the scoring of this exercise has been completed, comparisons of parent and child performance in the same assessment will be made.

84 Osborn, A.F., Butler, N. R. and Morris, A. C. (1984). *The Social Life of Britain's Five Year Olds. A report of the Child Health and Education Study*. London: Routledge and Kegan Paul.

Figure App3.1: **Example of a copying booklet completed by a child age 3**



Example of a copying booklet completed by a child age 5



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