

General skills training in the workplace: the benefits for employers

Because there has been so little direct research into the benefits for employers of basic skills workplace training, we have summarised in some detail the evidence on the benefits of training in general. Some of the training covered may be, and indeed probably is, basic-skills related: we have noted above that a good number of companies report providing such training, and we also know from a number of case study-based research projects that manufacturing companies introducing new procedures often find it necessary to provide some integrated literacy/numeracy instruction as part of their staff training, especially for employees with English as a second language. (See e.g. Hoyles et al. 2002; Wolf and Sutherland, 1995.) However, most data sets do not discriminate clearly between types of training, and so do not allow for differential analysis of basic skills-related as opposed to other types of training.

Although there has been a huge proliferation of studies in labour economics in the last 20 years or so, the literature on the economic benefits which employers derive from the training of the workforce is not perhaps as great as might be expected, nor is there a set of well-established results. The methodological reasons for this were discussed in Section III. The main focus is on econometric studies, and most research has looked at the effects of training on firm productivity and sometimes on profit, too. Early work in this area was conducted mainly in the USA, but there are also interesting results from France, which has excellent panel data. We look first at the evidence relating to productivity where a good number (though by no means all) of the well-constructed studies show a positive impact from training. We

then summarise the results on labour turnover/commitment to the firm. In our view, these latter results are especially encouraging, since they suggest that training does not lead to poaching of employees by other companies, but, on the contrary, reduces labour turnover.

The impact of training on productivity and profit

The only major recent study for the UK (and the one cited in most discussion of this issue) is that by Dearden et al. (2000) who constructed an industry-level longitudinal dataset for manufacturing industries (but not service ones) by combining data on training from the LFS with Census of Production information on labour, capital and value-added. Over the period 1984 to 1996 it was found that increases in the proportion of workers trained in a given industry were associated with increases in productivity (value-added per worker). The effects were quite large. The researchers estimate that raising the percentage of workers trained in an industry by 5 percentage points was associated with a 4% increase in productivity and a 1.6% increase in wages. The implication is that not all productivity gains accrue to workers in the form of higher wages; some are appropriated by firms as enhanced profitability (as one can reasonably assume would be the case with basic skills-related improvements).

The main strength of the study is that the use of longitudinal data enables effects to be traced over time. However, because industry data were utilised there is a possibility that, although the authors do their best to control for technological change, certain high technology industries may train lots of workers at the same time as productivity gains are really due to the richness of technological opportunity. From our perspective the main problem with the study is that, as already noted, it does not use firm-level data: firm-level panel data do not appear to be available for Britain.

Turning to the international literature, a number of important studies use US firm-level data. Holzer et al. (1993) gathered data on manufacturing firms in the Michigan area of the United States in the period 1987 to 1989 and investigated the effects of training (hours of training per employee) on the scrappage rate (percentage of units manufactured which had to be discarded as faulty) as a measure of productivity. Sample sizes varied between 60 and 107 firms. They found that firms with higher levels of training had lower scrappage rates – in fact a doubling of the volume of training per employee reduced the scrappage rate by about 7%.

Bartel (1994) also utilised US data, in this case a sample of 155 firms from a 1986 Columbia Business School survey. Productivity was measured as net value-added per worker. Training was measured by the presence or absence of a formal training plan. Training was assumed to change if a formal training plan was implemented between 1983 and 1986. It was found that the introduction of a new training plan between 1983 and 1986 was associated with large increases in productivity, of the order of 40%. The research revealed that other changes in the workplace, such as new methods of job design, new performance appraisal schemes, or employee involvement schemes did not have statistically significant effects on productivity. One weakness of the study is that the training variable is quite poor as it conveys little idea of how much training firms were providing. The response rate for the survey was also very low – at 6.5% – which raises concerns about the representativeness of the results.

Some papers by Black and Lynch are among the most widely-cited US studies of the effects of training. In Black and Lynch (1996), cross-sectional data from the 1994 *National Employer Survey* were used to estimate equations for labour productivity on samples of 821 manufacturing and 525 non-manufacturing firms. The number of workers in the firm in

receipt of training did not have an effect on productivity for either the manufacturing or non-manufacturing samples of firms. However, the percentage of formal training that occurred off the job had a significant effect (at the 5% level) on labour productivity in the manufacturing sector while for the non-manufacturing sample, computer training tended to increase productivity (at the 10% level of statistical significance). Of course, as with any cross-sectional analysis of training, there are problems in interpreting the results.⁸

Black and Lynch (1997) also analysed panel data on the effects of workplace training and other HR practices on productivity. The researchers matched 1994 NES data with information from the Longitudinal Research Database of the US Bureau of the Census, so enabling investigation of how workplace practices and training affected the change in labour productivity over time (admittedly a rather short – three-year – period). The combined dataset comprised information on some 627 manufacturing establishments. In fact the panel data results revealed that none of the training variables were significant in regression analyses. The authors suggest that the survey information on training may have been too weak for its effect to be adequately picked up in an elaborate estimation framework.⁹

⁸ For instance, if firms with a low level of productivity were engaged in lots of training to catch up, this would result in a negative correlation between training and productivity in a cross-sectional dataset.

⁹ They did find that other workplace practices had some influence on productivity: for example, greater worker involvement in decision-making and the use of performance-related pay tended to increase productivity levels.

Research in France

As already noted, French data are, in this area, greatly superior to British, and this is reflected in a number of recent studies. These are ably summarised by Greenhalgh (2002) who concludes that, 'These studies demonstrate that vocational training activity is associated with increased net output by firms, a higher rate of return on assets, payment of higher wages and a greater propensity to innovate.'

The main findings from five relevant French studies are listed in Table 7 but we also describe, in some detail, the findings from Ballot et al. (2001); Carriou & Jeger (1997) and Delame & Kramarz (1997) because of their use of firm-level panel data and of variables not available to UK researchers.

Authors	Details of Sample	Main Results from Regression Analysis
1. Carriou & Jeger, 1997	10,000 firms with 100+ workers, 1986–1992	Repeated cross-sections: a 1% increase in training expenditure as a share of the wage bill was associated with a 2% increase in value-added.
2. Ballot & Taymaz, 1996	51 firms from manufacturing and construction sectors	Training (training expenditure as a share of the wage bill) had large positive effect on rate of return on total assets.
3. Delame & Kramarz, 1997	Panel of 495 firms with 10+ workers, 1982–1987	They focused on value-added and rate of profit. Positive effects of training were observed for enterprises spending above the training levy (the majority of firms) ; the main effects of training occurred through higher productivity of well-qualified workers (engineers, professionals and technicians).
3. Delame & Kramarz, 1997	Panel of 495 firms with 10+ workers, 1982–1987	They focused on value-added and rate of profit. Positive effects of training were observed for enterprises spending above the training levy (the majority of firms) ; the main effects of training occurred through higher productivity of well-qualified workers (engineers, professionals and technicians). No significant effects of training on the rate of profit.
4. Haloues, 1997	Cross-section of 638 firms in 1987	Training measured as: total hours of training per employee, 1985–1987, and for specific types of worker; and training expenditure; proportion spent on general training in 1987. Investigated effect of training on innovation in 1987. Training hours and expenditure associated with likelihood of innovation. Training of engineers associated with more innovation; training of clerks associated with less innovation.
5. Ballot et al. 1998–2001	Panel of 90 large firms, 1987–1993	Training expenditure and hours of training per worker had positive effects on value added.

Table 7: Evidence on the benefits of training for employers in France.

Both the article by Carriou and Jeger (1997) and that by Delame and Kramarz (1997) take as their starting point the steady increase in expenditures on workplace training which was reported by French companies between 1972 and 1994. In spite of this, the training levy imposed on French companies, and the right to take leave for training, the numbers of employees receiving training in France do not appear to be particularly high by European standards. This is partly because many small companies, in particular, pay the levy effectively as a tax, rather than developing and documenting in-house training. In examining the actual firm-level impact of training, therefore, they emphasise the importance of more direct measures of training activity than simply reported expenditure.

Carriou and Jeger use repeated cross-sectional data for 10,000 companies with more than 50 employees during the period 1986 to 1992: and have figures for the actual number of hours of training received.¹⁰ They impute a cost to these, based on the figures used by the French training authorities, and estimate the effects on value-added. Controlling for a number of workers at different qualification levels, capital stock and sector, they find that a 1% increase in expenditure on training yields a 2% increase in value added.

In addition, using four years of panel data for the larger companies (100+ employees), they establish that the returns to training are independent of prior levels of training expenditure. In other words, there is no evidence of training 'saturation': the effects of additional training continue year by year.

Delame and Kramarz (1997) use panel data from the 1980s (when the training levy was already in place) to examine the impact of training on both profitability and value added. They emphasise that there are clear and stable differences among companies in whether they tend to spend less or more on training in-house than the levy requires: those who are committed to training remain so, and vice versa. Firms are categorised accordingly. Controlling for employee qualifications and capital, they examine the relationship between a firm's training 'status' and level of activity and its value added. The results indicate that there is no simple relationship between providing training and value-added. Training seems to raise value added only among the 'committed', high-expenditure firms, and does so largely via an interaction with the numbers of highly qualified personnel. In other words, it appears to raise their productivity, and have its main impact on value-added in this way. Direct links between profit and training expenditures do not emerge in this analysis at all.

Ballot et al. (2001) also investigated the effects of both training investments and R&D investments on the performance of firms. Their data were for large firms in two countries, France and Sweden, and consisted of panel data on firms in each country over the period 1987 to 1993. In the French case, the data were obtained by integrating information from two sources, one covering financial information and one information on training and R&D activities. The sample covered 90 very large firms, representing about 10% of French industry in terms of number of employees. In the Swedish case there were about 200 firms in the

¹⁰ Data are combined from firms' returns to the Treasury, which include training-levy related material plus an annual company survey by INSEE.

¹¹ Data are from CEREQ's panel study of training plus a merged INSEE panel data set on over 1,000 industrial enterprises, providing detailed information on salaries and worker qualifications as well as company finances.

