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Introduction

The term STEM groups together the subjects of Science, Technology, Engineering and Mathematics. The Further Education (FE) and Skills sector has an essential role to play in STEM education by improving progression through STEM related subjects for both adults and young people and servicing the needs of employers with a suitably qualified workforce. The figures and charts in this report provide firm evidence on how the sector undertakes that role and allow:

- Those from the FE and Skills community to assess the scale and distribution of publicly funded STEM qualifications being undertaken in the FE and Skills sector in England.
- Those from the S, T, E and M communities to assess the contribution that the FE and Skills sector in England makes to their subjects and disciplines.
- Public policy makers to see a more complete picture of S, T, E and M provision in England, complementing what is already published for schools by the Department for Education and the Joint Council for Qualifications and what is published for Higher Education by the Higher Education Statistics Agency.

The report builds on the FE and Skills STEM Data report published in October 2010. It uses the same classified list of S, T, E and M qualifications as the October 2010 report compiled through an analysis of the Register of Regulated Qualifications and the Learning Aim Database updated with the most recent completions and achievements data taken from the Individualised Learner Record and the National Pupil Database. It is providing the basis for ongoing research on the wage returns from STEM qualifications.

The data included in this report illustrate a number of headline messages that have been agreed by the project Advisory Group which has a membership drawn from across the S, T, E, M and FE and Skills communities. These are set out in the dark green text boxes on pages 3–30 supported by additional observations made in 35 light green boxes.

Key topics which require more than an examination of the data alone were considered at three ‘roundtable’ discussions on ‘Complexity’, ‘Progression’ and ‘Mathematics’ held during the course of the project. The key findings are included in the main body of the report, but for completeness a summary of each meeting is included in the Appendix.

The FE STEM Data Project has provided long overdue insight into the various ways that the FE and Skills sector in England contributes to the education and training of young people and adults. Deeper and continuing exploration and analysis must follow to provide the sound evidence base required to inform future public policy.
Key findings: Overview

Proportion of funded qualifications achieved in the FE and Skills Sector which can be classified as STEM in academic year 2009/10

A total of 1,744,000 STEM qualifications were achieved in 2009/10 measured in terms of numbers of qualifications achieved across all qualification levels and all ages (post 16).

Not STEM: 72%
STEM: 28%

A further 0.64 million were taken in schools (as measured by completions).

Proportion of funded STEM qualifications completed by 16–18 year olds in Schools and the FE and Skills sector in 2009/10

943,000
60%
639,000
40%

Proportions of funded qualifications achieved in S, T, E and M in the FE and Skills Sector in academic year 2009/10

Not STEM: 72%
Science: 4%
Technology: 7%
Engineering: 6%
Mathematics: 5%
Numeracy: 6%

S, T, E and M qualifications account for 28% of all achievements in the FE and Skills sector. However, at Levels 1, 2 and 3 the proportions are in the range 34–40%.

In 2009/10, 1.74 million publicly funded S, T, E and M qualifications were achieved by people aged 16+ in the FE and Skills sector in England, with a further 0.64 million S, T, E and M qualifications taken by 16–18 year olds in schools.

6.8 million qualifications were achieved in the FE and Skills sector in England in 2009/10 with 1.74 million in S,T,E,M and Numeracy.

Note: The figures for Science, Technology, Engineering and Mathematics include ‘related’ qualifications.
Key findings: S, T, E and M

Science Numbers of funded S, T, E and M qualifications achieved in FE and Skills sector over the academic years 2007/08 to 2009/10

<table>
<thead>
<tr>
<th>Year</th>
<th>Science</th>
<th>Technology</th>
<th>Engineering</th>
<th>Mathematics</th>
<th>Numeracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007/08</td>
<td>1,000,000</td>
<td>900,000</td>
<td>800,000</td>
<td>700,000</td>
<td>600,000</td>
</tr>
<tr>
<td>2008/09</td>
<td>900,000</td>
<td>800,000</td>
<td>700,000</td>
<td>600,000</td>
<td>500,000</td>
</tr>
<tr>
<td>2009/10</td>
<td>800,000</td>
<td>700,000</td>
<td>600,000</td>
<td>500,000</td>
<td>400,000</td>
</tr>
</tbody>
</table>

Note: All figures include ‘related’ qualifications, eg ‘Science’ and ‘Science related’

Per cent Achievements in funded S, T, E and M Qualifications in the FE and Skills sector in 2009/10 by Qualification level

The distribution of achievements across the levels varies significantly between each S, T, E, M and N discipline

