CENTRE FOR ECONOMIC PERFORMANCE

DISCUSSION PAPER NO. 353

July 1997

RECENT TRENDS IN ENGINEERING AND CONSTRUCTION SKILL FORMATION — UK AND GERMANY COMPARED

H. STEEDMAN

ABSTRACT

Accurate accounting for annual flows of vocational qualifications by sector of economic activity has been greatly impeded by the data collection methods put in place since the setting up of the National Council for Vocational Qualifications (NCVQ) in 1986. Using unpublished data from a variety of sources, the paper concludes that, allowing for differences in the size of the engineering and construction sectors in the two countries, Britain continues to lag well behind Germany in the production of intermediate level engineering skills and in craft qualifications in the building trades. Assessments of the relative quality of the NVQ Level 2 in Construction and the German construction apprenticeship show the standard of practical competence acquired to be similar in both countries. The standard of the German tests of technical knowledge and of mathematics was judged to be well above the building trades craft level in Britain. Unlike their German counterparts, British construction and engineering trainees awarded NVQ 2 and NVQ 3 qualifications are no longer obliged to pass externally set and marked tests in occupationally-related technical skill and knowledge and in mathematics. It appears that Britain is still some way from closing the skills gap with Germany in engineering and in the building trades despite sacrificing rigour in assessment and the breadth and technical knowledge base of traditional skills training programmes and concentrating instead on work-related practical competences.

This paper was produced as part of the Centre's
Human Resources Programme

RECENT TRENDS IN ENGINEERING AND CONSTRUCTION SKILL FORMATION — UK AND GERMANY COMPARED

HILARY STEEDMAN

JULY 1997

Published by
Centre for Economic Performance
London School of Economics and Political Science
Houghton Street
London WC2A 2AE

ISBN 0 85328 566 7

RECENT TRENDS IN ENGINEERING AND CONSTRUCTION SKILL FORMATION — UK AND GERMANY COMPARED

HILARY STEEDMAN

The Centre for Economic Performance is financed by the Economic and Social Research Council.

ACKNOWLEDGEMENTS

Thanks are due to Ansgar Richter for translating the examination papers from German and for many other helpful contributions. I am also indebted to our two evaluators. Keith Marshall of the Engineering and Marine Training Authority (EMTA) has provided much helpful advice. Staff at City & Guilds and EdExcel (formerly BTEC) are thanked for help in providing unpublished statistics of awards. All errors are, of course, my own.

Dr Hilary Steedman is a Senior Research Fellow at the Centre for Economic Performance.

RECENT TRENDS IN ENGINEERING AND CONSTRUCTION SKILL FORMATION — UK AND GERMANY COMPARED

HILARY STEEDMAN

1. PROBLEMS OF DATA COLLECTION

1.1 The Situation Prior to 1992

The task of assembling reliable statistics of annual flows of individuals holding vocational qualifications has never been an easy one in Britain. Until 1992/3 each awarding body recorded and published its own examination entries and passes and information was usually only collected on awards made, not on individuals gaining awards. Double counting was, therefore unavoidable. No information was available on the age of those gaining awards so that it was only possible to obtain a general overview of the qualifications acquired by an age group from the stocks figure supplied in the Labour Force Survey. This figure had the disadvantage of not giving the area of specialisation of the vocational qualifications held so that it was not possible to use stock data to obtain a view of growth of vocational qualifications in engineering and construction. The method applied in creating the NIESR estimates of annual flows of vocational qualifications in technical fields in the 1980s was simply to obtain the annual published data from all the relevant bodies and to make laborious calculations by hand. At that time this data was not assembled by any government agency — or by any other body.

1.2 The Present Arrangements for Collecting and Publishing Data on Vocational Awards

With the introduction of National Vocational Qualifications (NVQs) the situation has become more difficult. Responsibility for collecting, classifying and publishing data on vocational awards has now passed

to the DfEE (Analytical Services Qualifications 1). The resulting datafile is known as the National Information System for Vocational Qualifications (NISVQ). The NISVQ does not collect information on all vocational qualifications awarded — there may be as many as 200 awarding bodies in England and Wales — but collects from the four major bodies, the former Business and Technician Education Council (BTEC) now EdExcel, City and Guilds (C&G), the Royal Society of Arts (RSA) and the Scottish Vocational Education Council (SCOTVEC). Possibly as a consequence of this new procedure, the main awarding bodies no longer publish their own statistics.

Annual statistics of awards made are now forwarded by the awarding bodies directly to the National Council for Vocational Qualifications (NCVQ). NCVQ then allocates the awards to an NVQ Level and forwards the information to the DfEE for inclusion in the NISVQ. The outcome of this procedure is that DfEE staff are not aware of the process whereby awards have been allocated to one NVQ level or another and NCVQ have not so far been willing to divulge the criteria used despite a number of enquiries. Nevertheless, despite ignorance of the criteria used for the allocation of awards to different NVQ levels, the DfEE publishes annual data on NVQs awarded. Considerable changes will be needed before this official source can provide useful information on, for example, the numbers of Level 3 awards in engineering for a number of recent years. As a consequence, the DfEE statistics could not be used for the purposes of this paper, namely to provide estimates of numbers of engineering and construction craft awards over the last ten years[1]. Instead, it has been

