# Lack of employment: the threat to numeracy

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**Abstract**

National Child Development Study (NCDS) data are used to examine the negative impact of time out of paid employment on numeracy, as measured by a maths test at 16 and a functional numeracy test at 37. Restricting the sample to respondents who left full-time education at 16 and accounting for maths at 16, we found negative correlations between time out of paid employment and adult numeracy scores. Using the whole sample, adult numeracy scores were regressed on maths at 16, family background and adult experiences. The longer the absence from paid employment, the greater the negative impact on adult numeracy. The relationship was strongest for men with poor maths at 16. This suggested that a certain level of maths was needed before skills were retained and not weakened by absence from paid employment. Training offered some protection against skill loss, as did women's more diverse roles at home and work.



## Introduction

The relationship of basic skills problems to poor labour market experience is well established. Men with poor literacy or numeracy have problems gaining entry to secure employment and in retaining it. Women with poor basic skills have similar problems with labour market entry and are the first to exit from employment. In a recent study of adult basic skills problems, men and women at age 37 with the worst literacy or numeracy skills were more likely to be out of employment at the time of interview. The men were unemployed, women were "at home" (Bynner and Parsons, 1997a). Taking this work a step further, the increasing importance of numeracy, over and above literacy, for successful participation in the modern labour market was made strikingly clear. At *every age between 18 and 37* a higher percentage of men and women who *had poor numeracy and competent literacy* were out of full-time employment in comparison with men and women who had *competent numeracy and poor literacy* (Bynner and Parsons, 1997b). Out of the 21 years of labour market participation available to early school leavers between age 16 and 37, those with poor numeracy and competent literacy spent an average of *one year less* in full-time employment in comparison with those with competent numeracy and poor literacy (15.7 years to 16.8 years for men, 8.5 years to 9.5 years for women).

Numeracy problems, therefore, appear to reduce employment opportunities. But do basic maths skills get worse in response to poor labour market experience? Given the wide range of occupations in today's labour market, which increasingly demand the use of basic numeracy (Atkinson and Spilsbury, 1993), it is important to establish whether men and women with poor numeracy have always had such poor skills or whether time spent out of the labour market has added to their difficulties. We can all think of mathematical skills that have been "lost" over the years, but these are generally not *basic* skills: most of us do not forget how to follow plainly written instructions, to add up or subtract simple numbers. It is the more complex numerical skills that are more vulnerable to "memory loss". For example, the ability to

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work out percentages or calculate the cubic area of a room are skills often relegated to "something I could do when I was at school" unless they are used and practised during adulthood. More often than not it is employment that provides us with the opportunity to practice and develop such specific skills. Certain kinds of numerical skills are not likely to be required in many everyday situations, their use is restricted to particular types of job. For example, many men with poor basic skills find work in and around the semi-skilled "craft" areas of the building trade, where basic maths skills are likely to be called upon (Bynner and Parsons, 1997a).

We need to know the extent to which "memory loss", arising from non-use or practice, extends to the basic number skills on which the more complex ones are founded, and more importantly, does this relate to the amount of time spent out of paid employment (Bynner and Parsons, 1998)? Given the centrality of employment to men's lives, we might expect that continued employment would have a role in preventing the deterioration of their numeracy, and, if anything, lead to their improvement. Conversely, we might also expect that any deterioration would occur through extended time out of paid employment: unemployment, sickness, etc.

For women, the relationship between numeracy skills and employment is more complicated, because of the periods of time spent out of the labour market when having children or mixing part-time employment with child-care responsibilities (Bynner *et al.*, 1997). At age 37, four-fifths of the women in the basic skills survey referred to earlier had one or more children; two in five were in full-time employment and two in five worked part-time at the time of interview. The more diverse roles often demanded of women, in the child-caring role for example, are likely to involve a range of basic numeracy skills. Household management and home-based educational support for children involve the use of basic maths on a near daily basis. We might speculate, therefore, that for women, absence of paid employment would not have such a detrimental effect on basic skills as it might for men.