¹² The researchers estimated production functions for the French and Swedish samples separately, with (log of) value added as the dependent variable in each case, and examined the effects of training and R&D on the level and growth of production. A range of estimation techniques was utilised including OLS, fixed effects and random effects panel models, GMM models and extensions of GMM based on recent work by Blundell and Bond (1999). The training measures included the percentage of the wage bill devoted to continuing training, and hours of training paid for by the firm. Training stock measures were also constructed by cumulating the flows of training expenditure per year, in a manner analogous to that for physical capital, but allowing for the fact that a proportion of workers quit the firm each year.

sample, covering about 50% of total employment in Swedish manufacturing.¹²

For France it was found that training played a significant effect in the production function. It was managerial training which appeared to play the key role, with non-managerial training not displaying significant effects. R&D had very limited effects and neither training nor R&D had a significant impact on the growth of output. In the Swedish case, R&D expenditure had much more robust effects on the level of production. Training in general was not significant, although, when disaggregated, the training of technical personnel was statistically significant. As with France, there were no growth effects identified for either R&D or training.

The authors suggest that the greater role of training for the French sample of firms compared to those in Sweden may be due to differences in institutional arrangements, and point to the importance of the levy system in France. On the other hand, the training data for France seem to be of better quality than for Sweden, while the reverse applies to the R&D data, with French firms apparently under-reporting their R&D activities and it is possible that this had some influence on the results obtained. In summary, this is a good study which is unusual in attempting to make comparisons between two countries. The authors maintain that their results for France are broadly consistent with an earlier study by Delame and Kramarz (1997) who found that training had a significant effect on productivity in France, but only for managers, engineers and technicians, and only for firms spending above the levy minimum. In the present study, which was confined to large firms, most were also spending above the minimum.

Other international evidence

Laplagne and Bensted (1999) report on the impact of training and innovation on the performance of workplaces in Australia. They utilise data from the 1990 and 1995 *Australian Workplace Industrial Relations Surveys* (AWIRS), a large-scale survey of medium to large (→20 employees) workplaces. AWIRS consists of both cross-sectional surveys (covering about 2,000 workplaces) and a panel survey of some 600 establishments, surveyed in both 1990 and 1995. Performance was labour productivity, subjectively assessed by respondents in relation to competitors, and training covered the provision of formal training to employees, and also the funding of study leave.¹³ When the sample was split between 'leaders', those with high productivity, and 'laggards', productivity assessed as average or below, training helped to explain productivity growth for the laggards but not for the leaders, for whom innovation was more important. Using the panel data to examine effects of levels of training in 1990 on productivity growth during 1993 to 1995, it was found that the lagged training and innovation variables did not have significant effects on the changes in productivity. In summary, the main strength of this study was its use of a large, representative dataset. The results, however, are rather mixed and not easy to interpret.¹⁴ There are also bound to be concerns about the subjective nature of the performance measures.

A study by Barrett and O'Connell (2000) examined the effect of training on productivity growth

¹³ Ordered probit regressions of labour productivity growth in the preceding two years using the 1995 cross-sectional data and controlling for a wide range of other variables revealed that both formal training and innovation (the use of new technology, reorganisation, restructuring of the way work was done) had significant positive effects on the subjective assessments of labour productivity growth.

¹⁴ On methodological grounds the panel study should probably carry more weight, but the sample size for the panel was much smaller than for the cross-sectional analyses.

in a sample of approximately 200 Irish enterprises over the period 1993 to 1995. It was found that training had a positive effect on the growth of productivity over this period. The authors also distinguished empirically between general and specific training and showed that while general training had a positive influence on enterprise productivity growth, specific training did not. (Basic skills training would definitively count as 'general' but we do not know how much of it there was.)

Rather than productivity, Ottersten et al. (1996) focused on cost reduction. Data on eight Swedish firms in the machine tools industry indicated that workplace training had a large effect on cost reduction. The very small sample size is an obvious limitation of this research. De Koning (1994) reports briefly on a survey of 2,000 companies in the Netherlands. He states that external training had a statistically significant positive effect on productivity, while internal training also had a positive effect but was not statistically significant. The effect of training on productivity was quite small in that a doubling of the training effort raised productivity by approximately 10%. However, as Green (1997) has noted, there is not enough information in the paper to properly evaluate the findings. The survey appears to have been cross-sectional, but no tables of statistical results are presented and it is not clear how either the productivity or training variables were defined and measured. So, the reported findings must be treated with some caution.

Alba-Ramirez (1994) examined the effects of training on productivity in Spain using cross-sectional data from a 1988 survey covering about 600 firms.¹⁵ The proportion of workers in entry-level jobs in receipt of training had no significant impact on measured productivity but the proportion of senior workers who obtained such training did have a positive and significant effect. Initial estimates suggested that a 10% increase in the proportion receiving training raised productivity by about 8% but the inclusion of other explanatory variables reduced the size of the training effect to 2–3%. Of course, as with other cross-sectional studies there is some doubt as to the direction of the causal linkages between training and productivity.

Von Bardeleben et al. (1995) [cited in Barrett and Hovels, 1998] investigated the effects of training in Germany. They used mixed methods (i.e. both a quantitative questionnaire survey and case studies) and while they were not able to assess the monetary benefits of training they asked employers why they chose to train rather than hiring outside workers who were already trained. This gave a sense of why training was considered cost-effective. Some of the most widely-cited responses by employers were: so as to obtain skilled workers who could not easily be recruited in the labour market; strengthening the ties between workers and firm; to sort out which were the best workers among the various trainees.

As noted above, one of the difficulties associated with estimating the effects of training (including basic skills provision) is that it may not operate in isolation from other practices of the organisation. A number of US studies have investigated the effects of 'bundles' of innovative work practices on productivity, with training usually included as one component of the bundle. For instance, Ichniowski et al. (1997) showed that productivity levels in US steel plants tended to be significantly higher on production lines where a bundle of HRM practices were in use and a study by de Kok (2000) also provided some support for linkages between

¹⁵ The survey contained two questions on training: 'How many workers in entry-level jobs attended training courses in 1988?' and 'How many senior workers have attended training courses in 1988?'. Productivity was measured either by sales per employee or by value-added per employee. Controls included the occupational composition of the workforce, whether the firm was foreign owned, and technological change.

training and broader HR practices of the firm. More recently, the effects of HRM practices have also been analysed using British data (Guest et al. 2000a, 2000b; Michie and Sheehan Quinn, 2001). These suggest that bundles of HR practices, including training, may be related to measures of corporate performance, but it is not possible to extract the role of training specifically in the analyses.

Rates of return

Most of the research surveyed so far has looked at the impact of training on measured variables such as productivity and occasionally innovation, but has not included data on training costs. It therefore leaves unresolved the question of whether and when training is a good investment, or what is the rate of return earned on investment in training. This question is difficult to answer because it requires data on both the benefits of training in monetary terms, and the costs of training, direct and indirect. For example, if training results in higher wages for trained workers this needs to be included in the costs of training for the firm (although it is also a benefit for the workers involved).

Large-scale econometric research has not been able to provide rate-of-return estimates. As noted earlier, studies typically find that productivity growth outstrips wage growth, implying that not all the gains from training go to the worker (e.g. Barron et al. 1999). However, datasets on training in large samples of firms do not contain information on the costs of the training programmes, ruling out the computation of rates of return. The fact that the skills acquired in training could depreciate over time, and that some trained workers may leave the firm where they trained are further complications for rate-of-return analysis.

Case study research on the return to training for particular firms is also scarce. In the basic skills-specific literature, only the study by Krueger & Rouse was able to estimate these (and found that the existence of a government subsidy produced returns on the employer's own investment of acceptable levels). Firms seldom undertake evaluations of their training programmes (CBI, 1993), perhaps perceiving the benefits to be obvious, or that the evaluation process would be time-consuming and costly in itself; insofar as evaluations are undertaken they are likely to be informal and not involve strict cost-benefit analysis (Barrett and Hovels, 1998). The limited amount of research in this area has been reviewed by Bartel (2000). She looks at 16 case studies, all in the US. The returns on training investment estimated in the studies were extraordinarily high, varying from a mere 100% to 5,900%! However, many of the studies were methodologically flawed, as Bartel demonstrates.¹⁶ Only two of the 16 studies were judged to have avoided serious methodological defects. The calculated rate of return on investment in training for these firms were 100–200%, considerably higher than for other types of evidence, although there must be doubts about how typical such results are.

Training, turnover and organisational commitment

The risk that trained employees may leave the firm is often cited as a disincentive for employers considering providing training for their workforce. Economists distinguish between general and specific training and suggest that while general training may result in employees being attracted away by other firms, this will not apply to firm-specific training. In practice, it

¹⁶ Methodological problems in some studies included the use of subjective supervisor evaluations of trainees' performance or self-reporting of performance by trainees, monitoring for a very short time after the completion of training, selecting only the best employees for training, and ignoring changes in the operating environment which could impact on performance.

is likely that almost no training will be entirely specific to one firm, so the 'poaching' issue is a legitimate concern.

In fact, the evidence points consistently towards the provision of training actually lowering the risk of workers leaving, rather than increasing it. A survey of relevant studies in the US and UK published in the 1990s by Green (1997) concluded that 'The general finding is that the impact of training on labour mobility is comparatively small, in relation to other factors determining mobility, and for the most part is in the downward direction.' It may well be that the provision of training by employers helps to improve the motivation of the workforce and to play a part in persuading them that they are with a good employer.

There is reliable evidence of such a statistical association for UK companies and workplaces in WERS 98, a nationally representative survey of workplaces with more than ten employees. A recent study by Dex and Smith (2001) used data from this survey, in which 2,000 workplaces in Britain were studied and at each workplace up to 25 employees were asked to complete questionnaires about their attitudes to their employment and work activities. Employees were asked to score, on a scale from 1 (strongly disagree) to 5 (strongly agree) three statements: 'I share many of the values of my organization', 'I feel loyal to my organization' and 'I am proud to tell people who I work for'. Controlling for a wide range of other potential influences, it was found that those employees who had had five or more days of training in the preceding twelve months were more committed to the organization than those who had received less than five days' training.¹⁷ The training variable was statistically significant at the 5% level. The positive effect of training held for employees in both the public and private sectors of the economy.