[1]DfEE Statistical Bulletin 4/96 'Awards of vocational qualifications 1991/92-1994/95' gives totals of full NVQ certificates awarded by 11 'framework areas' for the period in question. Engineering and construction are two of the 11 areas. However, there is no breakdown by Level in this table (Table 2). Table 5 provides for one year (1994/5) a breakdown of **all** awards but by SOC at the most aggregated level (9 categories). These cannot be matched to the 'framework areas' mentioned above and engineering and construction cannot be identified. Furthermore, the data is supplied in terms of percentages. The table does provide a breakdown by NVQ

necessary to request data on vocational awards from the individual awarding bodies and from NCVQ. In fact, the whole process of assembling this apparently simple set of statistics is now considerably more time-consuming than it was before the NCVQ was established when at least the awarding bodies made their statistics public. In Germany, by contrast, annual information is available over many years on apprenticeship places sought and offered, on enrolments in apprenticeships by programme area and also on passes by programme area. However, because of important changes in Germany, of which reunification is the most significant, assembling a time series of German data also presents some problems as explained in footnote 2 and in the notes to Tables 1 and 2.

Section 1 of this study examines difficulties with the data sources as a result of recent changes in collection methods. Section 2 presents flows of intermediate engineering and construction qualifications for selected years for the period 1984-1996 in Germany and Britain. Section 3 compares the quality of the NVQ qualifications in construction with the German apprenticeship while Section 4 contains a brief analysis of the aims of the two training systems together with conclusions.

2. ANNUAL FLOWS OF ENGINEERING AND CONSTRUCTION SKILLS 1984-1996

Level but sums vertically, thus telling us what percentage of all Level 3 awards were awarded to those employed in eg *Clerical and Secretarial* but not what percentage of all awards in *Clerical and Secretarial* were made at Level 3. Table 6 introduces a third classification by 'subject area', *engineering production and design* is included as is also *construction and architecture*. It is not clear what year this Table relates to. Again, information is presented in percentages and summed vertically so that while we can observe that *engineering production and design* contributes 4% of all Level 2 awards, we cannot tell what percentage of all *engineering production and design* awards are made at Level 2.

This section reports the results of investigations of the differences between the two countries in the output of certificated skills in two important sectors of economic activity. In studies carried out at the National Institute of Economic and Social Research (NIESR) between 1984 and 1995 researchers found that the great difference between Britain and Germany in terms of qualifications held lay not in the quality or standard of the awards in the two countries but in the far greater numbers gaining vocational qualifications in Germany compared to Britain (Prais, 1995). Since those studies were carried out, a comparison has been published of the production and deployment of post-graduate engineers and scientists in the two countries (Mason and Wagner, 1994), Prais (*op cit*) showed City & Guilds passes in selected engineering occupations and in the building trades for 1989 compared to Germany, and Bierhoff and Prais (1997) compared percentages of 19 year olds passing vocational examinations in five occupational groups (including engineering and construction) in Britain, Germany and Switzerland.

This paper reports an attempt to update comparisons of the flows of engineering and construction skills in Germany and Britain (Steedman 1988, 1992; and Prais, *op cit*) within the limitations imposed by difficulties with the recent data outlined above.

2.1 Engineering Craft Qualifications

Table 1 compares numbers of engineering qualifications awarded at craft level in Germany (former West Germany only) and Britain for a series of recent years[2]. The term craft is used here because it is widely

[2]A number of problems have arisen as a result of attempting comparisons of occupational qualifications in two countries over an eleven year time period. Firstly, it became clear on looking at the City & Guilds passes for Britain that over this period there had been a shift from certain specialisms within engineering to others, some of them new. It was not, therefore possible to follow the sub-set of engineering qualifications examined in Prais and Wagner (1983) and in Steedman

understood by all those working in the engineering industry as denoting a distinct and substantial level of skill. Observation of British and German engineering companies has confirmed that those classified to craft level by the industry and by their prior qualifications operate at similar levels of responsibility and skill within the organisation. However, it has been pointed out that the term craft is becoming more problematic in engineering as the distinction between craft and technician employees becomes blurred by wider changes in the organisation of production. A further complicating factor is the recent trend in engineering towards the up-skilling of semi-skilled employees to 'single-skill' craft status usually by means of an NVQ Level 2 assessment (see Notes to Table 1). While it is not claimed that this new 'craft' level is equivalent to the traditional craft standard, insofar as it certificates additional skills acquired as opposed to the certification of

---

(1988). Instead, a more comprehensive definition of the British engineering qualifications has been used for all years. Consequently, in Table 1, I have taken as the definition of engineering qualifications all those qualifications classified to engineering by the awarding bodies in Britain at both craft and lower technician level. Similar problems arise for Germany. The classification of apprenticeship training occupations was revised in 1992 and complete consistency with earlier years and in particular with the limited range of engineering qualifications identified in Prais and Wagner (1983) and used again in Steedman (1988) is not possible. To overcome this problem, German (craft) engineering qualifications have been redefined in line with the redefinition for Britain to include all the main categories of engineering qualifications. The categories used are numbers 22, 25,26,27, 28,29,30,31 from the Classification of Occupations (revised 1992) of the *Statistisches Bundesamt.* Previous comparisons (Steedman, *op cit*) recorded numbers of qualifications awarded at two levels, craft and technician. This somewhat overstated the German advantage since, in Britain, the set of individuals holding craft qualifications hardly overlaps with the set holding technician qualifications. In Germany, on the other hand, *Meister* and *Techniker* must all have first obtained an apprenticeship and their inclusion results in a degree of double counting of the German qualifications. *Meister* and *Techniker* qualifications have not therefore been included for Germany. As a result of all these changes, the figures in Table 1 are not consistent with earlier comparisons referenced above.

skills already acquired, this development may be contributing to an overall increase in skill levels in the industry.

