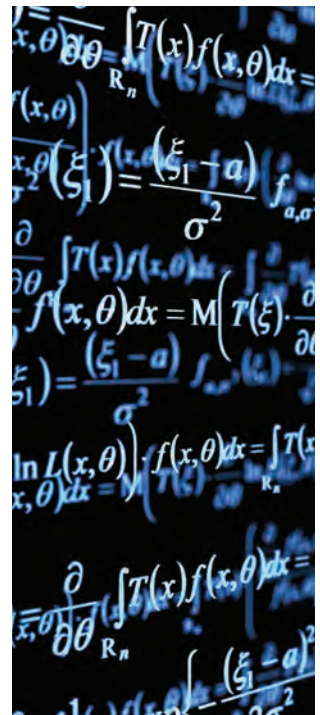


A 157 Group project report



The challenges of Stem provision for further education colleges



GATSBY

Association of Colleges **A^oC**

Acknowledgements

The 157 Group would like to thank the colleges that participated in the project, the Gatsby Charitable Foundation, Association of Colleges (AoC), the National Science Learning Centre, the Royal Academy of Engineering and the Institution of Civil Engineers for their involvement and support.

Authors

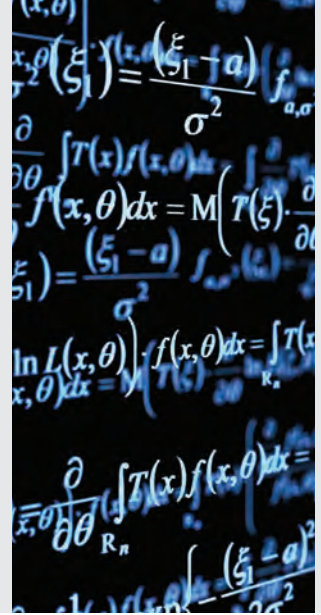
Kate Green and Mick Fletcher.

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Contents

- Introduction** **4**

- The 157 Group** **5**

- The challenges of Stem provision for further education colleges** **7**

- Introduction 7

- Background 8

- Project objectives and methodology 10

- The challenges FE colleges face in delivering vocational Stem provision at levels 3 and above 12

- Curriculum planning methodologies and the costs of Stem provision 14

- Expected changes in Stem provision 18

- Feedback from focus group discussions 20

- Conclusions and recommendations 22

- References** **23**



Introduction

I am very pleased to introduce this report detailing the findings of a 157 Group project undertaken with support from the Gatsby Charitable Foundation and in partnership with the Association of Colleges (AoC).

The delivery of training and education in science, technology, engineering and mathematics (Stem) subjects is a key priority for many further education (FE) colleges, driven by their focus on responding to local, regional and national priorities and employers' demands for upskilling and reskilling their workforces. High-quality vocational provision is vital in ensuring that Stem sector employers have access to the skilled individuals they need for business productivity and competitiveness.

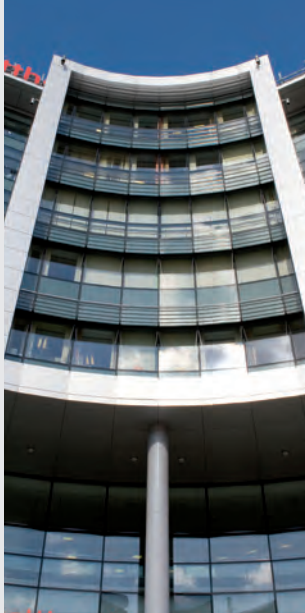
For colleges there are, however, several challenges involved in delivering Stem programmes, which this project has sought to explore, focusing in particular on the financial challenges associated with the higher capital and revenue costs required for delivery.

As a membership organisation, we are also increasingly concerned about current, multiple changes to FE policy (such as the introduction of FE loans and reductions in overall college funding) and wanted to explore the perceptions of college staff of the impact of these changes on the predicted offer and take-up of Stem provision, particularly at higher levels of learning.

I am especially pleased that this project involved a number of colleges that are not 157 Group members. We are increasingly seeking to involve non-member colleges in our project activities and would like to thank all those that took part in this project for their commitment and contribution.

The report concludes with a number of recommendations to further support the critical role that FE colleges play in providing a wide and responsive range of high-quality Stem provision. The 157 Group looks forward to working with the government and other sector stakeholders in addressing these recommendations, to ensure the maintenance and development of a vibrant and responsive Stem offer in FE.

Marilyn Hawkins
Chair, 157 Group



The 157 Group

The 157 Group is a membership organisation that represents 27 large, regionally influential further education colleges in England, most of which are highly successful. All our members are key strategic leaders in their locality, who take seriously the role of leading policy development, and improving the quality and reputation of further education.

Providing a national voice on strategy and policy for large, mostly urban colleges in England, we aim to promote change for the benefit of our members and the sector as a whole. Our members' knowledge, capability, experience and commitment brings a unique breadth and depth of expertise to bear on every aspect of further education and skills. We also work together as a peer support network, and are committed to equality and diversity.