## Maths and numeracy assessments at 16 and 37

To discover the effects of labour market experience on the basic skills, we use data from the same longitudinal study in which the survey referred to earlier was carried out – the National Child Development Study (NCDS). NCDS comprises a sample of over 17,000 people born in a single week in 1958 and followed up subsequently at ages 7, 11, 16, 23 and 33 when 11,407 were surveyed. At 37 a representative 10 per cent sample was surveyed ($n$ = 1,714) which in addition to updating information on family formation, employment, housing, etc., the respondents completed functional literacy and numeracy tests designed by the National Foundation for Educational Research (NFER). Earlier on in their lives, a complete record of their educational progress has been built up, through tests taken at different ages. These included maths tests at ages 7, 11 and 16.

Mathematics performance at 16 is highly correlated with scores on the numeracy test (0.51) (Parsons and Bynner, 1998). It is therefore reasonable to see the 16-year-old test as a marker of the numeracy skills attained at the time of leaving full-time education and first entry into employment. The school-based mathematics test at 16 was different in form and content from the functional numeracy test at 37. The maths tests at 16 were designed to assess the full range of a student's competence, from very poor to very advanced. The numeracy test at 37, however, was designed with adults possessing very weak skills in mind. This test covered a range of performance tasks at the three levels of numeracy defined by The Basic Skills Agency's *Basic Skills Standards*: Foundation Level, Numberpower Level 1 and Numberpower Level 2. These emphasise "functional" performance, i.e. the ability to apply basic skills in everyday life situations (ACACE, 1982). The most difficult tasks in the test were assessed at Numberpower Level 2.

The 37-year numeracy test has a score range of 0-18. Reflecting natural breaks in the distribution, scores were initially grouped into four groups: "very low" (0-10), "low" (11-13), "average" (14-15) and "good" (16-18) (Bynner and Parsons, 1997a). In other reports we have compared those with "poor" scores (23 per cent, the "very low" group) against the majority with more "competent" scores (77 per cent, a re-grouping of "low", "average" or "good").

Given the much lower "ceiling" in the test at age 37, direct measures of skills "improvement" or "loss" between age 16 and 37 were

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difficult to obtain. The maths test at 16 has a score range of 0-30. After some experimentation a degree of equivalence was achieved through a classification of the 16-year mathematics scores 0-7 as "poor" (20 per cent) versus scores of 8-30 as "competent" (80 per cent).

## Are numeracy skills affected by absence from the paid labour market?

The amount of time cohort members had spent in the labour market was highly variable depending on the age at which they left school. The initial analysis was therefore restricted to those who left full-time education at 16, i.e. the maximum working time available was 21 years ($n$ = 302 men; $n$ = 293 women). To help take account of the time women spend out of the labour market having and bringing up children, the sample of women was further restricted to those who had at least one child by the age of 37 (85 per cent of the early school leavers, $n$ = 245 women). Time out of the labour market was measured in duration of months, as obtained from the complete employment histories back to 16 that cohort members supplied.

If time out of paid employment in these restricted samples does have a detrimental impact on an individual's numeracy, we would expect the mean numeracy scores at age 37 to decline in accordance with time spent out of paid employment. Men and women who have amassed most time out of the labour market should have the lowest scores. Inevitably, relatively small numbers had spent large amounts of time out of paid employment ($\geqslant$5 years for men, $\geqslant$12 years for women) which reduces the reliability of the mean scores.

### Men

Figure 1 shows how the mean numeracy scores at 37 change with the amount of time spent out of employment, for the different skills groups as defined at 16. Exactly in line with prediction, the more months out of paid employment, the more the mean numeracy score declined, whatever the level of maths that had been reached at 16. For men with "competent" maths at 16, the decline in mean numeracy scores began after one year out of the labour market. For those who were in the "poor" maths group at 16, the decline began immediately; with every month out of the labour market these men's mean scores declined.