TABLE 1

Under 25 Year Olds Qualifying at Craft Level in All Engineering Trades, Britain and Germany(a) 1985-1996

	1985	1984	1992	1992	1995	1995	1996	1996
	BRITAIN	**GERMANY**	**BRITAIN**	**GERMANY**	**BRITAIN**	**GERMANY**	**BRITAIN**	**GERMANY**
Craft (b)	17,600	161,400	11,000	107,800	10,900	105,400	11,000	97,900(f)
NVQ 3 (c)	n/a		1,500		12,200		28,100	
Technician (d)	20,500		17,800		13,500		12,000	
Unadjusted Total	38,100	161,400	30,300	107,800	36,600	105,400	51,100	97,900
Adjusted Total	**38,100**	**161,400**	**30,300**	**107,800**	**26,500(e)**	**105,400(f)**	**35,700(e)**	**97,900**
As Percentage of 20 Year Old Age Cohort	4.34	13.78	3.86	14.7	4.3	16.39	6.1	16.58

Notes: **(a)** West Germany and former West German territory. **(b)** Passes at City & Guilds Part II Course numbers 20-29 inclusive (2 digit level). For Germany all engineering apprenticeships (Course numbers 22, 25,26, 27, 28,29,30, 31). Although some re-allocation of apprenticeships to occupational categories took place in the 1992 revision of the classification of apprentice occupations, overall this did not materially affect the categories considered here. **(c)** All NVQ passes recorded over a twelve month period (last quarter of previous year, first three quarters of year given in Table 1 in NVQ Framework Area 4 *Engineering* Awards at Level 3. In addition to Level 3, 49,494 passes at NVQ 2 (Foundation) Level were recorded in engineering (cumulatively) to 1995; however, these are not recognised by the industry as being at the level of a traditional engineering craft qualification and may be of a similar standard to the German *Angelernte* status corresponding to a trained semi-skilled employee below craft level in Germany and not included in this table. **(d)** All BTEC awards in engineering at Ordinary National

Certificate and Ordinary National Diploma Level. **(e)** It is estimated that since NVQs became established around 1992 some 6,000 NVQ 3 awards a year in engineering are made to candidates who also acquire a pass at C&G Part II and the total number of awards has been adjusted downwards by 6000 for 1995 and 1996. Furthermore, around one third of NVQ awards are made to individuals aged 25 and over (DfEE Statistical Bulletin 4/96 Table 4a) and to achieve consistency with German apprenticeship qualifications which are normally only awarded to young people under 25 the adjusted total has been reduced by one third of all NVQs awarded in 1995 and 1996 This adjustment also helps to solve the problem of discounting for 'grandfather rights' ie the practice of awarding NVQ 3 certificates to employees who already hold craft awards or craft status. It is assumed that most of these will be aged 25 and over. **(f)** German reunification in 1990 resulted in training statistics being prepared in 1993 and in 1995 for the whole of Germany whereas previous figures related to West Germany. To allow for this change, 1995 totals for the whole of Germany have been reduced by 17% to reflect the proportions of all trainees recruited from former East Germany. **(g)** Figures for Germany for 1996 not yet available. This estimate based on 1995 numbers reduced by 3% to correspond to the overall fall in numbers apprenticed in 1993/1992.

Source: Britain: City & Guilds Examination Statistics 1985, 1992; Unpublished tabulations prepared by City & Guilds; Unpublished tabulations prepared by BTEC Unpublished tabulations prepared by NCVQ and *Annual NVQ Statistics Supplement* 1997; Germany: *Statistisches Jahrbuch* 1986, 1994, and *Statistisches Bundesamt, Fachserie 11, Reihe 3, Berufliche Bildung* 1995.

Table 1 shows that, despite rebasing the calculations to reduce the advantage to Germany of including technician level qualifications (see footnote 2), the German advantage remains substantial. In Britain, passes at City & Guilds Part II and at technician level fell by around 40% over the period 1985-1996 although the fall now seems to have slowed and the steady state may reflect an appreciation by engineering companies of the need for technical knowledge and understanding in addition to NVQ competences. For this reason it is estimated that roughly half of all City & Guilds Part II awards are made to individuals who are also awarded an NVQ at Level 3 and these have been discounted from the totals in Table 1. In 1995, numbers gaining NVQ 3 awards were insufficient to make good the fall in 'traditional' qualifications. In 1996, however, awards at NVQ 3 level were more

than double those of 1995 and for the first time since 1985 total (discounted) numbers rose above 35,000. After discounting (see Notes to Table 1 above), it appears that NVQ 3 awards to young people under the age of 25 are only now (1996) beginning to compensate for the fall in City & Guilds and BTEC awards which occurred following the introduction of NVQs in the late 1980s. It is as yet too early to include GNVQ 3 (Advanced) qualifications in engineering since these were launched on a pilot basis only in 1994. The recent very great volatility in annual numbers of Level 3 NVQs awarded makes it difficult to predict future trends at this point.

In both countries, the size of the relevant age group has declined steadily throughout the 1980s and early 1990s. The rate of decline has been somewhat steeper in Germany than in Britain. In Britain, the 1996 20 year old cohort was 63% of the 1984 cohort, in Germany the corresponding figure for 1994 was 57%. In Germany, overall numbers qualifying have declined between 1985 and 1996 by less than the fall in the age groups (40%), in other words, German engineering employers have been employing fewer apprentices but these have constituted increasing proportions of the available age groups. In Britain, a slightly larger percentage of the age group (6.1%) received engineering training in 1996 than in 1985 (4.3%).