We are actively promoting the development of a strong and world-class college sector that not only has a transformative impact on individuals, employers and their local communities, but also makes a real difference to the economic and social well-being of the nation and its global success. Together, 157 Group colleges:

- turn over £1.6 billion a year
- serve 700,000 learners
- employ 39,000 staff
- engage with 32,000 employers.

Our approach

- We strive to be thoughtful, flexible and responsive; acting quickly and decisively for the benefit of our members and the sector.
- We promote the FE and skills sector as a whole. Committed to excellence and instrumental in resolving sector debates and issues, we adopt a pragmatic approach to delivering positive solutions and achieving success.
- We are bound by a strong and unanimous commitment to using our collective knowledge, capability and experience to lead policy development, improve performance and champion the reputation not only of members but also the sector as a whole.
- We seek to be critical friends and advisers to the government and shadow government, local communities and the sector itself to achieve positive outcomes for communities, employers, businesses and individuals.
- We work with fellow 157 Group members, sharing expertise, ideas and resources.

Policy role

Our member colleges operate within a complex and volatile policy environment, and our objective as thought leaders is to exert powerful influence on critical policy priorities. Our policy and discussion papers draw on and reflect the practical experience of 157 Group member colleges. The themes, developed over a series of debates, represent the areas of greatest concern for them as leaders of some of the largest and most successful colleges. The following policy and discussion papers are available to download from our website:

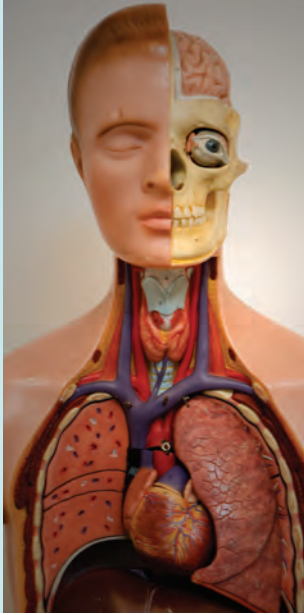
- *Protect services to students, by targeting cuts and embracing efficiency*
- *Real choices for 14 to 19-year-olds*
- *Preparing colleges for the future*
- *Learning and skills needs local leadership*
- *Strong colleges build strong communities*
- *Making the QCF work for learners*
- *Colleges' international contribution*
- *Rising to the challenge: how FE colleges are key to the future of HE*
- *Learning accounts that count*
- *Doing more for less*
- *Leading learning in further education*
- *The role of local enterprise partnerships in tackling skills needs*
- *Adult further education – the unfinished revolution*
- *Expanding apprenticeships – colleges are key to employability*
- *Information is not enough: the case for professional careers guidance*
- *Tackling unemployment: the college contribution*
- *Effective transitions from school to work: the key role of FE colleges*
- *Great teaching and learning.*

Through these papers we seek to:

- contribute a new, strong and relevant perspective, influencing national policy through offering workable and practical policy ideas
- focus our recommendations on changes that can bring improvements for learners, stakeholders, colleges and the whole sector
- raise the level of debate and discussion across the sector
- recommend improvements that can be made by colleges themselves and the sector
- raise awareness amongst sector agencies of their own roles.

Our members

- Barnet and Southgate College
- Bedford College
- Birmingham Metropolitan College
- Blackpool and The Fylde College
- Chichester College
- City and Islington College
- City of Bristol College
- College of Haringey, Enfield and North East London
- Cornwall College
- Derby College
- Ealing, Hammersmith & West London College
- Highbury College Portsmouth
- Hull College
- Leeds City College
- Lewisham College
- Liverpool Community College
- New College Nottingham
- Newham College
- St Helens College
- Stoke on Trent College
- Sunderland College
- Sussex Downs College
- The Manchester College
- The Sheffield College
- Vision West Nottinghamshire College
- Warwickshire College
- York College.



The challenges of Stem provision for further education colleges

Introduction

This report documents the activities and conclusions of a research project undertaken by the 157 Group, supported by the Gatsby Charitable Foundation, and in partnership with Association of Colleges (AoC).

The project aimed to develop a better understanding of the challenges further education colleges face in offering Stem (science, technology, engineering and mathematics) provision at level 3 and above. The project focused primarily on the financial challenges, in particular the costs associated with Stem provision, and the potential impacts of changes to FE policy, including funding reductions and the introduction of FE loans, on the offer and uptake of vocational Stem programmes.

The report outlines the context for the project, the methodology applied and then describes the key findings in terms of:

- the broad challenges facing colleges
- the process of curriculum planning in colleges
- the cost of Stem programmes (compared to non-Stem programmes)
- the changes colleges expect to see in their Stem provision over the next two years.

The report concludes by making a number of recommendations to strengthen the valuable role that FE colleges fulfil in providing a wide range of high-quality Stem provision that responds to the needs of learners, communities and employers.

Background

Policy on Stem

Stem skills are widely seen as critical to key areas of future growth and employment, including advanced manufacturing and low-carbon industries. A focus on Stem skills and the need for further development of high-quality provision in these subjects has been a high priority for policymakers for some years.