‘STEM’ is better described as S, T, E and M because the characteristics of each are different. Numeracy is recognised as distinct from Mathematics

Only Technology has a significant number of ‘related’ achievements relative to the total for each S, T, E, M and N discipline

S, T, E, M and N provision changes from year to year: here are the changes for the period 2007–2010

‘STEM’ is better described as S, T, E and M because the characteristics of each are different. Numeracy is recognised as distinct from Mathematics

Numbers of achievements in funded Science, Technology, Engineering and Mathematics qualifications and in ‘related’ qualifications, including Numeracy, in the FE and Skills sector in 2009/10, by Qualification level

The distribution of achievements across the levels varies significantly between each S, T, E, M and N discipline

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Numbers of achievements in funded Science, Technology, Engineering and Mathematics qualifications and in ‘related’ qualifications, including Numeracy, in the FE and Skills sector in 2009/10, by Qualification level
There are many S, T, E and M qualifications offered in the FE and Skills sector but only a small proportion of these are taken by large numbers of people.

The number of different funded qualifications available varies significantly between each subject or discipline. Engineering offered the most in 2009/10 and Numeracy the least.

At level 3, people completed 403 different qualifications in Engineering. Of these, approximately 50 were completed by more than 500 people but only 6 were completed by more than 5000 people (the most popular being in electrotechnology). Over 250 Engineering qualifications were completed by less than 100 people in 2009/10.

Note: Qualifications have been grouped by common qualification title in each level
Note: Qualifications can be assigned to more than one STEM area
Note: STEM related qualifications are included within the respective STEM area
Key findings: Levels

Numbers of funded STEM qualifications achieved by Adults and Young People in FE and Skills sector in 2009/10 by Qualification level

- At level 3, 72% of the S, T, E and M qualifications were achieved by young people, while at level 2 adults achieved 65% of S, T, E and M qualifications.

- Qualifications at Level 2 and below dominate S, T, E and M provision in the FE and Skills sector. Achievements at Level 4+ remain small to date.

- 74% of all S, T, E and M achievements in the FE and Skills sector were at Level 2 or below in 09/10.

- 33% of Science achievements were at Level 2 and below, whereas the figures were:
  - 60% for Engineering
  - 70% for Technology
  - 79% for Mathematics
  - 100% for Numeracy

- 74% of all S, T, E and M achievements in the FE and Skills sector were at Level 2 or below in 09/10.

- Achievements at Level 4+ remain small to date.
Proportion of funded STEM qualifications completed by 16–18 year olds in Schools and the FE and Skills sector in 2009/10

- Of all the S, T, E, and M qualifications completed by 16–18 year olds in 2009/10, 60% were completed in the FE and Skills sector.

Key findings:

- There were at least 250,000 qualifications completed by 16–18 year olds in S, T, E and M but less in Numeracy.
- Even when considering just 16–18 year olds, more S, T, E and M qualifications are taken in the FE and Skills sector than in schools (as measured by completions).
- However, the majority of Level 3 completions are in schools.

Most Level 3 S, T, E and M qualifications completed by 16–18 year olds in schools were GCE A and AS levels.

Note: STEM and STEM related qualifications are included.

Note: Qualifications were assigned to more than one area of STEM.
Key findings:

Progression plus 8 others

Number of other qualifications taken by Adult and Young People when taking one of nine selected level 3 Engineering qualifications, as percent of learners taking each combination in academic year 2009/10

Note: 21% of Adults were not publicly funded

Selected Qualifications account for 28% of all level 3 Engineering

- BTEC National Certificate in Electrical/Electronic Engineering
- BTEC National Diploma for IT Practitioners
- BTEC National Diploma in Electrical/Electronic Engineering
- BTEC National Diploma in Mechanical Engineering
- Certificate in the Requirements for Electrical Installations (BS 7671 June 2008)
- GCE AS Level in Information and Communication Technology
- NVQ in Electrotechnical Services
- NVQ in Engineering Maintenance
- NVQ in Mechanical Engineering Services – Plumbing (Domestic)

Until PLR data are more widely available, we rely on case studies such as this to increase our understanding of subject choices and progression. This analysis identifies the number of other qualifications people take alongside 9 popular Level 3 Engineering qualifications

Achievement at Level 3 is important for many progression pathways in S, T, E and M. Anonymous data from Personal Learner Records (PLR) over time will enrich what we know about progression into, through and from level 3 S, T, E and M qualifications and make it possible to track people as they progress.

Achievement in Level 3 S, T, E and M qualifications can provide a gateway to employment and higher qualifications.
The FE STEM Data Project provides an effective way of collecting trend data. With only three years of data so far, it is too early to identify definite trends but variability year on year is evident.