Detailed comparisons of German apprenticeship examinations in engineering with National Vocational Qualifications similar to those described for the construction sector below have not yet been carried out. However, on the basis of experience of other sector comparisons it seems likely that the NVQ 3 qualification alone would not be allowed to be equivalent to the German apprenticeship unless complemented by a pass at City & Guilds Part II or BTEC ONC/OND since all German apprenticeship qualifications require passes in written tests of mathematics and technical subjects. But if we leave aside questions of equivalence for the moment, we can see that the gap between Britain and Germany in numbers of engineering craftsmen/women produced has been narrowed — Germany out-produces Britain by just under three to one in 1996 rather than by over

four to one in 1985. However, the closing of the gap has resulted largely from a fall in output in Germany and not from an increase in numbers qualifying in Britain.

Germany's historical comparative advantage in engineering is well known and is reflected in the weight of the German engineering industry in the economy as a whole (40% of all manufacturing employment compared to 28% in Britain). From the European Labour Force Survey (NACE 30 category) it appears that employment in engineering in Germany is around twice that of the UK. Allowing for this difference Britain has continued to produce fewer engineering craftsmen/women than Germany in relation to the size of employment in the sector over the period 1985-1996 and the gap has narrowed only in the most recent year considered here (1996). If Britain aimed to produce annual flows of young people qualified in a ratio similar to total engineering employment as in Germany, annual output in Britain would need to be higher than in 1996 by around one half of the estimated 36,000 under 25 year-olds trained in 1996. This is turn would mean recruiting around 10% of all young people into engineering training as opposed to around 6% at present.

Studies comparing manufacturing in Britain with other European countries have drawn attention to the importance of engineering skills in ensuring high standards of maintenance and production flow in a wide range of manufacturing industries (Prais, *op cit*; Mason, van Ark and Wagner, 1994). Because differences between the two countries in the size of manufacturing as a whole are less than in engineering, the production of engineering skills in the two countries viewed in relation to manufacturing shows an even less favourable ratio than in engineering alone. Britain would need to double the current output of engineering awards to equal the German ratio of annual engineering awards to employment in manufacturing.

2.2 Craft Qualifications in the Construction Sector

For engineering, the comparator craft qualifications selected for Britain and Germany were NVQ 3 and City & Guilds Part II (considered an NVQ 3 equivalent) and the German apprenticeship qualification. For construction, the choice of comparator qualification is less straightforward. The comparisons reported in this paper (Section 3 below) of NVQ 2 and 3 in construction and the German apprenticeship have indicated that the German qualification is broader than NVQ 2 in terms of underpinning knowledge and general education requirements but possibly on a level with NVQ 2 in terms of practical skills required. The C&G Part II qualification in construction has been judged to be at the level of the construction NVQ 2 — possibly reflecting the higher standard of the NVQ 2 in construction relative to other NVQ 2 qualifications. For construction, therefore, the comparator qualifications selected are NVQ 2/City & Guilds Part II and the German apprenticeship. It should be understood that, as for engineering, the aim is to establish annual flows in each country of individuals qualified at 'craft' level as that level is defined in each country; that is, setting NVQ 2/City & Guilds against the German apprenticeship in Table 2 below does not imply equivalence of the two qualifications, but is based on the fact that in each country those qualifications are defined as 'craft' level.
Questions of equivalence are addressed in Section 3 below.

TABLE 2

Under 25 Year Olds Qualifying at Craft Level in Construction, Britain and Germany(a) 1984-96

Year		City & Guilds (b)	NVQ Level 2 (c)	Unadjusted Total	Adjusted Total
1984	Britain	12,500	n/a	12,500	12,500
1984	Germany			59,800	59,800
1991	Britain	23,700	300	24,000	24,000
1991	Germany			32,200	32,200
1993	Britain	6,500	12,600	19,100	14,900(d)
1993	Germany				37,900
1995	Britain	600	14,000	14,600	9,900(d)
1995	Germany				40,200
1996	Britain	300	10,900	11,200	7,600(d)
1996	Germany				39,000(e)

Notes: **(a)** West Germany and former West Germany only; apprenticeship passes 1984 and 1991 for training occupations 44-46, 48, 49,51; following the reclassification of vocational training occupations, categories used for 1993 and

1995 are for training occupations 44, 46, 48, 5010 and 51; German reunification in 1990 resulted in training statistics being prepared in 1993 and in 1995 for the whole of Germany whereas previous figures related to West Germany. To allow for this change, 1993 and 1995 figures for the whole of Germany have been reduced by 13% and 17% respectively**.** **(b)** Britain, City & Guilds Part II awards in carpentry and joinery, brickwork and masonry, plastering, tiling, painting and decorating, plumbing. **(c)**All NVQ passes recorded over a twelve month period (last quarter of previous year, first three quarters of year given in Table 2) at Level 2 awarded in NVQ Framework area 3 (Constructing). **(d)** Around one third of NVQ awards are made to individuals aged 25 and over (DfEE Statistical Bulletin 4/96 Table 3a) and to achieve consistency with German apprenticeship qualifications which are normally only awarded to young people under 25, the adjusted total has been reduced by one third of all NVQs awarded in 1993, 1995 and 1996. **(e)** Figures for Germany for 1996 not yet available. This estimate based on 1995 numbers reduced by 3% to correspond to the overall fall in numbers apprenticed in 1993/1992. n/a — not available.