### Women

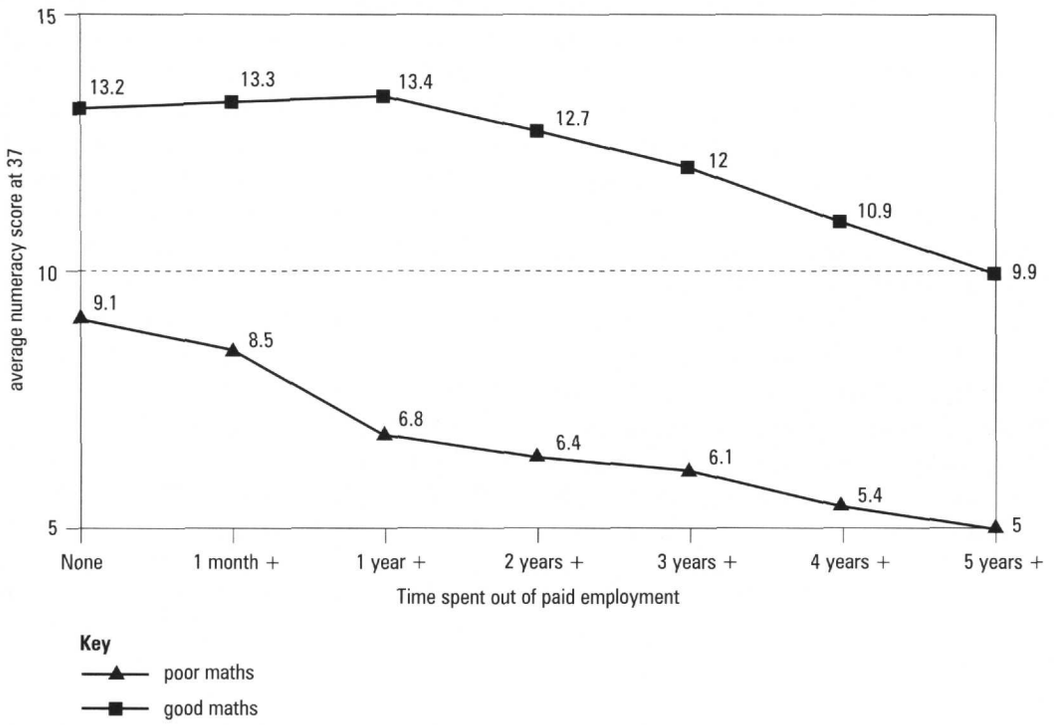
Very few women with children had not spent some time out of paid employment by the time they were 37 ($n$ = 29). We therefore compare average difference scores between women who had all spent some time out of paid employment, between one month and 12 plus years. Figure 2 compares women's average numeracy score by the different periods of time they had spent out of paid employment between ages 16 to 37. Months out of paid employment were associated with a decline in women's numeracy skills, but to a smaller extent than was the case for men.

For women with "good" maths at 16, a steady decline in mean numeracy scores was evident. Conversely, a decline in scores was only really evident for women with poor maths at 16 once $\geqslant$10 years had been spent without paid employment. We tentatively suggest that this anomaly arises as women with good maths at 16 need and use their numeracy skills in the jobs they do to a larger extent than women with poor maths at 16. As the numeracy of women with good maths at 16 has closer direct links to employment than the numeracy of women with poor maths at 16, the skill lost through lack of practice when out of the labour market will be evident sooner.

## Strength of relationship between numeracy scores at 37 and time out of paid employment

The graphs provide evidence of a relationship or *correlation* between time out of paid employment and lower scores in the numeracy assessment at 37 after controlling for maths performance at 16: the longer the time out, the lower the numeracy scores, especially for men with poor skills at 16. To place complete confidence in this finding we need to apply a more rigorous test to the data. We need to take account not only of the effects of maths scores at 16, but also of the effect of other influences. What else might explain why men and women who had spent the most time out of employment between the age of 16 and 37 achieved the lowest scores in the numeracy test at 37? For example, age of leaving full-time