An earlier study by Gallie and White (1993) obtained similar results, again for the UK. They used data from a 1990 survey to investigate employee commitment and found it to be related both to the characteristics of the individual (such as beliefs, sense of success) and to organizational characteristics. Commitment was raised by several factors including opportunities for personal development, the extent to which employees felt their skills were utilised, greater access to training, the greater the extent to which the organization was regarded as a caring employer, and the existence of teamworking practices.

A US study by Campbell (1993) provides further corroboration of the relationship between training and job tenure. Data came from the *Employer Opportunities Pilot Project* survey of employers which was carried out in 1980 in eleven US states and focused on the characteristics and job of the worker most recently hired by the firm. Training was measured as the number of hours spent orienting and training the worker in the first month of employment.¹⁸ Even with controls for a very large number of other variables, the training variable was highly statistically significant, with a negative effect on the quit rate. A limitation of the research is the focus on the most recently hired worker, and perhaps more seriously

¹⁷ The researchers used these statements to measure commitment by constructing a scale from 3 to 15. Among the total sample of about 26,000 people, 16% had low commitment, (scores of 3 to 8), 42% had medium commitment (scores of 9 to 11) and 42% had high commitment (scores of 12 to 15). The scale was used as the dependent variable in regression models. Both OLS and ordered probit models were used, although the results differed little by the type of model used. Controls included the age of the person, gender, number of children, educational level, type of job, job tenure and other variables.

¹⁸ The dependent variable was the length of the worker's employment spell. The probability of job termination was estimated utilising a proportional hazard model, with data on the last worker hired. Explanatory variables included characteristics of the worker, such as age, work experience, gender, education, labour market conditions – namely the local unemployment rate and the industry unemployment rate, characteristics of the firm, covering percentage unionised, percentage white collar, and percentage craft, the size of the firm, and the firm's expenditure on hiring and screening. Also included were the top wage, i.e. the highest wage the worker could earn in the current job, and model-based estimates of the wage the worker could earn elsewhere (since the probability of leaving a job will depend on the wage which could be earned in current employment and what the worker might earn elsewhere).

that it only covers initial training and not the training of more experienced workers.

Wholey (1990) utilised information on 140 large employers in the Indianapolis area. Questionnaires were completed by samples of employees in each company so that again the dataset combined information about the individual and the organisation. Formal training provided by the employer was seen to have a significant effect in raising the tenure of supervisors, managers and male workers, but had no discernible effects on the tenure of female workers; informal training appeared not to influence the tenure of workers (both male and female) or supervisors, but did raise the tenure of managers.

Individual gains from improvements in basic skills

As we have already noted above, it was research into the links between individuals' earning and employment, and their skills, which first made policy-makers fully aware of the negative implications of poor basic skills levels. This has also been the main foundation for predictions of the benefits to the economy of raising adults' basic skills. (See especially Dearden et al. 1999.) We summarise the major studies below, but concentrate on the UK data. The UK studies all rely primarily on the NCDS data set, and to a lesser extent the BCS70 one.

While the results of these studies are highly suggestive of the likely impact of basic skills improvement on workplace productivity, it must also be emphasised that they cannot be more than very imprecise estimates of the scale of impact. On the one hand, they may underestimate the effects, in that productivity gains are only partly captured by workers themselves, while, on the other, it must be remembered that adults with poor basic skills also tend to have lower attainment (and, probably, ability) as children, and differ from higher-skilled respondents on a large number of observed variables and, therefore, in all probability on unobserved variables as well, and also that, in the current UK labour market, qualifications attained by adults have generally yielded lower returns than those attained by young people (Machin et al. 2001; Jenkins et al. 2002).

Bynner and Parsons (1997) discuss the impact of basic skills on various aspects of an individual's life, such as employment, health and family life, based on the findings of the 37-year NCDS survey discussed above. Below we summarise some of their findings that relate to employment, training and occupational achievement.

Qualifications achieved at age 37: half of the respondents with very low literacy skills had no formal qualifications; this proportion was higher than for those with low numeracy skills, where 31% of men and 23% of women had no formal qualifications (but note that the proportion of the population with low numeracy skills is approximately twice that with low literacy ones).

Employment and unemployment: 23% of men in the very low literacy group and 19% in the very low numeracy group reported being unemployed or sick at the time of the survey. Bynner and Parsons suggest that self-report of long-term sickness in the case of these individuals may in fact be masking unemployment. The above percentages compare with 4% and 3%

respectively in the high literacy and numeracy groups. The case of women is more complex as home-care and part-time employment are more common across all groups compared to men. For the very low literacy group, 26% of women reported being engaged in home care, 31% were in full-time employment and 34% were in part-time employment. These percentages are 14%, 43% and 39% respectively for women in the high literacy group. Hardly any women in this study defined themselves as being unemployed.

Employment history: The employment history of respondents from age 17 to 37 shows that men with very low or low literacy skills were more likely to be in full-time employment at an earlier age compared to their better-skilled peers. However, by the time they reached their mid-twenties this picture had been reversed, with a higher proportion of men with average or good literacy skills being in employment compared to those with low or very low skills. For example, at age 31, 75% of men with very low literacy skills were in full-time employment, compared with over 90% of men with good literacy skills. There was a less strong effect of poor numeracy skills on employment history. A similar picture is found for women, i.e. those in the very low or low literacy groups were the first to enter the labour market but also the first to leave it, with just one in three women with very low or low literacy skills being in full-time employment between the ages of 29 and 36.

Work-related skills: Respondents were asked to report whether they thought they were 'good', 'fair', 'poor' or 'did not have' each of a list of 17 work-related skills drawn by the (then) Department of Employment. A lower proportion of men and women with poor literacy and numeracy skills perceived themselves to be good at these work-related skills. The differences between men with good and very low literacy or numeracy skills were largest for the following work-related skills: writing, reading plans, computing, teaching, supervision, maths calculations, organisation, comprehension and decision making. For women, the skills in which those in the two extreme groups differed most were: writing, reading plans, computing, support/advice, maths calculations, finance and comprehension.

Promotion at work: Between the ages of 23 and 37 almost two thirds of men and three quarters of women with very low literacy skills had never been promoted, compared to under one third of men and two fifths of women with good literacy skills. There was a smaller difference between the two extreme groups with respect to numeracy skills for men, although for women the difference was on the whole maintained, with approximately 60% of women in the low numeracy group never having been promoted compared to 34% of those with good numeracy skills.

Earnings: Since literacy and numeracy skills were found to have an effect on occupation and this in turn obviously affects level of income, the analysis on earned income presented by Bynner and Parsons only refers to respondents who left school at 16 in an attempt to control in part for the effect of occupation. (All other results reported are for the complete 10% sample.) The data show that 42% of men with very low and low literacy fell in the low-income group (less than £200 per week) compared to 24% for those with good literacy. The respective figures for women were 53% (low or very low literacy) in the low-income group (less than £150 per week) compared to 39% of those with good literacy. An even more marked effect was found with respect to numeracy skills for men: 49% of men and 52% of women with very low numeracy fell in the low income group compared to 19% of men and 30% of women with good numeracy skills.

In summary, the results of the NCDS survey showed that people with poor basic skills are

more likely to experience unemployment and be in low paid jobs and to have fewer opportunities for progression and promotion in their jobs. These individuals also report to possess fewer of a range of work-related skills such as computing and supervisory skills.

Dearden and colleagues extended the analysis in a report commissioned by the DfEE (Dearden et al. 2000, 2002) which looks at the returns to a wide range of British academic and vocational qualifications, as well as the returns to basic literacy and numeracy skills, and also examines earnings effects for the whole population rather than just those who left school at 16. The authors evaluated the wage and employment returns to having better literacy and numeracy skills using data from both the NCDS 10% sub-sample assessed for basic skills in 1995 and from IALS.

Looking at the impact of literacy and numeracy on wages, Dearden et al. found that individuals with level 1 numeracy skills¹⁹ can expect, on average, to earn between 15% and 19% (according to the NCDS and IALS respectively) more than individuals below this level, when not controlling for any other factors that may influence earnings, such as family background (i.e. mother and father's education) or education level.

The premium for literacy at this level is only slightly smaller, at about 15% for both datasets. (NB As explained above in Section 2, the population is partitioned differently for these two comparisons, since only about a fifth of the population, based on NCDS estimates, has literacy skills below level 1, compared to about a half for numeracy.)

The impact of people's basic skills levels on earnings is partly explained by their association with qualifications (which indicate skill levels, and also have independent, separate effects on earnings) and with other background variables. However, strong effects on earnings remain, even when controls are introduced for factors such as family background, ability at age 7 and 16 and education level achieved. These results suggest that for numeracy skills there is still an effect of around 6–7% for those with level 1 skills. The evidence on literacy is more mixed however, as results from the two datasets differ substantially. Results are presented in more detail in Table 8: column 1 shows raw effects, column 2 controls for a variety of family background variables²⁰ plus own education level achieved; and column 3 controls for measured ability at ages 7 and 16.

¹⁹ Participants below level 1 are grouped together rather than further subdivided because of the importance of level 1 in terms of the Moser report (DfEE, 1999), where it is considered the minimum acceptable level for literacy and numeracy for adults.

²⁰ For NCDS, controls were family background (i.e. parents' educational level, social class, financial difficulties in family when child aged 7) plus various childhood variables (school type, parental interest in education) and ability at age 7. For IALS data, a more limited set of background variables was available/used.

	Raw effects	With some controls	With full controls
Numeracy level 1			
IALS estimates	0.187	0.066	
NCDS estimates	0.147	0.069	0.057
Literacy level 1			
IALS estimates	0.152	0.114	
NCDS estimates	0.148	0.026	0.013
Controls			
Family background		X	X
Age 7 ability			X
Age 16 ability			X
Education level		X	X

Table 8: Wage effects associated with level 1 numeracy and literacy skills. (From Dearden et al. 2000.)