Source: Britain: City & Guilds Examination Statistics 1984, 1992, 1993 and special tabulations prepared by City &Guilds; Unpublished tables supplied by NCVQ. Germany: *Statistisches Jahrbuch* 1985, 1992, 1994, 1995 *Statistisches Bundesamt, Fachserie 11, Reihe 3, Berufliche Bildung* 1993, 1995**.**

Table 2 shows that numbers of City & Guilds craft level awards in the construction trades more than doubled in the period 1983-1991 but fell back after 1991 when government funding for Youth Training was made conditional on the trainee working towards an NVQ qualification (Steedman, 1992). The results of that policy are clear to see in the numbers of City & Guilds awards made since 1991. By 1993 City & Guilds awards were just over a quarter of their 1991 level and by 1996 had practically disappeared. Despite an increase in numbers of NVQ 2 awards between 1991 and 1993, the increase was not sufficient to bring construction craft level awards back to the total awarded in 1991. In Germany, numbers obtaining apprenticeship certificates in equivalent areas fell substantially between 1984 and 1991, recovering somewhat by 1993 when they stood at 63% of their 1985 level. While Britain had almost drawn level with Germany in construction qualifications awarded in 1991 (after allowing for

differences in numbers employed in the sector in the two countries), by 1996 the gap had widened again dramatically and the number of German awards was five times the British figure. Even allowing for the fact that employment in the construction sector is higher in (West) Germany than in Britain by around 50% (Clarke and Wall, 1996) it appears that a significant skills gap in output of qualified construction workers persists in Britain compared to Germany. Unlike in engineering, where qualifications awarded have increased sharply in 1996/1995, in construction, awards have declined every year since 1991. In 1996 the number of craft level awards made in England was less than half those in 1991.

3. THE STANDARDS OF NVQs COMPARED TO THE GERMAN *BERUFSABSCHLUSS*: WHAT DO GERMAN APPRENTICES LEARN?

3.1 Earlier Comparisons of German and British Vocational Qualifications and Examination Papers in the Building Trades

Some thirteen years ago, a NIESR study compared the range and type of assessment of craft level qualifications (*Berufsabschluss* and City & Guilds Part II and Part III) as part of a wider study of the process of skill development in Germany and Britain (Prais and Wagner, 1983). The comparator qualifications for Britain considered in that study were City & Guilds certificates at Part II and Part III. At the time that the NIESR study was carried out (1981), 2, 333 passes a year were recorded in Bricklaying at City & Guilds Part II and 1,433 passes at Part III; the understanding was that trainee bricklayers in Britain had taken the Part II examination after two years of the training period and that over half had taken Part III at the end of the third year. The methods used to carry out this comparison (exchange of examination papers, discussions with experts) are similar to those used in the study

described below. The conclusion reached in that study was that many of the questions on the written papers testing technology and industry-related knowledge were of a broadly similar standard in the two countries. The judgement reached at that time was that 'by the end of their three year course German brickwork apprentices would have been able to tackle most of the questions in the City & Guilds examinations at both Part II and Part III levels, though some of the questions were judged difficult, and some topics lay outside their scope (pipe-laying, drainage)'.

It was therefore established thirteen years ago that the German *Berufsabschluss* standard lay somewhere between City & Guilds Part II (Craft) and City & Guilds Part III standard (Advanced Craft). The most striking difference between the two countries arose from the disparity in numbers trained. In the same range of occupations in 1981, Germany trained over five times as many to craft standard compared to Britain.

In 1985, shortly after the NIESR study was carried out, new training frameworks (*Rahmenlehrplan)* were issued for the main construction occupations in Germany. In Britain at around this time, a process of restructuring and expanding of vocational qualifications was initiated starting with the establishment of the NCVQ in 1986. In both countries, therefore, the qualifications examined in the original NIESR study changed — quite considerably in the English case — in the 1980s and the need for a fresh comparison became obvious.

In 1992, work started at the NIESR comparing the range and scope of the mathematics syllabus prescribed for building apprentices in Germany, France and Britain as part of the 'underpinning knowledge component' of apprenticeship courses and taught off-the-job in educational/training establishments. Results were made available in two papers (Steedman, 1992; Steedman and Hawkins, 1994). Since, at this time, the switch from City & Guilds to the NVQ 2 qualification was taking place in many colleges training young people, the comparisons carried out for these studies included both City & Guilds Part II and NVQ Level 2 qualifications in Britain.

The conclusions from these studies were that the mathematics syllabus for City & Guilds Part II covered many (but not all) of the topics prescribed for study in the corresponding French and German apprenticeship programmes. The German programme of study in mathematics for bricklayers required knowledge of some topics lying at Level 9 of the English National Curriculum while the French programme included some topics in algebra at NC Level 8 not required in England or Germany. These topics were generally outside the range of the mathematics required for the syllabus of the Part II qualification of the City & Guilds. The NVQ 2 required a considerably more restricted range of topics in mathematics and at a lower level than either the old City & Guilds and the current French and German qualifications.

Since 1992, when comparisons had focused solely upon the mathematics required for NVQ 2, the NVQ 3 and GNVQ Level 3 had been developed. When requested by the British government to contribute to a Skills Audit to inform the government's White Paper on Competitiveness published in 1996 (DfEE 1996 and HMSO 1996), it became necessary to try to understand better the equivalence of all components of the German *Berufsabschluss* with regard to these new levels. The comparison published below first appeared in the report published by the Centre for Economic Performance detailing the results of the comparisons of education and training standards carried out for the Skills Audit. (Steedman, Green, Bertrand *et al*, 1997.)