As the total number of all qualifications achieved in the FE and Skills sector also varies considerably from year to year, it is more meaningful to look at proportions that are S, T, E and M across years.

The absolute number of achievements at each level varies considerably between S, T, E, M and N disciplines.
For the majority of the English sub-regions, the proportion of Level 3 achievements that are in S, T, E, and M lies between 30% and 40%.

The FE STEM Data Project is able to analyse regional variations in S, T, E, and M provision. These variations are sensitive to factors such as age, gender, and level of qualification.

For example, numbers of S, T, E, and M achievements vary from ~2,000 to ~50,000 per sub region. The proportion achieved by female learners varies from 12% to 52% across the sub regions.
Local Authority variation

Key findings: Local Authority variation

Geographic variation in Engineering provision in 2009/10 Local Authorities with the highest proportion of level 3 Engineering achievements and those with the lowest proportion. Proportion of Engineering is the proportion of the level 3 qualifications achieved in that Local Authority that had been classified as Engineering qualifications. The 5% of Local Authorities with the highest proportion (blue bars) are compared with the 5% with the lowest proportion (green bars). The national average is 10.9% of level 3 achievements are in Engineering.

The volume of S, T, E and M provision varies between Local Authorities. Significant variability in provision can be seen in the data for consecutive years.

At the level of the Local Authority, Level 3 S, T, E and M achievements can vary between 5% and 85% of all achievements, as exemplified by this example from Engineering (chosen because there are few Level 3 Engineering achievements in schools).

Between 2008/09 and 2009/10 the yearly change in the number of Level 3 S, T, E and M achievements across all Local Authorities varied between +15% and -35% (Chart shows 5% of Local Authorities with largest increase or decrease in S, T, E and M achievements).
In the FE and Skills Sector 84% of Level 3 Science and 96% of Level 3 Mathematics achievements were AS and A levels taken in Sixth Form Colleges or General FE Colleges.

Science and Mathematics AS and A Levels taken in 6th Form Colleges dominate Level 3 achievements in those subjects in the FE and Skills Sector. The picture for Level 3 Engineering and Technology is more varied.

AS and A Levels account for only 20% of Level 3 Engineering and 44% of Level 3 Technology achievements. Vocationally related and occupational qualifications feature more prominently than for Science and Mathematics.

30% of Level 3 Engineering and 12% of Level 3 Technology qualifications are achieved with independent training providers (including employers).

Type of funded level 3 Science qualifications that were achieved in the FE and Skills sector in 2009/10, and in which type of Provider

Type of funded level 3 Mathematics qualifications that were achieved in the FE and Skills sector in 2009/10, and in which type of Provider

Type of funded level 3 Technology qualifications that were achieved in the FE and Skills sector in 2009/10, and in which type of Provider

Total number of level 3 achievements in Science: 161,479

Total number of level 3 achievements in Mathematics: 47,320

Total number of level 3 achievements in Technology: 62,204
Numbers of funded Science, Technology, Engineering and Mathematics qualifications achieved by Females and Males in the FE and Skills sector in 2009/10 by Qualification level

<table>
<thead>
<tr>
<th>Qualification level</th>
<th>Adult Achieves</th>
<th>Young People Achieves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry</td>
<td>Adult</td>
<td>Young People</td>
</tr>
<tr>
<td>Level 1</td>
<td>Adult</td>
<td>Young People</td>
</tr>
<tr>
<td>Level 2</td>
<td>Adult</td>
<td>Young People</td>
</tr>
<tr>
<td>Level 3</td>
<td>Adult</td>
<td>Young People</td>
</tr>
<tr>
<td>Level 4 and above</td>
<td>Adult</td>
<td>Young People</td>
</tr>
</tbody>
</table>

Adults are people aged 19 and over
Young People predominantly refers to 16–18 year olds but includes a small number of under 16 year olds who are taking qualifications with FE & Skills providers

Key findings:
- Gender imbalance is clearly evident in Engineering provision, but is much less marked in S, T, and M – although imbalances exist between specific qualifications (e.g. physics vs biology).
- Only 8% of engineering qualifications are achieved by women.
- Female achievements in S, T, E and M average 41% of total. There is significant variation around the country
Chinese and Asian learners tend to take higher level S, T, E and M qualifications than other ethnic groups.

The picture of ethnic representation in S, T, E and M is complex and requires comparison against national and local demographic data to enable meaningful conclusions to be drawn.