Turning to the impact of basic literacy and numeracy skills on the probability of being in employment, Dearden et al's analysis finds that having level 1 numeracy skills is associated with an extra 5% probability of being in employment, not controlling for any other factors; this figure is consistent for both the NCDS and IALS results. For literacy, the figures between the two studies differ even before controls are introduced, with NCDS results indicating that individuals with level 1 literacy are 5% more likely to be employed compared with their less skilled peers, while the IALS results suggest that they are 13% more likely to be in employment. These differences may be partly explained by the fact that the IALS covers the entire age range (16–64) and therefore has a lower aggregate level of employment than the NCDS sample, which is confined to a particular one-year cohort. Again, the authors provide further analyses controlling for factors such as education level, ability at 7 and 16 and family background, presented in Table 9.

	Raw effects	With some controls	With full controls
Numeracy level 1			
IALS estimates	0.056	0.020	
NCDS estimates	0.045		0.029
Literacy level 1			
IALS estimates	0.134	0.095	
NCDS estimates	0.051		0.002
Controls			
Family background		X	X
Age 7 ability			X
Age 16 ability			X
Education level		X	X

Table 9: Employment effects associated with level 1 numeracy and literacy skills.

Adapted from Dearden et al. 2000.)

Both the NCDS and the IALS data indicate that there are significant differences between men and women in the labour market returns to basic skills. Such gender differences are certainly consistent with other studies of earnings and employment patterns. Tables 10 and 11 summarise them (for raw effects only).

Numeracy level 1

Males only

IALS estimates	0.242
NCDS estimates	0.148

Females only

IALS estimates	0.101
NCDS estimates	0.124

Literacy level 1

Males only

IALS estimates	0.152
NCDS estimates	0.090

Females only

IALS estimates	0.218
NCDS estimates	0.135

Table 10: Raw wage effects associated with numeracy and literacy skills by gender

Numeracy level 1

Males only

IALS estimates	-0.035
NCDS estimates	0.050

Females only

IALS estimates	0.120
NCDS estimates	0.021

Literacy level 1

Males only

IALS estimates	0.120
NCDS estimates	0.062

Females only

IALS estimates	0.180
NCDS estimates	0.026

Table 11: Raw employment effects associated with literacy and numeracy skills by gender
(From Dearden et al. 2000.)

In summary, it appears that whether or not people have numeracy skills below level 1 has an impact on both earnings and employment rates. The effect is still quite strong even after other factors that may have an impact on these two variables have been taken into account. The evidence on literacy is more mixed, as the two data sets examined suggested substantially different effects on earnings and employment rates. The authors discuss various

issues related to measurement error and other problems that may explain these differences, and conclude that 'the empirical evidence ... supports the view that both literacy and numeracy skills are important determinants of economic outcomes'.

A second study commissioned by the DfEE extends the work by Dearden et al. discussed above by considering the relations between labour market outcomes and attitudes and 'soft' skills, such as attitudes to school and homework at age 16, attitudes to life in general at ages 16 and 37, ability to trust others, tendency to argue, need for control and caring skills. Measures of 'soft' skills were taken from surveys of respondents' parents and teachers as well as self-assessments. The hypothesis was that 'soft' skills may correlate with basic skills, and could therefore explain some of the effect of basic skills on labour market outcome variables. A second aim of the study was to examine whether improvement in literacy and numeracy since age 16 has any significant impact on earnings. The study, by Machin et al. (2001), was again carried out through secondary analysis of NCDS data.

The results showed that, on the whole, literacy and numeracy skills have a larger and more robust effect on individuals' labour market outcomes, such as earnings and employment status, than do 'soft' skills and attitudes. In other words, individuals with better mathematics and reading skills (as measured at age 16) have higher earnings and are more likely to be in work, even when factors such as a person's attitudes and 'soft' skills are taken into account. (Some of this positive association is due to the higher qualifications that individuals with better literacy and numeracy skills possess, although there remains an independent effect of those skills on employment outcomes.) In addition, most of the attitudinal variables and soft skills measures examined did not have a significant effect on individuals' earnings or employment status.

One of the most interesting parts of this study, for evaluating the likely effects of basic skill training, is the analysis of skill improvement. Four measures were used: i) asking respondents if they had followed a literacy or numeracy course between survey dates; ii) comparing scores of literacy and numeracy tests at ages 16 and 37; iii) the acquisition of any qualifications between the ages of 22 and 33 by low-qualified individuals (below level 1); and iv) self-reported changes in numeracy and literacy skills over the last decade.

Of all these measures, the clearest effects were found for individuals who reported that their skills had improved in the period of time since the last sweep of the survey. These people (between a quarter and a third of the sample) earned more than those who did not believe that their skills had improved. For example, the effect of self-reported improvement in numeracy skills on earnings for males was approximately 3%, whereas for women it was 11%. Women who reported improvement in skills were also less likely to be unemployed.²¹

For other measures, the results were largely insignificant (though numbers were also generally small. Less than 1% of the sample had ever taken a literacy or numeracy course: while quantitative data on skill changes between 16 and 37 were available for only the 10% subsample tested at age 37). Taking a numeracy course was, for men, negatively associated with earnings, perhaps because of self-selection into such courses: other coefficients for course taking were insignificant. Direct measures of skill improvement showed no significant effects for women; for men, there were some positive effects from improved numeracy but

²¹ The results reported are for analyses with controls for family background, parental interest, schooling, age 7 and 16 attainment, qualifications and soft skills.

only for those who were not very low achievers at age 16. Finally, and surprisingly, there did not appear to be any positive outcomes in earnings or employment for poorly qualified men and women who gained additional qualifications in their 20s.

Looking at both set of findings, i.e. both those reported in Dearden et al. (2000) and those in Machin et al. (2001), the authors draw the conclusion that 'better adult numeracy skills are associated with higher men's earnings, while literacy is the dominant skill for influencing women's wages'. They also note that, at present, 'most of the connection between adult basic skills and labour market outcomes' is reflected in differences between skill groups in their education and qualification levels, but that skills do have independent importance in explaining adult earnings.

Individual gains from workplace training

As discussed earlier, the available data on benefits to employers from workplace training are far more wide-ranging than is the case for basic skills provision, but still far less extensive than might be expected, nor is there a set of well-established results for the impact on productivity. We have therefore summarised the major findings with respect to the financial gains from training for individuals, since these can be seen as indicative of likely productivity gains for employers.

In general – though not universally – the literature finds strong evidence of wage effects of training for individuals. Good overviews of this literature include Blundell et al. (1999) and Greenhalgh (2002). We summarise the more important studies here, focusing particularly but not exclusively on evidence for Britain.

Blundell et al. (1996) present a thorough and methodologically-aware analysis using NCDS data for 1981 to 1991, covering the training of cohort members over a 10-year period when they were between the ages of 23 and 33. The NCDS questionnaire in 1991 asked about courses in the previous ten years which led to qualifications, and about other training courses during this time designed to help them develop work skills, and the research focused on the effects of both types of courses on wages. Once those not in employment in 1991 and those with missing data were excluded, the sample consisted of about 1,600 men and 1,100 women.

The research²² suggested that training in the current job boosted the real wage of men by, on average, some 3.6% (for on-the-job training) and 6.6% (for off-the-job training). For women the effects of training in the current job were 4.8% (on-the-job training) and 9.6% (off-the-job training). Training in previous jobs also had a positive effect on wages. The average effects for men of training in a previous job were 5.7% (on-the-job training) and 5.4% (off-the-job training), while for women they were 4.6% (on-the-job training) and 6.2% (off-the-job

²² As already noted in Section III, estimating the returns to training is complicated by the fact that the recipients of training may differ from non-recipients with respect to unobserved variables. A standard method for dealing with this issue is to use a model in first differences, i.e. to focus on wage growth rather than wage levels (just as, in looking at the effects of basic skill acquisition, it is preferable to look at the effects of changes in skill). This is essentially what Blundell et al. do here, although they use a more general technique which they refer to as 'quasi-differencing'. Heckman selectivity corrections were used to allow for the endogeneity of the initial wage, as well as employment status and occupation.

training). These estimates refer to training which did not lead to a qualification. Returns were higher if a qualification was obtained, although only higher vocational qualifications (such as professional qualifications, nursing qualifications, HNDs etc.) had statistically significant effects. Higher vocational qualifications boosted male wages by about 8% on average, and female wages by about 10%.

One interesting implication of the findings, with possible implications for basic skills training, is that obtaining a vocational qualification (as opposed to an academic one) on an employer-provided course provides a higher return than obtaining a qualification on a non-employer provided course. For example, a higher vocational qualification raises male wages by some 15% for an off-the-job employer provided course compared to 8.5% if the course was not provided by the employer.²³ Overall, the research suggests a wage gain from training of around 5%; middle and higher vocational qualifications deliver earnings increases of perhaps 5–10%, and training transfers readily across employers. This is a study of high quality; the main limitation is that it relates to a single cohort of relatively young workers, so it is not clear whether the results would also be applicable to other age cohorts.

Arulampalam et al. (1997) also used data from NCDS and looked at the effects of both training and educational courses on wage growth, for males only, over the period 1981 to 1991 (NCDS sweeps 4 to 5):²⁴ the study is carefully constructed but provides only 878 cases after those with missing data are dropped. The results (with multiple controls) indicated that receipt of training increased wages by about 11% over the period 1981 to 1991 (comparing those who experienced at least one training episode to those receiving none). The size of the effect falls after the first five years of completing the training event by 0.44% per month. Completing an educational course leads to increase in wages of 0.2% per month, and is estimated to start taking effect 12 months after completing the course. Compared to Blundell et al. these results confirm the value of employer-provided training but indicate lower transferability: employer provision of the (most recent) training (or educational course) was found to have a large positive effect on earnings growth, while non-employer provision had no such effect. Moreover, the effects of employer-provided training only held for those who stayed with the employer. They got an average 12% wage increase.