3.2 The Choice of Vocational Areas to be Compared Between the Two Countries

Data obtained from the German *Mikrozensus* showed that in 1993 a very high proportion (80%) of 25-28 year olds in former West Germany held an apprenticeship or higher qualification. Of these, only a small proportion (6%) had passed through apprenticeship programmes which were of less than 3 years duration. Around one half of all those with apprenticeship qualifications in this age group had previously gained

the *Realschulabschluss* (usually considered equivalent to 3 or more GCSEs Grades A-C including English and Mathematics) and the remainder had gained the *Hauptschulabschluss* (usually considered equivalent to 3 or more GCSEs Grades D/E including English and Mathematics). A negligible number gained an apprenticeship without holding either a *Realschulabschluss* or a *Hauptschulabschluss*. Within the group of German young people gaining an apprenticeship qualification, those gaining a qualification in any building occupation constitute some 6% of all apprenticeship certificates gained, of these, bricklayers are the single largest group. For male apprentices, bricklaying was the third most important group of apprenticeships (after car repair and electrical apprenticeships).

For the Skills Audit comparisons two German apprenticeship qualifications were scrutinised; both attracted substantial numbers of applicants for apprenticeship. The first, *Industriekaufmann/frau* (business administration) normally accepted only young people holding at least the *Realschulabschluss*, the second was that of *Maurer/in (bricklayer)* for which most applicants for apprenticeship held the *Hauptschulabschluss* only. Here only the work carried out on bricklaying is reported.

As pointed out above, most building apprentices hold the *Hauptschulabschluss*, judged in our report (Steedman, Green, Bertrand *et al, op cit*) to be closer to a GCSE Grade D standard. In England, a normal progression on that basis might be to Level 2 (G)NVQ in one year and to Level 3 in a further two years, making three years in all. A similar progression could be expected for NVQ 2 and NVQ 3. Since the German apprenticeship lasts for 3 years, with the first year full time in college, it did not seem out of line with this pattern of progression to expect that the German bricklaying apprenticeship could also reach a level similar to NVQ 3 during the three year period of apprenticeship rather than NVQ 2. It will be recalled that previous comparisons had placed the German bricklaying apprenticeship closer to Part III City & Guilds standard than to Part II.

3.3 Methodology

For these most recent comparisons the German examination papers set to German apprentice bricklayers in their final year examinations were translated into English. Independent evaluations were commissioned from two training experts with experience of teaching and examining in the relevant area (hereafter referred to as Evaluator A and Evaluator B). Evaluator A was selected by the Industry Lead Body; Evaluator B is Head of Construction at a College of Further Education. The evaluators were asked to have regard to the whole range of qualifications available in Britain at Level 2 and Level 3 including the traditional qualifications offered by the City & Guilds and by BTEC and to suggest the most appropriate comparator qualification type and level.

Examinations necessarily only sample the whole range of topics and skills prescribed for the German apprenticeship. By contrast the NVQ tests all competences listed as comprising a particular area of economic activity. These differences are important in studies aiming to establish with some precision a degree of comparability between different qualifications. Space does not here permit a detailed discussion of these issues. The purpose today is to set out the evidence that exists on what is learned by German and British apprentice/trainee bricklayers based upon scrutiny of the tests they undergo to achieve an award. It is, however, assumed that the range and scope of the examinations set to the German apprentices gives a reliable indication of the standard of knowledge and skills that these apprentices have tackled in the course of their studies. Externally-set and marked multiple choice written examinations are set to German bricklaying apprentices in the following subjects:-

Technical Drawing 1 1/4 hours
Economic and Social Studies 30 minutes
Technical Mathematics 1 1/2 hours
Technology 1 1/4 hours

Practical examination 7 1/2 hours

The overall pass mark is 50% and compensation is permitted between papers; a failure on the Technology paper which is weighted by a factor of 1.5 in the calculation of the final mark is deemed an overall failure. For this reason, the evaluators were asked to concentrate their scrutiny upon the Technology paper.

3.4 Results of the Evaluation

Space does not permit a full presentation of the differences between sets of NVQ competences and the German apprenticeship programmes (set out at length in Steedman, Green, Bertrand *et al*, 1997). This section concentrates on the elements of the German programme tested in the final examination and the extent to which these elements were also specified in the relevant NVQ sets of competences and/or City & Guilds awards.

In **Technical Drawing**, Evaluator A pointed out that many of the twenty questions in this paper required the use of calculations for adding, subtracting and deducing. Unlike in the Technical Mathematics paper, calculators were not allowed for this test. A good knowledge of symbols and understanding and comprehension of different points of an object was expected in the test. It was concluded from this report and our own examination of the papers that a competent student could be expected to be capable of interpreting and working from a site drawing. Evaluator B pointed out that 'being able to interpret construction working drawings is a very important part of any craftperson's job' and was 'very impressed with the requirements of the technical drawing examination'.

In **Technical Mathematics**, Evaluator A pointed out that the twenty questions were devised 'mostly around abstract shapes', although it should be pointed out that all were 'contextualised' to the extent that they referred to, for example, calculating volumes of concrete, the width of a trench, or the mass of a concrete beam. The

calculations required determining volumes, slopes, pricing, mass, pressure, cubic quantity, linear measurement and areas. In the opinion of Evaluator A, ‘ the knowledge necessary to perform these calculations is beyond the needs of a bricklayer’. Evaluator B’s view was distinctly more positive — the Technical Mathematics ‘extends the candidate by placing various mathematical principles within relevant applied tasks’ and is ‘markedly more difficult than anything the NVQ would expect’.