As an example of the variation observed, achievements in Engineering by ethnic minority groups vary by region around a national average of 14%.

<table>
<thead>
<tr>
<th>Region</th>
<th>% White</th>
<th>% Asian or Asian British</th>
<th>% Black or Black British</th>
<th>% Chinese or other ethnic group</th>
<th>% Mixed</th>
<th>% Missing/Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td>86%</td>
<td>6%</td>
<td>4%</td>
<td>1%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>East Midlands</td>
<td>87%</td>
<td>8%</td>
<td>2%</td>
<td>1%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>East of England</td>
<td>90%</td>
<td>4%</td>
<td>3%</td>
<td>5%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Greater London</td>
<td>56%</td>
<td>14%</td>
<td>18%</td>
<td>1%</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>North East</td>
<td>92%</td>
<td>5%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>North West</td>
<td>90%</td>
<td>5%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>South East</td>
<td>90%</td>
<td>3%</td>
<td>2%</td>
<td>1%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>South West</td>
<td>93%</td>
<td>1%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>West Midlands</td>
<td>83%</td>
<td>10%</td>
<td>4%</td>
<td>1%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Yorkshire &amp; Humber</td>
<td>90%</td>
<td>4%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Region not applicable/ not known</td>
<td>93%</td>
<td>3%</td>
<td>2%</td>
<td>0%</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>
Analysis of the qualifications that are taken alongside those in S, T, E and M indicates that 16–18 year olds take more qualifications at once than adults do.

As illustrated in this exemplar analysis, which charts the number of qualifications being taken with the 9 most popular level 3 Engineering qualifications. Over a third of the adults were taking one of these qualifications on its own, whilst for young people it was less than one in ten doing so.

Key Findings: Qualification Mix

Selected Qualifications account for 28% of all level 3 Engineering
BTEC National Certificate in Electrical/Electronic Engineering
BTEC National Diploma for IT Practitioners
BTEC National Diploma in Electrical/Electronic Engineering
BTEC National Diploma in Mechanical Engineering
Certificate in the Requirements for Electrical Installations (BS 7671 June 2008)
GCE AS Level in Information and Communication Technology
NVQ in Electrotechnical Services
NVQ in Engineering Maintenance
NVQ in Mechanical Engineering Services – Plumbing (Domestic)

Note: 21% of Adults were not publicly funded.
Numbers of Adults and Young People Achieving STEM relevant Apprenticeships in 2009/10

- Of all apprenticeships started in 2009/10, 6% were young people starting Advanced Apprenticeships in S, T, E or M.

- A third of apprenticeships are in S, T, E and M and these are predominantly in Engineering. 6% are advanced apprenticeships taken by young people.

- 74% of all S, T, E and M apprenticeships achieved in 2009/10 were Engineering or Engineering related.

Key findings: Apprenticeships

- A third of apprenticeships are in S, T, E and M.
- These are predominantly in Engineering.
- 6% are advanced apprenticeships taken by young people.
- 74% of all S, T, E and M apprenticeships achieved in 2009/10 were Engineering or Engineering related.

Starting and achieving in STEM relevant Apprenticeships in 2009/10 comparing STEM relevant programmes and non STEM programmes

- Note: Starts in Advanced Apprenticeships include Starts in Higher Apprenticeships.
- Note: Starts include both funded and non funded Apprenticeships.

Intermediate Apprenticeships
- 16–18, Intermediate, Not STEM: 21%
- Adult, Intermediate, STEM: 11%
- Adult, Intermediate, Not STEM: 30%
- 16–18, Advanced, Not STEM: 4%
- Adult, Advanced, Not STEM: 16%
- Adult, Advanced, STEM: 8%
- 16–18, Intermediate, Not STEM: 25%
- 16–18, Intermediate, STEM: 14%
- Adult, Intermediate, STEM: 5%
- Adult, Advanced, STEM: 18%

Advanced Apprenticeships
- 16–18, Advanced, Not STEM: 4%
- Adult, Advanced, Not STEM: 14%
- Adult, Advanced, STEM: 8%

Higher Apprenticeships
- 16–18, Advanced, STEM: 6%
- Adult, Advanced, STEM: 18%

FE STEM Data Project – July 2011 report
Focus on Science

Science is a compulsory subject at KS4. As a result more than half a million 14–16 learners take GCSE and vocationally related Level 2 Science qualifications every year in England. It is therefore not particularly surprising that relatively few post-16 students take Level 2 Science qualifications in the FE and Skills sector. However, amongst 16–18 year olds, there are far more Science qualifications taken in schools than in the FE and Skills sector.