Booth (1993) used data from a national survey of 1980 graduates carried out in Britain in 1986–1987. The survey contained information about employer-provided training received by respondents since their graduation in 1980.²⁵ For men, external courses in the current job, days of training in the previous job, and any form of training in earlier jobs significantly increased earnings growth between 1980 and 1986 while the number of days of training in earlier jobs had a noticeable negative impact. For women, only training days in the current job or internal courses in the previous job significantly increased earnings.²⁶ Overall, training had

²³ The researchers also show that the skills enhancement which training delivers tends to depreciate over time. Returns to training courses taken before 1989 were substantially lower than those recent courses taken in 1989 to 1991.

²⁴ Controls included ethnic background, early test scores (maths and reading at age 11), trade union membership, sector/firm type, marital status, regional unemployment rate, qualifications by 1981. They also controlled for endogeneity bias using a probit for selection into education/training.

²⁵ For the current job, data were provided on several sorts of training including on-the-job training, courses within the organization, courses outside the organization, and the number of days of training. There was also information on training in their previous job and in earlier jobs. The sample consisted of approximately 2,300 men and 1,300 women. The potential endogeneity of training was dealt with both by using the Heckman two-stage procedure and also by estimating equations in first differences (earnings growth).

²⁶ All these estimates controlled for a range of individual characteristics including age, marital status, number of children, educational background, months unemployed and months out of the labour force, current job tenure as well as type of university attended, class of degree and further education since 1980.

a considerable impact on earnings, but it needs to be borne in mind that the sample consisted of graduates only so that the results do not necessarily generalise to the population as a whole.

Jenkins et al. (2002) aimed to investigate the effects of lifelong learning on labour market outcomes using the most recent NCDS data, using information about whether people had obtained a qualification between the ages of 33 and 42. They studied whether lifelong learning defined in this way had an effect on wages in 2000 controlling for a wide range of other factors.²⁷ In general there were no effects on wages. The exception was men who left school with only low-level qualifications (for example, lower grade CSEs) and who acquired degrees in their 30s or early 40s. They earned more than their peers who had not engaged with lifelong learning. The research also uncovered employment effects. Gaining a qualification between 1991 and 2000 was associated with a higher probability of being in employment in 2000 among those who were out of the labour market in 1991.

This study is of interest because research on the economic effects of lifelong learning is scarce, and because the NCDS dataset contains a rich array of background information on a cohort of prime age workers. The very weak wage effects found in the paper are consistent with weak effects for qualifications acquired in people's 20s (Machin et al. 2001). They are also puzzling, given the strong effect of measured skills on wages, and the generally positive returns found for training, but they underline both the danger of extrapolating to adults from information on returns to qualifications and skills obtained by young people, and the need to distinguish between returns to formal qualifications and returns to workplace-related training. There were also a number of limitations to the analysis undertaken. The research did not allow for how recently qualifications were obtained or for whether they were higher or lower than qualifications already held; as noted above, only lifelong learning which resulted in a qualification was investigated, and due to data limitations it was not possible to distinguish between training/learning with employers, and other forms of lifelong learning such as leisure courses or self-learning.

International evidence

A cross-sectional analysis of micro-data on the effects of training on wages in seven developed countries is described in OECD (1999).²⁸ There was a significant positive relationship between training and wages for five of the countries: Australia, Canada, Germany, Italy and Britain, with no significant effects for France and the Netherlands. For France, Italy, the Netherlands and Britain there was also a significant positive relationship between wages and the training of less educated workers, where a less educated worker was defined as below ISCED level 2, meaning that they had not completed upper secondary

²⁷ These factors included educational qualifications obtained up to age 33, early attainment scores on maths and reading tests at age eleven, family background (such as social class educational level of parents), type of school attended, and characteristics of the job in 2000 (public/private sector, size of organization, union membership). Potential endogeneity bias was allowed for by running equations in first differences as well as in levels.

²⁸ For each country the logarithm of the gross hourly wage was regressed on explanatory variables including age, gender, hours of work, nature of contract, organization size, public sector employment status and industrial sector. Samples were confined to employees aged 25 to 54 years. The endogeneity of training was controlled through Heckman's two-stage procedure (i.e. including among the explanatory variables a term summarising information obtained from a separate probit estimate of the likelihood of receiving training).

²⁹ He used data from the 1983 Dutch Brabant Survey, which contained information on individuals who were in the sixth grade of primary school in 1952 (i.e. were then aged eleven or twelve) and who were re-interviewed in 1983. In 1952 data on social background and on IQ were gathered; in 1983 the questions covered education after primary school, current job status, earnings, and vocational training. Groot used a sample of 1,075 individuals who were wage earners in 1983. Wage regressions were estimated by both OLS and using a general switching regression model, designed to allow for self-selection into certain types of training.

education. This finding provides some support for the proposition that the lower educated, when trained, obtain larger wage gains.

Groot (1995) provides some evidence that the wage returns to training for individuals vary according to the type of training provided.²⁹ The training data covered three different types of training: technical training, economic/administrative training (defined as covering 'economic, administrative and commercial training) and other training (encompassing agricultural training, medical training, teacher training, legal training, science training, government/public admin training and various other kinds of training). OLS wage equations, including controls for schooling, the IQ variable, gender and experience, suggested that technical training increased wages by about 4%, economic/administration training by some 14%, and other training by about 12%, while more sophisticated models also found wage gains from technical training (for those who participated in it) to be the lowest at about 5%, while economic, administrative and other training yielded very high estimated returns for participants of 50% and 70% respectively. These last results seem surprisingly large, and recall bias may also be a serious issue in this study. (Krueger & Rouse, 1994, who were able to compare company records with trainee recall, note major discrepancies and caution accordingly against possible bias in self-reported data.)

Lillard and Tan (1992) carried out an extremely thorough study of training and its effects on male wages and employment in the United States using five different data sources – the Current Population Survey (CPS), three cohorts of the National Longitudinal Survey (young men, old men, women), and the Employers Opportunity Pilot Project (EOPP). The data sources cover the period up to the early to mid-1980s. The main drawback in interpreting the results is that the earnings results do not control for possible endogeneity.

The analysis of earnings focused on the CPS and the young male cohort of the NLS. They found that the earnings effects of training varied both by the type of training, and who was providing it. Once again, as suggested by the UK data, company training had the largest effects on earnings, and this persisted over a 13-year period. Other types of training had smaller effects and lasted for 8–10 years. Managerial training increased earnings the most, but its effects did not last as long as that for semi-skilled manual workers (12 years and 15 years respectively). Training also had an impact in reducing the likelihood of experiencing unemployment, with company training again having the longest-lasting effects, of some 13 years, whereas regular school sources of training effects disappeared within 7 years.

Bartel (1995) is an econometric case study. Estimates are presented of the effects of training on wage growth with data from the personnel records of a large US manufacturing company over the time span 1986 to 1990. The use of personnel records provides an interesting alternative approach to the usual one of estimates from a large-scale survey.³⁰ Bartel found that number of days of training did have a positive wage effect. Distinguishing between three different types of training – core training (managerial and leadership programmes), employee development (covering, for example, oral presentations, effective writing, time management), and technical programmes (such as quality control, manufacturing practices, computer programming) she found that that largest wage effects were for core training, which was

³⁰ Clearly the disadvantage of the approach is the potential difficulty of knowing how far results can be generalised, but there are some advantages. One is that the training data should be more precise because they have been obtained from documentary records rather than the hazy recall of individuals responding to surveys. Secondly, there is no bias from differences in training varying across diverse firms. Bartel estimated a wage growth equation to eliminate person-specific fixed effects; she used an incidence of training equation to control for the selection of certain types of individual into training programmes.

fractionally ahead of employee development, with technical training having the lowest (but still statistically significant) returns.

Training and job mobility

In Section V, we noted the strong association between company-provided training and lower workforce turnover. Individual-level data generally confirms this association. For example, Booth and Satchell (1994) investigated the effects of apprenticeship training on job tenure in Britain, again using data from the National Child Development Study (NCDS). The researchers utilised a subset of the data consisting of young men who had left school at the age of 16. Women were excluded from the analysis because relatively few of them entered an apprenticeship. Among the sample of young men who left school at 16, some 43% began an apprenticeship in their first job.³¹

The main result was that completing an apprenticeship substantially reduced the exit rate from the first job into each of the three possible destinations, while failing to complete an apprenticeship increased each exit rate compared to the base of no apprenticeship training. These effects were statistically significant even when a range of control variables were included. These results provide some support for the idea that training increases job tenure; however, as the authors point out, a completed apprenticeship implies job tenure of, on average, about four years by definition (traditional apprenticeships, as taken by these NCDS cohort members in the 1970s, typically involved either three or five year spells with a single employer). Also, apprenticeships are one particular form of training, and the results may not carry over to other forms of training.

Elias (1994) also presents an event history analysis of the probability of job termination.³² Controlling for a range of factors it was found that training had a negative effect on the probability of a job ending. The effect was weak for males and not statistically significant, but for women training had a statistically significant effect (statistically significant at the 1% level) on mobility, reducing the propensity to leave an employer. Evaluated at the sample mean, the provision of formal training reduced the probability of a job termination by about 7 percentage points for women. The small size of the sample is one concern about this study. There is also the general problem of whether training is lowering the propensity to quit or whether employers are selecting those likely to stay for more training.

Dearden et al. (1997) provide a very detailed investigation of the links between training and job mobility in Britain. Two datasets were used: the *NCDS and the Quarterly Labour Force*

³¹ Booth and Satchell modelled the length of time (in months) until the respondents' first job came to an end using an event history model with competing risks. The data came from the fourth follow-up of the NCDS sample which occurred in 1981 when cohort members were 23 years old. The competing risks framework was considered appropriate because a person's first job can end in several different ways: a voluntary quit into another job, a voluntary quit into unemployment, and involuntary termination of employment. Controls were for type of school attended, for test scores on maths and comprehension at age 16, for sector of employment (public or private) and for whether the person had a disability.