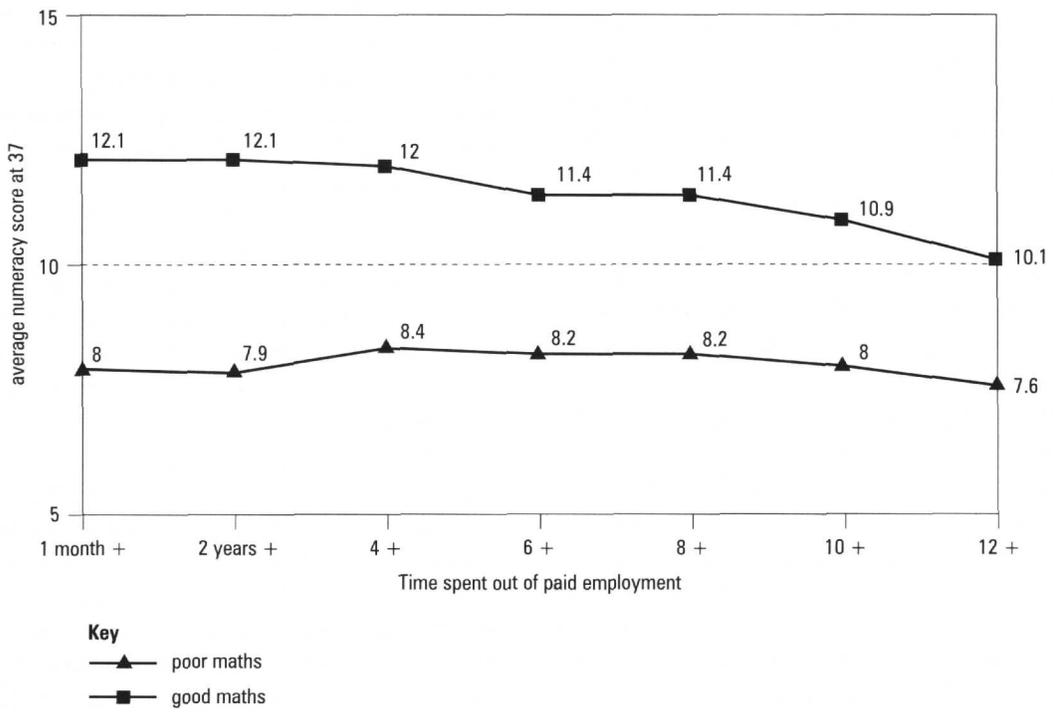
**Figure 1** Average numeracy score at 37 by time out of paid employment between age 16 and 37: men who left full-time education at 16 by their maths at 16




education and exam success at 16 were both related to numeracy at 37, and the amount of time spent in or out of paid employment.

Multiple regression analysis allows us to say how much of the variation in the scores attained by men and women in the numeracy test at 37 can be explained by other factors. To what extent can we explain how one person gets a higher score than another? The multiple correlation coefficient, $R$, shows the

**Figure 2** Average numeracy score at 37 by time out of paid employment between age 16 and 37: women with children who left full-time education at 16 by their maths at 16



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strength of the relationship between the set of "other" influences and the adult numeracy scores. $R$ has a range of 0 to 1. The closer to 1, the stronger the relationship between the set of influences and the adult numeracy scores. $R^2$ takes this further, giving the actual percentage of variation in the adult numeracy scores at 37 that can be accounted for by the influences. A high percentage tells us that the influences are good predictors of adult numeracy scores. The other factors are individual scores in the maths test at 16 and the amount of time the respondent had spent out of the paid labour market. They also embrace a number of family background circumstances and employment experiences between ages 16 and 37. The full correlation matrix between all the measures involved in the analysis is shown in the Appendix.

Multiple regression also calculates a standardised regression coefficient for each of these "other" influences. These give the strength of the relationship between any one influence, i.e. time out of the paid labour market, and the numeracy score at 37, while holding constant the effect of the other influences. These range between –1 to +1. Using time out of the paid labour market as an example, the further from zero $R$ is, the stronger the relationship between time out of the paid labour market and the numeracy score at 37. A positive coefficient (towards +1) tells us that time out of the paid labour market has a positive impact on an individual's skills at 37, while a negative coefficient (towards 1) indicates a negative impact. In other words, the higher number of months spent out of the paid labour, the lower the numeracy score. Evidence of a *negative* relationship between the 37-year score and time out of employment is therefore the primary focus of interest. The "influence" with the biggest regression coefficient is the more important predictor of adult literacy or numeracy, regardless of the direction of the relationship. We use the whole sample for this analysis, i.e. the cohort members who completed tests at both 16 and 37: 1,283 in all. Our focus is on statistical significant coefficients i.e. those with a significance level of 0.05 or less, indicating that the odds are less than 19 to 1 that they have arose by chance. Such coefficients are in italics in Tables I and II.