One of the interesting findings of the data project is that compared to engineering and technology the FE and Skills sector. However, even amongst qualifications every year in England. Science is a compulsory subject at KS4. As a result what is known about recent positive trends in the limited period available for analysis. This mirrors looking at data over the period 2007–2010, Level 3 Science shows a steady rise in achievements over the period 2007–2010, Level 3 Science provision in the FE and Skills sector varies around the country and between Local Authorities in each sub region of England. The proportion of Level 3 provision that is delivered by Schools, the FE and Skills sector.

Level 3 Science provision in the FE and Skills sector is delivered by Schools, the FE and Skills sector or a combination of the two. A study of 14+ Science provision, cutting across schools and the FE and Skills sector (England, 2009/10)

Type of funded level 3 Science qualifications that were achieved in the FE and Skills sector in 2009/10, and in which type of Provider

Distribution of funded level 3 Science qualifications achieved by 16+ year olds in the Schools and FE and Skills sectors (England, 2009/10)

Variation in the provision of funded Level 3 Science qualifications achieved by 16+ year olds in Schools and FE and Skills sector (England, 2009/10)

Recent patterns in the numbers of achievements in funded Science and Science related qualifications in the FE and Skills sector over academic years 2007/08 to 2009/10 by Qualification level
Focus on Technology

The FE and Skills STEM Data report (2010) categorised Technology as including:
- IT/ICT practitioner qualifications
- CAD/CAM
- Electronics/systems & control
- Interactive media
- Music technology
- Design & Technology GCEs and GCEs
- Production technology and technical theatre (light; sound; media)
- IT/ICT GCEs and GCEs
- 3-D design

Technology-related areas were taken to include, for example, IT/ICT user qualifications and general Art & Design.

Many Technology qualifications are also included as Engineering qualifications. Technology qualifications involve mathematics and science. Joint Council for Qualifications and Statistical First Release data confirm that GCE Design & Technology and ICT GCEs and vocationally related qualifications together account for more than half a million Level 2 qualifications taken by 14–16 learners in English schools. This pre-16 Level 2 Technology achievement is a whole order of magnitude greater than the number of Level 2 Technology qualifications achieved in the FE and Skills sector in England. However, amongst 16–18 year olds and across all levels there are more completions of Technology and Technology-related qualifications in the FE and Skills sector than in schools.

When looking at achievements of Technology qualifications across all age groups, the dominance of Technology-related qualifications at entry level and levels 1 and 2 is clear. These are predominantly IT user qualifications.

Looking at data over the period 2007–2010, there is some variability in the volumes of both Technology and Technology-related qualifications achieved. However, although only a three year picture is yet available, an upward trend in Technology at all levels may be indicated.

At Level 3 and looking across all age groups, learners are achieving a broad mix of different types of Technology qualifications in a range of settings.

Level 3 Technology provision in the FE and Skills sector varies around the country and between Local Authorities in each sub region of England. There are few Local Authorities that specialise in Level 3 Technology provision although data on qualifications taken in school 6th Forms is required before definitive conclusions can be drawn.
Focus on Engineering

The volume of Engineering qualifications taken in English schools is generally small, although much boosted amongst 16–18 learners by the IT and computing qualifications that are included in the definition of Engineering used here.

Looking across all age groups, the dominance of Level 2 and 3 provision is clear. Both are boosted by a few very popular electrotechnology and IT qualifications. Engineering related qualifications (such as those in engineering operations) play a relatively small part in overall engineering provision.

At Level 3, the provision of vocationally related qualifications dominates, with both colleges and independent training providers making significant contributions to overall volumes.

The variability of data over the period 2007–2010 illustrates the significant changes in volumes that can occur between consecutive years. These are more likely to be in response to funding incentives than market demands.

Engineering dominates S, T, E, M apprenticeships but these are a small component of apprenticeships more widely.

Level 3 Engineering provision in the FE and Skills sector varies around the country and between Local Authorities in each sub region of England. There are few Local Authorities that show little or no engineering provision in the FE and Skills sector. This is partly because the Engineering provision in an area will be almost entirely held in the FE and Skills sector rather than being shared with schools.
Focus on Mathematics and Numeracy

Mathematics is the ‘language of STEM’, as well as being a subject in its own right and being embedded in most non-STEM subjects. As a compulsory subject up to 16 in English schools, it is taken at GCSE by more than half a million learners pre-16. Of these, over half achieve grade C or above. A key question is whether those who progress into post-16 education are experiencing mathematics appropriate to their needs, their courses and to enable progression. The data collected so far do not answer this question fully but do help in posing questions for further research.