³² The data came from the 1986 to 1990 Social Change and Economic Life Initiative (SCELI), a major research project conducted within six local labour markets in Britain (Aberdeen, Coventry, Kirkcaldy, Northampton, Rochdale and Swindon). In each locality a random sample of about 1,000 people aged 20–60 were interviewed about their work histories. Elias used data from one of the localities – Rochdale – only and modelled the probability of job termination on monthly work history data. Job termination in a person's work history involved a change of employer or a transition to a non-employment state. The sample consisted of 171 males and 258 females. Controls included job tenure, the age of the respondent, part-time work, trade union membership, large employer (500+ employees), working in a managerial, technical or professional job.

³³ Several different approaches were used. The main results were obtained from what they characterise as a 'before and after' approach in which the impact of training in an earlier period on the probability of moving jobs in the following year was assessed. More elaborate models were also tried out, such as instrumental variables (to allow for situations in which the unobservable individual characteristics which explain likelihood of moving jobs are correlated with previous training), sequential models and models in which training and mobility were determined simultaneously.

Survey. Both have advantages and disadvantages, and are in many ways complementary to each other. The NCDS has lots of information but on a single cohort and a long time span. QLFS is larger but covers a shorter time span (the panel element consists of people for five quarters) and less detailed background variables.³³ For men in NCDS controlling for other individual characteristics it was found that receipt of employer-provided training reduced job mobility by some 3 percentage points, while other work-related training increased job mobility by about 2.5 percentage points. This positive impact was actually confined to those courses for which a qualification was obtained. For women in NCDS training had a positive effect on job mobility but the effect was not statistically significant. However, women obtaining a qualification on a course had a significantly higher probability of moving jobs (3.4 percentage points). In QLFS, for men employer-provided training leading to a qualification reduced job mobility by some 4 percentage points; and other work-related training also with a qualification at the end of it raised by 1.8 percentage points. For women employer-funded training lowered mobility by 1.6 percentage points. In general, the impact of training was fairly small compared to employer size, industry, age of the worker, unionisation and whether the job was full- or part-time.

It seems clear, from the evidence presented above, that a great deal of the training currently provided by employers has a major direct impact on recipients' wages and that this is generally more marked for employer-provided training than for training taken off-the-job. It seems reasonable to conclude – especially given the evidence on training and output reviewed earlier – that these wage gains reflect, at least in part, substantive changes in the productivity and value of the employee to the employer. Unfortunately, the literature rarely provides details on the nature of the training involved, let alone on the particular skills which are increased as a result of it. However, as the next section indicates, there is strong evidence, from other research literature, that general skills (including higher levels of basic skills) are of increasing importance in the workplace, and therefore likely to deliver important productivity advantages to employers in coming years..

The basic skills needed at work

There can be no doubt from the evidence available that poor basic skills are strongly associated with low earnings, limited job prospects, and heightened risk of unemployment for the individual. There is also a convincing body of evidence regarding the positive pay-offs to workplace training for both the individual and (especially with respect to labour turnover) for the employer. At the same time, projections of the value to the economy of improving basic skills are based almost entirely on the experiences of individuals who currently occupy a relatively advantaged position in the income and occupational hierarchy; the training literature provides very little clear data regarding the impact of training provided to workers whose basic skills are low. It therefore seems important to review, albeit briefly, some of the evidence on current trends on the labour market. How far is it likely that large-scale increases in basic skills levels would lead to large numbers of people having the opportunity to work differently and more productively, as opposed to, in all probability, simply carrying out jobs similar to their current ones with no marked impact on the economy (as opposed to other aspects of their lives)? This section, while not attempting a comprehensive review, highlights some important recent research findings.

A series of surveys was undertaken in England and Wales in 1991 and 1992 for the 73 TECs aiming to assess the level of demand for basic skills and how far employers were satisfied by basic skills provision among their own employees and in the labour market in general (Atkinson and Spilsbury, 1993). The surveys also looked at sources of demand for basic skills, i.e. addressed the question of what basic skills are needed for. They also looked at whether the level of demand for basic skills is changing. The survey concentrated on jobs below professional and technical level, thus covering the (less skilled) two thirds of the labour market. The surveys showed that on the whole relatively few jobs could be done without basic skills, particularly oral communication and reading skills, but there was substantial variation depending on type of job, industry and company size. On average, the need for basic skills as perceived by employers in the three communication skills investigated (reading, writing and oral communication) was pitched at well above Entry Level for all types of jobs.

More generally, as is well known, the overall distribution of jobs in the economy has changed in recent years, with continuing growth in professional, technical and managerial positions (Institute for Employment Research, 2000). Some commentators (see e.g. Leadbeater, 1999) have interpreted these changes as indicating that almost all jobs will be 'knowledge-based': equally, awareness of global competition in the manufacture of mass-produced items, from countries with far lower wage levels than ours, underpin government strategies designed to encourage the development of high-skill strategies and workforce development (PIU 2001).

Nonetheless, other data and analyses emphasise that, for the foreseeable future, a large proportion of jobs will be in low-skilled service sectors where there is no potential for overseas competition/replacement of services, and where a low-skilled strategy is a perfectly rational one for employers to adopt (Keep and Mayhew, 1999; Turner 2001).

Analyses such as these help to explain why so many employers (ALBSU, 1993) have not felt any need to develop a basic skills development strategy, in spite of the well-documented problems of many adult workers, and why a substantial proportion of the contemporary workforce report that their jobs require rather little in the way of reading and writing skills.

For example, a MORI survey on adult literacy in Scotland, commissioned by the Scottish Executive and published in 2001 (see Coleman and Keep, 2001), revealed that, in their work, the following proportions of respondents reported that they rarely or never needed to use these reading skills:

Information from computers	34%
Letters or memos	26%
Bills, invoices or spreadsheets	35%
Diagrams	31%
Manuals, reference books and catalogues	53%
Reports, articles or magazines	52%
Foreign language materials	91%

For writing skills the proportions never or rarely using them were:

Letters and memos	37%
Forms, bills, budgets or invoices	42%
Reports or articles	51%
Estimates or technical specifications	59%

In evaluating and making the business case for basic skill improvements, it is important to be aware that, as this evidence suggests, there will not be a strong case to be made for every business, or every employee. Nonetheless, and critically, there is a growing body of evidence that suggests that, among the less skilled and less well-paid parts of the workforce, technical change is increasing the need for higher basic skills levels. In other words, businesses which may feel that, in current conditions, basic skills investments are unlikely to pay for themselves, should be aware that skill improvements are likely to be increasingly valuable in the not very distant future.

In the USA, a body of sophisticated analysis has indicated that cognitive skills are increasingly important in determining individuals' wages – i.e. that, over and above formal qualifications, individuals' wages indicate increasing returns to their cognitive skills, and especially their numerical and mathematical skills. (See e.g. Murnane et al. 1995; Pryor and Schaffer, 1999.) These US studies use direct measures of wages and of cognitive skills. In the UK context, there is also accumulating evidence of increasing valuation of 'generic skills', but based on self-report by respondents about the skills they use at work. In particular, Francis Green and colleagues, in work first for the Skills Task Force and more recently in DfES/ESRC-supported work on the *2001 Skills Survey*, have established that generic skills are becoming more important in UK workforces. Computing skills are expanding particularly rapidly, and appear to have a significant positive impact on pay (see especially Dickerson & Green, 2002; Green, 1999).

These studies look at the workforce as a whole, but recent work by Tyler, Murnane and Willett of Harvard University (see especially Tyler et al. 2000) examines more specifically what is happening in the US workplace for those with low formal qualifications and low earnings. The data are for high school dropouts who later took their high-school diplomas through the nationally administered GED examinations, and for the researchers had both measures of attainment (on the GED) and detailed earnings data. Among dropouts who scored high enough to be awarded a GED, male and female minority-group members who scored in the upper ranges of the GED had annual earnings in 1995 that were nearly \$1,300 to \$1,400 dollars higher than lower-scoring minority-group members who had a GED. The comparable figure for white females was about \$950, and only about \$150 (and statistically insignificant) for white males. There were also returns to skills among dropouts whose skills were so low that they were unable to pass the GED exams. Among these lower-skilled dropouts the premium for higher GED scores (even though that score was too low to meet the GED passing standard) ranged from about \$2,000 for white and minority males to about \$3,000 for white and minority females.³⁴ The increasing valuation of cognitive skills is, in other words, evident not just through demand for the highly skilled, but also within the low-skilled, low-paid part of the job market, indicating that changes in work practices are feeding through into differential productivity and pay.

Finally, while we do not have comparable data for the UK, we do have some research into actual workplace procedures and practices which helps to explain why there may be rising

³⁴ The researchers also note that the significant economic return to modest skill differences among minority-group male dropouts sheds light on a puzzle in the random-assignment evaluation of the Perry Pre-School Program – the best conducted and most influential evaluation of an early childhood intervention program. Black males who participated in the study did not have greater formal educational attainments, on average, than did black males in the control group. Yet the black males in the treatment group did have somewhat higher average earnings at age 27 than did black males in the control group. The evidence on the economic returns to skill differences for minority male dropouts supports the hypothesis that this may have stemmed from the higher average cognitive skills of the treatment group, as measured by test scores during their schooling years.

returns to skills among lower-paid workers. As so often in this review, we have to report a very limited amount of published research, but a recent study of the current use of intermediate level mathematics skills is highly relevant to the way in which changing workplace needs are likely to increase required basic skill levels. The researchers examined recent changes in the nature and level of mathematical skills required in seven sectors with very different skill mixes, from very high to very low.³⁵ (Hoyles et al. 2002). In every case, the study found an increase in the average level of mathematical skills required, even though some individuals had become deskilled and despite changes in job practices and the need to work with maths being pushed further and further down the employment hierarchy. The report also underlines the extent to which mathematics and IT skills are symbiotic, with IT developments bringing a demand for higher and different levels of mathematical understanding, and consistently requiring far more than procedural familiarity with particular software. No comparable research has been located for literacy skills: but the findings clearly support the argument that the trend in basic skills requirements is definitely and cumulatively upwards.

Key evidence gaps

In reading this literature review it should be apparent that our knowledge of basic skills training and the effects of poor basic skills in the workplace is fragmentary and highly inadequate. Given the importance of the subject, it is really quite remarkable how limited are the studies in this field of enquiry. Fundamentally, the lack of good research stems from the absence of good data – both quantitative and qualitative. Here we draw together what appear to be some of the key gaps in the evidence.