**Can time out of the labour market affect numeracy, taking 16-year maths scores into account?**

The initial regression analyses explored the relationship of numeracy score at 37 with time out of paid employment, taking account of maths score at 16. The analysis was carried out for men and women with "poor" and "good" mathematics at age 16. The statistically significant coefficients in Table I confirm the picture for men and women with poor maths skills at 16: the longer the time out of employment, the lower the numeracy score at 37. This effect was particularly strong for the numeracy scores of men with poor maths at 16 (–0.24 men, –0.16 women). In contrast, for men and women with a good understanding of maths at 16, once the maths skills score at 16 was controlled, time out of paid employment lost much of its impact on their numeracy at 37 (0.06 men, –0.03 women).

**What else besides time out of paid employment can account for lower numeracy scores at 37?**

We now bring in the family background factors and adult experiences in both the workplace and at home, which might account for the relationship between time out of paid employment and lower numeracy scores at 37. Are people who come from well-off homes more likely to avoid the problem? Similarly are those who do well in the labour market, particularly those who get training in the jobs they do, likely to preserve or even enhance their skills? Again does the starting point make any difference? Are people who start off with good skills protected and those with poor skills more vulnerable?

In Table II we see that more of the variation in numeracy score at 37 is explained for men and women with poor or good maths at 16, when we include all these other factors (i.e. for men with poor maths at 16, $R^2$ increases from 14 per cent to 22 per cent). This suggests that these factors have an importance over and above time out of employment in determining scores at 37. Notably, the key relationship of interest, that of time out of the labour market and numeracy at 37, is sustained for both men and women with poor skills. Over and above all these other influences, the more time people with poor skills spent out of employment, the lower was their numeracy score. Although the relationship was weakened it remained

**Table I** Influence of maths skills at 16 and time spent out of paid employment on numeracy at 37

| | Men | | Women | |
|---|---|---|---|---|
| | Poor maths at 16 | Good maths at 16 | Poor maths at 16 | Good maths at 16 |
| **Maths score at 16** | *0.28*** | 0.44* | *0.32** | 0.53* |
| **Time out of paid employment** | – 0.24**** | 0.06 | *– 0.16**** | – 0.03 |
| *R* | *0.38** | 0.47* | *0.35** | 0.53* |
| $R^2$ | *14%* | 22% | *12%* | 28% |

**Notes:** *$p < 0.001$; **$p < 0.01$; ***$p < 0.05$; ****$p < 0.1$ (not statistically significant)

**Table II** Influence of maths skills at 16 and time spent out of paid employment on numeracy at 37: controlling for demographic and post-16 experiences

| | Men | | Women | |
|---|---|---|---|---|
| | Poor maths at 16 | Good maths at 16 | Poor maths at 16 | Good maths at 16 |
| **Maths score at 16** | 0.22**** | 0.33* | 0.30* | 0.44* |
| **Time out of paid employment** | – 0.15 | – 0.09**** | – 0.18*** | – 0.02 |
| **Social class at birth** | 0.16 | – 0.05[a] | 0.17**** | 0.07**** |
| **Age left full-time education** | 0.05 | 0.29* | 0.03 | 0.06 |
| **Number of children at 37** | 0.05 | 0.02 | 0.05 | 0.02 |
| **Work related training 16-23** | 0.11 | 0.02 | 0.18*** | 0.03 |
| **Work related training 23-33** | 0.15 | 0.02 | 0.11 | 0.14** |
| *R* | *0.47** | *0.50** | *0.46** | *0.55** |
| $R^2$ | *22%* | *25%* | *21%* | *30%* |

**Notes:** *$p < 0.001$; **$p < 0.01$; ***$p < 0.05$; ****$p < 0.1$ (not statistically significant)
[a] The relationship is in the wrong direction

statistically significant (–0.15 men, –0.18 women), suggesting that when we take account of these other influences, the effect of absence from the labour market is slightly less evident. Our earlier conclusion that poor skills are more susceptible than good skills to further deterioration if they are under utilised is supported.