Across all age groups in the FE and Skills sector, the dominance of numeracy at lower levels and Mathematics at higher levels is, of course, related to the definition and role of numeracy qualifications. However, comparison of numbers of numeracy and level 1 and 2 Mathematics achievements for 16–18 learners with numbers of learners who have already achieved GCSE grade C or above in school, suggests that some learners might be taking qualifications below the level they have already achieved whilst others are taking no mathematics or numeracy beyond 16.

The variability of data over the period 2007–2010 suggests that Mathematics and numeracy provision is particularly responsive to non-demand incentives such as funding, targets and league tables. This separation from learner demand might not always result in learners following the most appropriate pathways for their needs or having a high quality experience of Mathematics.

Exploration of existing pathways and further collection and analysis of workforce data would be beneficial. At Level 3, uptake is dominated by 16–18 AS and A Level Mathematics in 6th Form Colleges and General FE Colleges and there appears to be an increasing, welcome trend in uptake. Further investigation is needed to understand if learners are experiencing appropriate mathematics as noted above.

Level 3 Mathematics provision in the FE and Skills sector varies around England and between Local Authorities in each sub region. The proportion of Level 3 provision that is Mathematics varies substantially between Local Authorities, irrespective of whether this provision is delivered by Schools, the FE and Skills sector or a combination of the two. This could simply be due to effective alternative provision in schools with 6th Forms, but might also suggest that there is no provision for adults in these regions. A study of 14+ Mathematics provision, cutting across schools and the FE and Skills sector is needed before definitive conclusions on the uptake of Mathematics qualifications in England can be drawn. Other questions posed by the data were discussed at a round table discussion in May 2011 – see Appendix.
Roundtable Discussion – The Complexity of the S, T and E in the FE and Skills Sector

The FE STEM Data project report of October 2010 laid out the extent and nature of S, T and M provision in the FE and Skills sector in England. This had not been done before and a common reaction to the findings had been surprise at the large number of STEM qualifications on offer. The October 2010 report identified 2453 distinctly different qualifications filtered from a total list of around 20,000. These qualifications were made visible by public funding. There are many more, particularly in technology areas, that are provided on a solely commercial basis and these have not been included in the analysis to date.

A round table of people drawn from across the STEM community, met on the 18th April 2011 to discuss whether the number of qualifications was problematic to the diverse range of users trying to understand the FE, S, T and M offer and if so, to determine how the offer might be presented in a more digestible form. These users were perceived to include learners and their parents and carers, advisors, admissions staff and employers. Since number of enrolments does not necessarily signal the quality of a qualification, what was meant by ‘quality’ was also discussed, including what the components of quality might be (fullment of need, fitness for purpose, labour market signalling in terms of wage and other returns to the learner, etc.).

The roundtable considered why the list of S, T, E and M qualifications is as long as it is. With multiple modes of interaction between employers, Sector Skills Councils, a significant number of Awarding Bodies and the regulator (Ofqual) it is clear that there can be no single cause. The number of qualifications may be a symptom of the historic lack of a clear national purpose driving the development of the FE and Skills sector. International comparator countries have alternative systems for qualifications and these commonly produce fewer qualifications. The English system competes internationally for market share and the diversity of provision in England needs to be articulated clearly in order to be a market advantage rather than disadvantage. Such articulation needs to draw on the usefulness of qualifications in terms of progression to meaningful employment and study destinations now and in the future. What is known about wage returns from classes and levels of qualification must be put into context with what is known about learner pathways through education and training.

The project lists of S, T, E and M qualifications are very sensitive to the application of certain filters. Any full list will have a long tail of qualifications in which there is relatively little participation nationally. In the list reported in October 2010, over 1000 qualifications listed had enrolments of less than 100 learners nationally per annum. Separating qualifications into shorter lists, banded according to the typical number of enrolments per annum would make the provision clearer to users without losing sight of qualifications with lower participation which may well fill local particular needs.

Any un-filtered list of S, T, E and M qualifications derived from national databases will include a number of duplications. These might be qualifications in individual subjects that are offered in more than one mode of delivery or by more than one Awarding Body. Such entries could be nested in sub-lists for clearer presentation without loss of detail and this technique was used in the October 2010 report.

Sets of shorter, clearer sub-lists could be created through the use of carefully chosen classifications. For example 25% of the qualifications listed in October 2010 were taken in the workforce rather than in colleges which provides useful distinction for engineering qualifications in particular. The different types of qualification could be listed together (general, VRQs, NVQ-type) as could QCF levels. Qualifications that contribute to the S, T, E, M and (cross-discipline) apprenticeship frameworks could be listed together. Learners characteristics (age most notably) could be used to differentiate between qualifications and produce crosstab in S, T, E and M that for, example may indicate lifetime progression suites within broad disciplines.