The **Economic and Social Studies** paper is not specifically commented upon by Evaluator A but it is suggested that NVQ units 333 and 334 might be considered similar. A better comparator paper might be found at GNVQ Level 2 or Level 3 in Construction and the Built Environment. Questions cover the functioning of businesses within the economy eg ‘Who manages a plc?’, the rights and obligations of employees and the role of trade unions in the workplace. However, Evaluator B considers this paper similar to the Industrial Studies paper previously used for the City & Guilds Craft Certificate (a paper set and marked internally).

The German **Practical Examination** requires the apprentice to work from a technical drawing. The drawing is considered to be similar to that ‘once used in the City & Guilds Craft/Advanced Craft examinations’. Evaluator A criticises the German test in comparison with the NVQ practical requirements because it does not test skills of incorporating frames into brickwork, using blocks or laying a damp-proof course. In the view of Evaluator A, the German practical examination does not test such a wide range of skills as are tested by NVQs, being limited essentially to plumbing (using a plumb line) skills, setting out and maintaining the bond. Evaluator B considers that ‘an NVQ Level 3 student on a **quality** programme would find this task reasonable to complete with the possible exception of the outdated quarter brick reveal’.

The **Technology** paper is the one given the most weight within the German papers and consists of 60 multiple choice questions. A comparison with examination papers for City & Guilds Craft Parts I

and II and with knowledge questions and practical competences specified for NVQ 2 and 3 is entirely feasible.

Evaluator A points out that a number of skills thought essential for a bricklayer in England are not covered at any point in the German Technology examinations, these are principally all aspects of damp-proof courses, weathering of exposed walls and types of joint finishes to masonry. Evaluator A goes on to comment that the German questions cover a wide range of skills required on the building site together with a range of questions 'useful for an overall awareness and understanding of the work environment'. Evaluator B analysed the extent to which the topics tested in the German **Technology** paper overlapped with those tested in comparable British tests/specification of competences. This analysis is reported in Table 3 below.

TABLE 3

Test Questions of Similar Topic and Standard in the German Technology Paper and English NVQ 2, C&G Craft and Advanced Craft

(Numbers of similar questions expressed as percentage of all questions on the British papers)

Examination paper	Number of similar questions found in German paper	Percentage %
NVQ Levels 2 and 3	25	42
C&G Craft and Advanced Craft Certificate	50	84

Evaluator A concluded that the overall style of the examination is reminiscent of the City & Guilds Advanced Craft and the interpretation put forward by the Industry Lead Body was that the questions are generally similar to that at Advanced Craft City & Guilds. Evaluator B independently came to a similar conclusion based on the analysis given above. Evaluator A did not consider that the examination 'would guarantee that a person could operate successfully on site' and Evaluator B had similar doubts based upon the practical examination where, he assumed, a pass might still be possible even if the practical examination was not carried out to the normal standards of the industry. The interim judgement arrived at, based on the two evaluations is that a British candidate who had obtained a City & Guilds Advanced Craft certificate would probably have no difficulty in passing the German Technology paper. It was less clear whether a candidate who had passed City & Guilds Craft or at NVQ Levels 2 or 3 would be able to answer correctly half the questions on the German Technology paper and thus reach the 50% pass mark.

3.5 Differences in Aims of British and German Training for Young People

The fundamental differences between the aims of training programmes for apprentices/young people in the two countries need to be understood in order to offer an explanations for the contrasts pointed to by the two evaluators. Some differences of emphasis and coverage of the two sets of papers can be understood with reference to the differing methods of construction and range of responsibilities of building craftsmen in the two countries (Clarke and Wall, *op cit*)

More fundamental, however, is the contrast between the range of skills produced by the German apprenticeship and the English NVQ sets of competences.

The German apprenticeship programme is a partnership between education authorities and firms which has the dual aim of fulfilling the obligation of a young person to continue in part-time schooling until

age 18 alongside an obligation to a company to learn and practise an occupation. It is as a result of this dual structure that much of what is tested in the German apprenticeship examinations is not required by an individual who merely intends to acquire good bricklaying skills. Apprenticeships are normally only available to young people and different sets of qualifications are available for adults.

These dual aims, which are, of course, very different from the NVQ concept, aim only to bring a young person to 'entry level' competence in their occupation and not to that of an experienced worker. In Germany, special wage rates for employees in their first few years after apprenticeship are normally negotiated with employers which are lower than the rate for an experienced worker and reflect the fact that the ex-apprentice will continue to learn and improve after finishing an apprenticeship.

The sets of competences defined for an NVQ in a given area and at a given level are, by contrast more focussed and explicitly designed to bring the trainee to a standard which will make him/her operational on site within as short a time as possible. They are succinctly summed up by Evaluator A 'The bricklayer's role is still to lay bricks, accurately and to good practice/Regulations in the type of construction used within the industry. The NVQ system addresses these requirements'.

The broader educational content of the German apprenticeship is often justified on the basis of the fact that the **costs** of the German apprenticeship are shared between the individual apprentice (who accepts trainee wages for a fixed period), the education authorities and the employer. It is then argued that the apprentice has the right to acquire a broader range of skills and knowledge which can be applied in a wider context than just the chosen trade. In other words, the training given should not just be 'good for the industry and the employer' but 'good for the individual' by enhancing flexibility and future prospects of skill development and transfer.