We have established that time out of the labour market does have a negative relationship with numeracy throughout adult life, but what role do the other background circumstances and experiences have in relation to the problem? The fact that when all these factors are taken into account, the overall predictability of the numeracy scores improves, and the fact that the relationship between time out of employment and the numeracy scores is weakened, suggests that these other factors are having a significant impact. A higher social class at birth, for example, has a positive impact on the scores at 37 for those with poor skills at 16, particularly among women (0.16 men, 0.17 women). Although this aspect of an individual's life cannot be changed, it seems likely that the basic skills of those brought up in more disadvantaged circumstances are more adversely affected: middle class homes provide a degree of protection against the decline in skills. Work-related training is another good positive predictor of 37-year numeracy scores for men and women with poor maths skills at 16. It suggests that such training can also offer a degree of protection against the adverse effects of time out of the labour market for people with poor numeracy.

## Conclusion

Our original hypothesis that lack of use in employment does impact negatively on numeracy gains support from his analysis. Taking account of maths at 16 the longer the absence from paid employment between age 16 to 37, the greater the negative impact on the numeracy scores of men and women with poor maths skills at 16. The association was much weaker (and statistically insignificant) for both men and women with good maths skills at 16. As also anticipated, the

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relationship was stronger for men than for women.

The relationship between time out of paid employment and 37-year numeracy scores is strongest when maths skills are poor at 16, which suggests that once a certain level of maths has been attained at school, skills are not weakened as much by absence from paid employment. A skill "threshold" needs to be reached before we can be sure that the skill is going to be retained. In line with education standards, this threshold is qualifications level 2: GCSE grades A-C or NVQ equivalents.

The relationship between time out of paid employment and numeracy gives support to our earlier reasoning that certain kinds of numerical skills are more likely to be used mainly in particular types of job. As many men leaving school with relatively poor maths skills work in the semi-skilled craft areas of the labour market, lack of opportunity to exercise the numeracy skills demanded by this type of work appears to weaken them further. It seems likely that the skills begin to deteriorate through lack of use.

The implications of these results are apparent for both sexes. Clearly the areas of the labour market in which men and women with poor basic skills seek work demand basic numeracy as part of the work itself. Lack of employment depresses what are usually poor skills to start with even further. Education and training experiences at work appear to provide some protection, and women's numeracy skills are also somewhat protected by their more diverse roles both inside and outside the labour market. Time out of paid employment might carry fewer direct ramifications for the skills of women, but for both sexes it will reduce even more the capacity of the poorly skilled to find employment.

The challenge for policy directed at young people is to provide opportunities inside and outside the formal education and training systems for the acquisition of numeracy skills above the "threshold" level. The challenge for policy directed at adults is to provide opportunities for acquisition and retention of numeracy in a range of adult contexts inside and outside the workplace. Those with poor skills need to build on and keep the numeracy skills they have. Those out of work need to have opportunities for the numeracy support they need to both practice and keep their skills, if there is to be a realistic prospect of continuing access to employment.

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## Appendix

**Table AI** Correlation matrix for all measures included in multiple regression analyses

| | Maths score at 16 | Time out of paid employment | Social class at birth | Age left full-time education | No. of children at 37 | Work-related training 16-23 | Work-related training 23-33 |
|---|---|---|---|---|---|---|---|
| **Numeracy at 37** | 0.57** | –0.05 | 0.19** | 0.34** | –0.08* | 0.17** | 0.26** |
| **Maths at 16** | | 0.10**[a] | 0.24** | 0.54** | –0.10** | 0.16** | 0.32** |
| **Time out of paid employment** | | | 0.03 | 0.24** | 0.22** | –0.12** | –0.15** |
| **Social class at birth** | | | | 0.20** | –0.10** | 0.02 | 0.15** |
| **Age left full-time education** | | | | | –0.13** | 0.01 | 0.28** |
| **Number of children at 37** | | | | | | 0.00 | –0.16** |
| **Work-related training 16-23** | | | | | | | 0.18** |

**Notes:**
**Correlation is significant at the 0.01 level
* Correlation is significant at the 0.05 level
[a] The unexpected positive correlation between maths score at 16 and time out of paid employment between 16 and 37 arises from the confounding of time out of paid employment with age of leaving full-time education, i.e. the higher the maths score, the older the age of leaving full-time education and consequently the longer the time spent out of paid employment