Baseline descriptive information on the extent and nature of basic skills training provision in the workplace is highly inadequate. One English national survey, the Learning and Training at Work survey, contains a single question on basic skills: it asks about the provision of learning opportunities at the workplace. There is a need for far more information on the details of what employers are offering, how the courses are funded, and how many employees have taken part in them. One potential source of additional information is the Workplace Employee Relations Survey (WERS), coordinated by DTI and last conducted in 1998. This has not provided relevant information on basic skills in the past, but there are plans for another wave in 2005 and there might be scope for including additional questions in the survey if the survey sponsors were encouraged to do so.

In order to gain a proper understanding of basic skills tuition programmes and their effects, longitudinal (panel) data are required so that the effects of the training programme can be tracked over time. The dataset would clearly need to contain firm-level information both on training at the workplace and on business performance outcome measures such as productivity, turnover and financial performance. In contrast to some other countries, notably France, even for workplace training in general there is a serious lack of firm-level longitudinal data for the UK. If such data were to become available, for basic skills and for training more generally, it would enable robust quantitative estimates of the effects of such training to be obtained.

³⁵ Opto-electronics, financial services, leisure and tourism, food processing, pharmaceuticals, health care and packaging

While large data sets of this type are a necessary pre-condition for evaluating the general effects of basic skills (and other) training, there is a limit to the quantity and quality of data that can be obtained this way. Detailed firm-level studies are also needed if we are to understand the precise circumstances in which basic skills programmes impact on different aspects of the workplace, and how these effects are related to programme features. Here, too, the research base is extraordinarily small. The tiny number of good quantitative studies which look at the impact of basic skills, or other training, at firm level, all use data from US plants (e.g. Krueger, 1994, 1998).

Up-to-date and accurate information on the costs to business of poor basic skills is also of great importance in assessing the likely gains from policy interventions aimed at improving literacy and numeracy amongst those in the workplace. At present we only have one study on this topic. This was undertaken as long ago as 1992, and relied on subjective information volunteered by a very small proportion of those interviewed. There is clearly a need for detailed evidence of the full range of costs to employers of poor basic skills among the workforce, and the most frequent sources of problems.

The one area where research studies of good quality has been conducted in the past on basic skills in Britain is the wage and employment effect of poor basic skills for individuals. Much of this work has drawn on cohort data – either the *National Child Development Study* (NCDS), a cohort born in 1958, or the *British Cohort Study* (BCS), of individuals born in a single week in 1970. The main studies which have been conducted cover cohort members' lives up to the early- to mid-1990s and they are seriously constrained by the fact that testing of the cohort as adults has been restricted to a 10% sub-sample. There are plans to gather additional data just for the 1970 cohort in 2004, and this will include testing the adequacy of individuals' literacy and numeracy skills. Even here of course the findings, when available, will relate only to a single cohort of people in their early thirties, all of whom are UK-born.

To summarise, we suffer from an absence both of large-scale survey data, especially at the firm level, and of case study material on basic skills training in the UK. Information both on the costs to workplaces where some individuals have poor basic skills, and on the effectiveness of skills training interventions is needed. It is likely that the problems caused to employers by poor basic skills vary between industrial sectors, and also within sectors according to the technology used and the type of business strategy being pursued. The distinctive ways in which poor basic skills lower productivity and/or create additional costs at work need to be analysed through case studies.

The National Research and Development Centre for Adult Literacy and Numeracy is planning a small-scale study of the effects of basic skills interventions taking place at the workplace, but more evidence would be useful. The evaluation of the Treasury-funded Employer Training Pilots scheme, which is currently being trialled in six regions of the country, may produce some evidence on the benefits of workplace basic skills training at firm level. Detailed case studies, perhaps focusing on key sectors where poor basic skills have been identified or matched plant studies across a range of sectors, would improve our understanding of what is currently happening with basic skills on the shop floor and help us to understand how changing skill demands are impacting on the workforce and on employers. It would also be extremely useful to review the amount of relevant data being collected through the *Learning and Training at Work* survey, and through other government-funded surveys.

Bibliography

Alba-Ramirez, A. (1994)

"Formal Training, Temporary Contracts, Productivity and Wages in Spain," **Oxford Bulletin of Economics and Statistics** 56/2, 151–170.

ALBSU. (1993)

The Cost to Industry Basic Skills and the Workforce. London: ALBSU.

Arulampalam, W., Booth, A., and P. Elias (1997)

"Work-Related Training and Earnings Growth for Young Men in Britain," **Research in Labor Economics** 16, 119–147.

Atkinson, J. and M. Spilsbury (1993)

Basic Skills and Jobs: A Report on the Basic Skills Needed at Work. London: ALBSU.

Ballot, G. and E. Taymaz (1996)

'Firm Sponsored Training and Performance: a comparison between French and Swedish Firms,' presented to Association Francaise de Sciences Economiques. [cited in Greenhalgh, 2002]

Ballot, G., Fakhfakh, F. and E. Taymaz (2001)

"Firms' Human Capital, R&D and Performance: a Study on French and Swedish Firms," **Labour Economics** 8, 443–462.

Barrett, A. and B. Hovels (1998)

Exploring the Returns to Continuing Vocational Training in Enterprises: A Review of Research Within and Outside the European Union, CEDEFOP.

Barrett, A. and P. O'Connell (2000)

"Does Training Generally Work?: The Returns to In-Company Training," **Industrial and Labor Relations Review** Vol. 54 No. 3, 647–662.

Barron, J., Berger, M. and D. Black (1999)

"Do Workers Pay for On-the-Job Training?" **Journal of Human Resources** 34, 2, 235–252.

Bartel, A. (1994)

"Productivity Gains from the Implementation of Employee Training Programs," **Industrial Relations** 33, 4.

Bartel, A. (1995)

"Training, Wage Growth and Job Performance: Evidence from a Company Database," **Journal of Labor Economics** 13, 401–425.

Bartel, A. (2000)

"Measuring the Employer's Return on Investments in Training: Evidence from the Literature," **Industrial Relations** 39, 3.

Bishop, J. (1997)

"What We Know about Employer-Provided Training: A Review of the Literature," **Research in Labor Economics** 16, 19–87.

Black, S. and L. Lynch (1996)

"Human Capital Investments and Productivity," **American Economic Review, Papers and Proceedings** 86, 2.

Black, S. and L. Lynch (1997)

"How to Compete: The Impact of Workplace Practices and Information Technology on Productivity." Working Paper No. 6120, National Bureau of Economic Research, Cambridge, MA.

Bloom, M., Burrows, M., Lafleur, B. and R. Squires (1997)

"**The economic benefits of improving literacy skills in the workplace**" (ERIC ED412340). Ottawa: Conference Board of Canada.

Blum, A., Goldstein, H. and F. Guerin-Pace (2001)

"An analysis of international comparisons of adult literacy". **Assessment in Education** 8, 225–246.

Blundell, R., Dearden, L. and C. Meghir (1996)

The Determinants and Effects of Work Related Training in Britain, Institute for Fiscal Studies: London.

Blundell, R., Dearden, L., and Meghir, C. and B. Sianesi (1999)

"Human Capital Investment: The Returns from Education and Training to the Individual, the Firm and the Economy," **Fiscal Studies** 20, 1, 1–23.

Booth, A. and S. Satchell (1994)

"Apprenticeships and Job Tenure," **Oxford Economic Papers** 46, 474–495.

Booth, A. (1993)

"Private Sector Training and Graduate Earnings," **Review of Economics and Statistics** 75, 164–170.

Brooks, G. and A. Wolf (2002)

A position paper on international benchmarking (project A2). London: NRDC Institute of Education: University of London.

Bynner, J. and S. Parsons (1997)

It Doesn't Get Any Better. London: Basic Skills Agency.

CBI (1993)

Training: The Business Case. London: CBI.

Campbell, C. (1993)

"Do Firms Pay Efficiency Wages? Evidence from Data at the Firm Level." **Journal of Labor Economics** 11, 3, 442–470.

Carey, S., Law, S. and J. Hansbro (1997)

Adult Literacy in Britain. London: The Stationary Office.

Carr-Hill, R., Passingham, S., Wolf, A. and N. Kent (1996)

Lost Opportunities: The Language Skills of Linguistic Minorities in England and Wales. London: The Basic Skills Agency.

Carriou, Y. and F. Jeger (1997)

“La Formation continue dans les entreprises et son retour sur investissement,” **Economie et Statistique** 303, 45–58.

Coleman, S. and E. Keep (2001)

Background Literature Review for PIU Project on Workforce Development, SKOPE mimeo. ESRC Centre for Skills, Knowledge and Organisational Performance, Oxford University.

Davies, C. and M. Birbili (2000)

Learning to write in the workplace. Oxford: Centre on Skills, Knowledge and Organisational Performance, Universities of Oxford and Warwick.

De Kok, J. (2000)

“The Impact of Firm-Provided Training on Production: Testing for Firm-Size Effects,” **Tinbergen Institute Discussion Paper** 73/3.

De Koning, J. (1994)

Evaluating Training at the Company Level in R. McNabb and K. Whitfield (eds). **The Market for Training: International Perspectives on Theory, Methodology and Policy**, Avebury: Aldershot.

Dearden, L., Reed, H. and J. van Reenen (2000)

Who Gains when Workers Train? Training and Corporate Productivity in a Panel of British Industries, Institute for Fiscal Studies, Working Paper 00/04.

Dearden, L., Machin, S., Reed, H. and D. Wilkinson (1997)

Labour Turnover and Work-Related Training, Institute for Fiscal Studies, London.

Dearden, L., McIntosh, S., Myck, M. and A. Vignoles (2000)

The Returns to Academic, Vocational and Basic Skills in Britain, London: DfEE.

Dearden, L., McIntosh, S., Myck, M. and A. Vignoles (2002)

“The returns to academic, vocational and basic skills in Britain.” **Bulletin of Economic Research**, 54, 249–274.