Identifying S, T and M qualifications as a subset of the sizable number of qualifications on offer in the FE and Skills sector is helping to demonstrate the important role that FE plays in the provision of STEM skills in England but the results are not immediately user-friendly. It seems that the production of sets of sub-lists based around subject/discipline and application would increase clarity and provide the basis for improved career and Subject/discipline choice information, advice and guidance.

Roundtable Discussion – Progression in STEM

The FE STEM project of October 2010 provided a ‘snapshot’ of the enrolments on S, T, E and M courses provided on the FE and Skills sector focusing on the academic year 08/09. The current project has updated the data to comprehensively include years 07/08, 08/09 and 09/10, but the data is ‘static’ and information on the progression of individuals through the sector or onwards to a meaningful destination can at best only be indirectly inferred.

However, issues relating to the progression which FE STEM Qualifications potentially offer are of particular interest to government, learners and employers and were the subject of many of the questions which arose from the original project. Since a quantitative analysis of these questions was not immediately possible (because Personal Learner Record data is not yet integrated with other information which could make it useful), a roundtable of people included from the STEM community was convened on 17/11 to discuss the issue and agree a qualitative narrative of the subject and b) a prioritisation for future work, whether as part of this project or another.

An initial discussion took place around the definition of progression and how to frame any narrative in terms which would lead to useful representation of populations and flows and could be applied to S, T and M separately or collectively. The diagram in the Progression section illustrates the possible components of such a model – scaling the size of the various boxes or arrows to represent population sizes and flows are potential options for future work. Alternatively the model could be used in an illustrative way to demonstrate individual progression pathways which lead to specific destinations, which would be of value to both learners and employers.

In the interests of focus and keeping to a manageable scope, it was agreed that further study should concentrate on the 16+ sector and that a stream of data should not be integrated, but used to contextualise any findings arising from the study. It was also noted that people do not necessarily acquire qualifications in a continuous way and may take breaks for career or personal reasons. The use of enrolment data was considered useful to describe learners’ characteristics but achievements data would be more informative in supporting discussion around successful progression pathways, as achievements are the best indication that an individual is in a ‘fit state to progress’.

It was recognised that a considerable number of papers have been produced which touch on the subject of STEM progression – providing a reading list of related documents as part of the report would be helpful.

Further Work

Develop visual maps illustrating the populations sizes at each level of achievement within the FE and skills sector for S, T and M respectively identify whether any information on the size of the flows involved can be inferred from existing data – whether by taking case studies of specific types of qualification or looking at year on year achievements.

Scope out the effort required to usefully access PLR data to address the questions raised in the briefing paper when it is more universally available.

Assemble a bibliography of recent relevant reports.

1 Matthew Harrison, Rhys Morgan (Royal Academy of Engineering), Carolee Sudworth (Cogent), Ruth Wright (Engineering Council), David Morgan (Royal Society), Catherine Elliott Gurner (Skills), Andy Fryst (Development Focus), Kevin Clissmann (Consultant). By email – Liz Hollingworth (E-skills), Daniel Sandford Smith (Gatsby).

2 Matthew Harrison, (RAEng), Ruth Wright (EngC), Jane Imrie (NCTJ), Daniel Sandford Smith (Gatsby), Catherine Elliott (Summit Skills), Andy Fryst (Development Focus), Stephen Price (Apprenticeships), Caroline Sudworth (Cogent), David Montague (Royal Society), Deborah Ribeche (Asic).
Roundtable Discussion – Mathematics

A roundtable of people from the mathematics community was convened on 19th May 2011 to consider the following questions:

1) What questions does the data project pose about the nature of the mathematics experienced and how it is experienced by learners in the FE and Skills sector?

2) Are there appropriate mathematics pathways to enable progression in S, T and E?

The group considered a series of the graphs which have already been presented in this report. The following are observations and opportunities for further work derived from the discussions arising.

General Observations

– The opportunity to access and review data of this nature was considered potentially game changing to the mathematics FE community.

– Mathematics is the language of STEM and therefore the combination of other subjects with which it is being studied would be useful – once personal learner record (PLR) data are more widely populated it will be possible to interrogate these to provide insights. At the moment, studying individual learner combinations can only be done on a pilot basis by looking at specific courses.