It might be expected that the more narrowly-focussed NVQ competences would have a different funding basis from that of the

German apprenticeship, ie that costs would be met entirely by the employer. In the case of adult employees, this is normally the case. It is not, however the case for young people, most of whom are funded in part by the DfEE and by their acceptance of a trainee wage (wages foregone). We need then to ask ourselves and the successive Secretaries of State responsible, how it is that since the introduction of NVQs for young people in 1990, public funds have been committed to funding NVQ qualifications for young people without any insistence by the responsible authorities on a balance of broader education combined with specific trade training for employment?

The young men in Germany who choose to follow a bricklayers apprenticeship are in terms of aptitudes and abilities very similar to the young people who enter the construction trades in this country. Thus the German example of the very sound achievements in basic technical education of these young apprentices shows all too clearly how much more could have been achieved with those young people who have been offered only the NVQ route during the last six years and with those who have gone straight to jobs at 16 with no training.

The recommendation of the Dearing Review of Qualifications for 16-19 Year Olds that all young persons receiving training financed out of public funds should receive some instruction in 'key skills' is a very belated step in this direction. (Dearing, 1996.) The Clarke and Wall study (*op cit*) has shown how quality training translates into quality buildings. But, looking at present standards specified, it seems unlikely that Britain's 'key skills' will match up to the Technical Drawing and Technical Mathematics mastered by German apprentices. Serious note should be taken of the sound technical and numeracy foundation achieved by German young people from around the same percentiles of the ability/attainment range as the British YT trainees. The standards reached by, for example, young Germans clearly show what can be achieved with so-called 'low achievers' where good quality training and education is provided by a partnership of employers, unions and government and the incentives to persevere with training are built into labour market and wage regulation mechanisms.

4. CONCLUSIONS

It could be argued that the considerable public expenditure on the setting-up, implementation and running of the NCVQ and National Vocational Qualifications (Robinson, 1996) could be justified if it could be seen to have led to a narrowing of the skills gap between Britain and other European countries. The first point to make is that the creation of the NCVQ has rendered the task of measuring that gap infinitely more difficult than it was before its arrival. In particular, the practices on publication of vocational training statistics adopted by NCVQ have removed from public scrutiny the data which would permit the monitoring of flows of certificated skills in key employment areas. Work is now in hand at the DfEE to address these difficulties; it is hard to understand how they could have been allowed to arise in the first place.

Using unpublished data from a variety of sources, the paper concludes that, allowing for differences in the size of the engineering and construction sectors in the two countries, Britain continues to lag behind Germany in the production of intermediate level engineering skills and in craft qualifications in the building trades. The continuing decline in craft awards in the building trades is of particular concern.

Assessments of the relative quality of the NVQ Level 2 in Construction and the German construction apprenticeship show the standard of practical competence acquired to be similar in both countries. The standard of the German tests of technical knowledge and of mathematics was judged to be well above the building trades craft level in Britain. Unlike their German counterparts, British construction and engineering trainees awarded NVQ 2 and NVQ 3 qualifications are no longer obliged to pass externally set and marked tests in occupationally-related technical skill and knowledge and in mathematics. It appears that Britain is still some way from closing the skills gap with Germany in engineering and in the building trades despite sacrificing rigour in assessment and the breadth and technical

knowledge base of traditional skills training programmes and concentrating instead on work-related practical competences.

REFERENCES

Bierhoff, H. and Prais, S.J. (1997) *From School to Productive Work: Britain and Switzerland Compared*, Cambridge University Press.

Dearing, R. (1996) *Review of Qualifications for 16-19 Year Olds*, SCAA Publications, March.

DfEE and Cabinet Office (1996) *The Skills Audit: A Report from an Interdepartmental Group* Occasional Paper.

Clarke, L. and Wall, C. (1996) *Skills and the Construction Process: A Comparative Study of Vocational Training and Quality*, Policy Press and Joseph Rowntree Foundation.

HMSO (1996) *Competitiveness: Creating the Enterprise Centre of Europe*, Cm3300 London: HMSO.

Mason, G. and Wagner, K. (1994) *High-Level Skills and Industrial Competitiveness: Post-Graduate Engineers and Scientists in Britain and Germany*, NIESR Report Series No.6.

Mason, G. van Ark, B. and Wagner, K. (1994) 'Productivity, Product Quality and Workforce Skills: Food Processing in Four European Countries', National Institute Economic Review, February.

Prais, S.J. and Wagner, K. (1983) 'Aspects of Human Capital Investment: Training Standards in Five Occupations in Britain and Germany', National Institute Economic Review, August.

Prais, S.J. (1995) *Productivity, Education and Training*, Cambridge University Press.

Robinson, P. (1996) *Rhetoric and Reality: Britain's New Vocational Qualifications,* Centre for Economic Performance Special Report.

Steedman, H. and Hawkins, J. (1994) 'Shifting Foundations: The Impact of NVQs on Youth Training for the Building Trades', National Institute Economic Review, August.

Steedman, H. (1988) 'Vocational Training in France and Britain: Mechanical and Electrical Craftsmen', National Institute Economic Review, November.

Steedman, H. (1992) 'Mathematics in Vocational Training for the Building Trades in Britain, France and Germany', National Institute for Economic and Social Research Discussion Paper No.9, March.

Steedman, H., Green, A. and Bertrand, O., Richter, A., Rubin, M., Weber, K. (1997) *Assessment, Qualifications and Standards: The UK compared to France, Germany, Singapore and the US,* Centre for Economic Performance Technical Report, London School of Economics and Political Science.