Dearden, L., Reed, H. and J. van Reenen (1999)

“**Estimates of the impact of improvements in basic skills on aggregate wages, employment, taxes and benefits.**” London.

Delame, E. and F. Kramarz (1997)

Entreprises et Formation Continue, **Economie et Prevision** 127, 1, 63–82.

Dex, S. and C. Smith (2001)

Employee Commitment as an Outcome of Family-Friendly Policies? Analysis of the Workplace Employee Relations Survey. WP 20/2001, Judge Institute of Management: Cambridge.

DfEE (1999)

Improving Literacy and Numeracy: A Fresh Start. London: Department for Education and Employment.

DfES (2001)

Delivering Skills for Life: The National Strategy for Improving Adult Literacy and Numeracy Skills. London: Department for Education and Skills.

Elias, P. (1994)

"Job Related Training, Trade Union Membership and Labour Mobility: A Longitudinal Study," **Oxford Economic Papers** 46, 563–578.

Dickerson, A. and F. Green (2002)

"The growth and value of generic skills SKOPE research paper 26:" **SKOPE.** Oxford & Warwick Universities.

Gallie, D. and M. White (1993)

Employee Commitment and the Skills Revolution, London: PSI.

Green, F. (1997)

Review of Information on the Benefits of Training for Employers, DfEE Research Report 7.

Green, F. (1999)

"The market value of generic skills:" **Skills Task Force Research Paper** 8, DfEE.

Greenhalgh, C. (2002)

"Does an Employer Training Levy Work? The Incidence of and Returns to Adult Vocational Training in France and Britain," **Fiscal Studies** 23, 2, 223–263.

Groot, W. (1995)

"Type Specific Returns to Enterprise-related Training," **Economics of Education Review** 14 4, 323–333.

Guest, D., Michie, J., Sheehan, M. and N. Conway (2000a)

Employment Relations, HRM and Business Performance: An Analysis of the 1998 Workplace Employee Relations Survey, CIPD.

Guest, D., Michie, J., Sheehan, M., Conway, N. and M. Metochi (2000b)

Effective People Management: Initial Findings of the Future of Work Study, CIPD.

Haloues (1997)

General Training and Innovation, 57th International Conference, Education Training and Employment in the Knowledge Based Economy, AEA: Maastricht. [cited in Greenhalgh, 2002]

Hamilton, M. and D. Barton (2000)

"The International Adult Literacy Survey (IALS): What does it really measure?," **International Review of Education** 46, 377–390.

Hoddinott, S. (2000)

"The Workers' Basic Skills 'Crisis': some industrial relations implications, in H. Rainbird, ed,," **Training in the Workplace: Critical Perspectives on Learning at Work,** Basingstoke: Macmillan.

Hollenbeck, K. (1996)

'A framework for assessing the economic benefits and costs of workplace literacy training.' Paper presented at the Workplace Learning: The Strategic Advantage, Milwaukee, Wisconsin.

- Holzer, H., Block, R., Cheatam, M. and J. Knott (1993)
“Are Training Subsidies for Firms Effective? The Michigan Experience,” **Industrial and Labor Relations Review**, 46, 4.
- Hoyles, C., Wolf, A., Molyneux-Hodgson, S. and P. Kent (2002). “**Mathematical Skills in the Workplace.**” London: Science, Technology and Maths Council.
- Huselid, M. and B. Becker (1996)
“Methodological Issues in Cross-Sectional and Panel Estimates of the Human Resources-Firm Performance Link,” **Industrial Relations** 35, 3, 400–422.
- Ichniowski, C., Shaw, K. and G. Prennushi (1997)
“The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines,” **American Economic Review** 87, 3, 291–314.
- Institute for Employment Research (2000)
“**Projections of Occupations and Qualifications 1999/2000.**” Coventry and London: University of Warwick and Department for Education and Employment.
- Jenkins, A., Vignoles, A., Wolf, A., and F. Galindo-Rueda (2002)
“The Determinants and Effects of Lifelong Learning,” **CEE Discussion Paper** 19, Centre for the Economics of Education, London.
- Keep, E. and K. Mayhew (1999)
“Towards a National Skills Agenda: The Leisure Sector.” **Skills Task Force Research Paper** 6. DfEE.
- Keep, E., Mayhew, K. and M. Corney (2002)
“Review of the Evidence on the Rate of Return to Employers of Investment in Training and Employer Training Measures,” **SKOPE Research Paper** 34, ESRC Centre for Skills, Knowledge and Organisational Performance, Oxford University.
- Krueger, A. and C. Rouse (1994)
New Evidence on Workplace Education. Unpublished working paper, Princeton University.
- Krueger, A. and C. Rouse (1998). “The effect of workplace education on earnings, turnover, and job performance”. **Journal of Labor Economics** 16, 61–94.
- Laplagne, P. and L. Bensted (1999)
The Role of Training and Innovation in Workplace Performance. Australian Productivity Commission Staff Research Paper, Melbourne.
- Leadbeater, C. (1999)
Living on Thin Air: The New Economy. London: Penguin.
- Lillard, L. and H. Tan (1992)
“Private Sector Training: Who Gets it and What Are Its Effects,” **Research in Labor Economics** 13, 1–62.
- Machin, S., McIntosh, S., Vignoles, A. and T. Viitanen (2001)
Basic skills, soft skills and labour market outcomes: Secondary analysis of the National Child Development Study (RR250). London: DfEE.

- Michie, J. and M. Sheehan-Quinn (2001)
"Labour Market Flexibility, Human Resource Management and Corporate Performance," **British Journal of Management** 12, 287–306.
- Murnane, R.J., Willett, J.B. and F. Levy (1995)
"The growing importance of cognitive skills in wage determination," **Review of Economics and Statistics** 77, 251–66.
- OECD (1999)
Training of Adult Workers in OECD Countries: Measurement and Analysis, in OECD **Employment Outlook**, Paris: OECD.
- OECD and Human Resources Development Canada (1997)
Literacy Skills in the Knowledge Society. Further Results from the International Adult Literacy Survey. Paris: OECD.
- Ottersten, E., Lindh, T., E. Mellander (1996)
Cost and Productivity Effects of Firm Financed Training, Working Paper No. 455, Industrial Institute for Economic and Social Research, Stockholm.
- Pearson, G. (1996)
More than money can say: the impact of ESL and literacy training in the Australian workplace. Canberra: Department of Employment, Education, Training and Youth Affairs.
- Performance and Innovation Unit, Cabinet Office (2001)
In demand: **Adult Skills in the 21st Century.**
- Pryor, F.L. and D.L. Schaffer (1999)
Who's Not Working and Why: Employment, Cognitive Skills, Wages and the Changing US Labor Market. Cambridge: Cambridge University Press.
- Rivera-Batiz, F.L. (1992)
"Quantitative literacy and the likelihood of employment among young adults in the United States." **Journal of Human Resources** 27, 313–328.
- Robinson, P. (1997)
Literacy, numeracy and economic performance. London: Centre for Economic Performance, London School of Economics.
- Spilsbury, D. (2002). **Learning and Training at Work 2001**, DfES Research Report RR334, Dept for Education and Skills.
- Tan, H., Chapman, B., Peterson, C., and A. Booth (1992)
"Youth Training in the US, Britain and Australia," **Research in Labor Economics** 13, 63–99.
- Turner, A. (2001)
Just Capital. London: Macmillan.
- Tyler, J.H., Murnane, R.J. and J.B. Willett (2000)
"**Cognitive Skills Matter in the Labor Market, Even for School Dropouts.**" NCSALL Report 15. Cambridge MA: National Center for the Study of Adult Learning and Literacy.

Von Bardeleben, R., Beicht, U., Herget, H. and E. Krekel (1995)

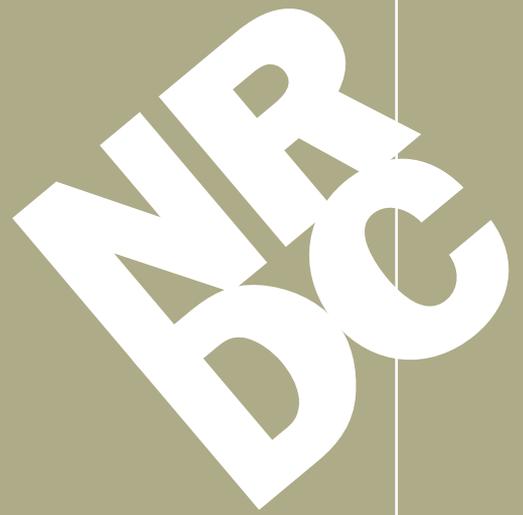
Betriebliche Kosten und Nutzen der Ausbildung, Ergebnisse aus Industrie, Handel und Handwerk, Bielefeld: Bertelsmann. [cited in Barrett and Hovels, 1998]

Wholey, D. (1990)

“The Effects of Formal and Informal Training on Tenure and Mobility in Manufacturing Firms,” **The Sociological Quarterly** 31, 1, 37–57.

Wolf, A. and R. Sutherland (1995)

“A Spreadsheet Approach to Mathematical Modelling for Engineering Students.” **Final Report of Project to the Nuffield Foundation**, London.



This report is funded by the Department for Education and Skills as part of **Skills for Life**: the national strategy for improving adult literacy and numeracy skills. The views expressed are those of the author(s) and do not necessarily reflect those of the Department.

www.nrdc.org.uk

NRDC
Institute of Education
University of London
20 Bedford Way
London WC1H 0AL
Telephone: +44 (0)20 7612 6476
Fax: +44 (0)20 7612 6671
email: info@nrdc.org.uk
website: www.nrdc.org.uk

NRDC is a consortium of partners led by the Institute of Education with:

- Lancaster University
- The University of Nottingham
- The University of Sheffield
- East London Pathfinder
- Liverpool Lifelong Learning Partnership

- Basic Skills Agency
- Learning and Skills Development Agency
- London Language and Literacy Unit, London South Bank University
- National Institute of Adult Continuing Education
- King's College London

Funded by the Department for Education and Skills as part of **Skills for Life**: the national strategy for improving adult literacy and numeracy skills.