– It is expected that mathematics and numeracy are embedded within most of the 72% achievements which are non-STEM – but it would be useful to know where, and to understand who is teaching it and how successful it is in terms of learner progression.

– It was noted that the 2008/9 to 2009/10 dip in numeracy achievements was due to many courses being re-categorised and having their funding withdrawn. The increase in Level 2 (L2) achievements between 07/08 and 08/09 could be attributed to policy initiatives.

– The ability to identify and understand all mathematics qualifications on offer in the sector, particularly those which are less popular or specialised will be very helpful to researchers.

– It was clear that all qualifications at the same level are not equivalent in difficulty.

– A ‘tail’ of qualifications with few achievements is not a problem if learners are clustered in one place, but becomes a cause for concern if they represent scattering of widely geographically distributed learners.

Other opportunities for further work

– If a decision is made to continue to collect and publish these data year on year, it was felt that involving potential researchers to advise on what fields are likely to be of most use would be a valuable early investment of effort.

– Having comparable schools data is likely to be of particular use to the mathematics community.

– Having regularly updated data of this nature available and accessible to the mathematics teaching and education research communities was considered by all to be an extremely valuable tool for aiding an ongoing understanding of the ‘mathematics experience’ delivered by FE.

The Learner Experience of Mathematics

(Question 1):

– There was a very positive response to steady increase in mathematics achievements over the 3 year period analysed although there must be caution about working quantitatively as false conclusions might be drawn e.g. those who need mathematics have no opportunity to take it, or there are enough learners studying mathematics when the mathematics they are studying does not necessarily offer them the right experience.

– Level 3 (L3):

– The lower numbers of achievements at L3 in FE were noted and may be explained by fact that L1 and L2 will be dominated by adult learners, whereas schools are the dominant providers of L3 (particularly A/AS level) achievements for 16–18 years olds.

– The ability to identify single L3 mathematics qualifications taken within a broader course or apprenticeship might provide a more inclusive view of how mathematics is being taught across FE.

– Sixth form colleges are the dominant providers of L3 achievements within FE, reinforcing that L3 mathematics is mainly taken by 16–18 year olds.

– Given the dominance of schools in providing L3 mathematics, an investigation of regional differences and whether, for example, there are areas of the country where adult learners cannot study at L3 would be instructive.

– There was surprise at the low numbers taking/achieving AS Statistics and Personal Finance.

– It would be useful to show a) nos. of learners vs. nos. of achievements at each level (to verify how many people are represented) b) achievements/completion rate for each of S, T, E, M to understand if success rate is different for mathematics compared to other subjects.

– Diversity statistics are encouraging from an overall male/female perspective for mathematics. Some patterns are emerging at a more detailed level which would warrant the ability continuously to monitor e.g. female young people and male fare less well than the opposite sex in numeracy achievements.

Other opportunities for further work

– Further investigation of diversity populations which deviate significantly from the norm in terms of mathematics and numeracy achievements would determine if they are getting these skills from other qualifications.

– What is known about students on entry to FE? E.g. How many have L2 on entry? What proportions with each grade at GCSE go into A/AS and other courses? What is the impact of early entry to GCSE?

– A related important question is whether or not learners have the right level of mathematics for the courses they are taking or for progression.

– The issue of the number of teachers of mathematics in FE and their qualifications was raised by the Smith Inquiry in 2004. However, little is still known about this and it was felt crucial that there should be at least as much information as for school teachers. The current project is very limited in what it can provide, and whilst the IFL is potentially the richest source of data, its free format entry does not lend itself to rigorous or efficient analysis. Such analysis would also help address concern that many learners, particularly those following vocational courses are being taught by tutors who lack relevant training or experience.

Mathematics pathways to progression (Question 2)

– The range of qualifications was seen to be good if qualifications have been developed to meet a specific need, but few developed simply because no one had been able to easily identify an existing appropriate qualification or to apply an alternative qualification due to funding or league table constraints.

Other opportunities for further work

– What do students without L2 mathematics on entry to FE then experience and what routes are offered? The data and other evidence suggest that they have a very variable experience. Again, there is a need to understand who is teaching them as well as what routes are on offer.

– Are there appropriate existing qualifications? It was felt that those such as the Free Standing Mathematics Qualifications can provide appropriate experiences, though are clearly not widely used.

– Do we need to enable curriculum designers to make good pathways from existing qualifications or are there different qualifications needed?

– The data could be used to identify how to combine qualifications to make useful learner pathways without adding to the list of qualifications.

– This could help people through the existing mix of qualifications rather than developing more qualifications to meet identified needs.
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