In 2009, the Department for Innovation, Universities and Skills (DIUS) published *The Demand for Science, Technology, Engineering and Mathematics (Stem) Skills*, which showed that “there are specific recruitment difficulties in some Stem-related sectors in so far as employers report insufficient UK candidates in particular areas of biosciences, engineering and IT of the quality they are seeking”.

The CBI/EDI education and skills survey 2010¹ reported that Stem skills are highly valued by employers across different sectors of the economy, with over 70 per cent employing Stem-skilled staff. This year’s education and skills survey by CBI/Pearson² confirms the strength of demand for Stem skills and predicts that this will grow in the future, with two in five (42 per cent) of those firms that require staff with Stem skills and knowledge currently expressing difficulties in recruiting staff, increasing to almost half of firms (45 per cent) expecting difficulty in the next three years, once the economy starts to recover.

The government is committed to supporting the growth of Stem skills and to increasing the number of young people choosing to study Stem subjects post-16. It has invested in improving the quality of science teaching in schools, and providing mentoring support from Stem ambassadors to raise the profile and awareness of the Stem sector. However, less attention has been paid to vocational Stem provision, delivered largely through FE colleges and apprenticeships. FE colleges play a vital role in delivering Stem education to young people and adults and ensuring that employers are provided with a suitably skilled and qualified workforce. The FE Stem data project³ found that FE offers almost 2,500 Stem-related qualifications and in 2009/10, 1.74 million Stem qualifications were achieved by individuals aged 16 and over in the English FE and skills sector. FE colleges play an essential role in providing the vocational skills that employers say are critical to ensuring individuals are effective in the workplace and that businesses are as productive as possible.

However, offering a high-quality Stem curriculum that responds to the needs of individuals, employers, the government and the UK economy can be resource-hungry. It often needs to be delivered within a highly specialised and technologically rich environment, and at a time of economic constraint the challenges involved in offering a suitable curriculum should not be underestimated.

Funding changes

The additional cost of delivering many Stem subjects has been recognised in the funding arrangements for FE colleges for over 20 years and in school sixth forms for over a decade. In calculating the resources that are required for effective provision, the successive funding formulae used by national agencies have given a ‘programme weighting’ to subjects that incur extra costs, such as the need for smaller staffing ratios, technician support for practical activities and above average requirements for materials and equipment. The weightings are based on the revenue cost of delivering these subjects, not the capital cost of setting them up.

The basis for the weightings has been derived from research evidence on effective practice in the sector and has been moderated by groups representative of key stakeholders. There is, therefore, a strong consensus that the overall range of costs represented is fair, though there are occasional disputes about the details. The primary driver of high cost and therefore high weightings has been the staff to student ratio. Many, but not all Stem subjects have practical components that cannot be taught in large groups, for health and safety reasons, and require additional technician staff support. This does not, however, apply to mathematics; and outside Stem the need for low group sizes also justifies increased weightings for programmes of basic skills or performing arts.

1 CBI, 2010. *Ready to grow: business priorities for education and skills. Education and skills survey 2010.*

2 CBI, 2012. *Learning to grow: what employers need from education and skills. Education and skills survey 2012.*

3 The Royal Academy of Engineering, 2011. *FE STEM Data Project – July 2011 Report.*

The latest set of weightings, produced by the Skills Funding Agency in 2012, recognises that subjects fall into six cost bands – a basic level of funding for classroom-based activity and uplifts of 12 per cent, 30 per cent, 60 per cent, 72 per cent and 92 per cent. The 12 per cent uplift covers laboratory-based science programmes; the 92 per cent is for land-based programmes requiring field scale practical activities; most construction, engineering and applied science falls into the 30 per cent and 60 per cent bands. A similar principle applies to apprenticeships in different sectors, though there is additional complexity: rates have to recognise, for example, that an assessor in the electrotechnical sector will need to be paid twice the rate of an equivalent in, say, retail.

Until recently, rates for young people have been the same as the rates for adults. The Education Funding Agency (EFA) has, however, announced a simplification programme that combines the different rates used until now into a lower number of bands. Critically for Stem subjects, it proposes to remove the 12 per cent uplift for science and some engineering subjects and to combine the other weightings into three bands – low, medium and high cost. This will have the effect of eroding the differential funding enjoyed by more expensive programmes as, for example, those programmes attracting uplifts of 30 per cent and 40 per cent will now all receive a weighting somewhere in-between.

Changes have also been announced concerning the funding of provision for adults over the age of 24 on programmes at level 3 and above. Currently those students required to pay fees contribute 50 per cent of the unweighted cost; so that a student on an expensive Stem programme will pay no more than a humanities student on a course of the same size. From 2013, there will be no fee subsidy and students will have to take out a loan for the full cost of the course. This means that while a humanities student will be faced with a fee increase of 100 per cent (supported by a loan) the Stem student may face a fee increase of 260 per cent or 320 per cent (requiring a more substantial loan). In higher education, there is continuing grant support to prevent Stem subjects becoming disproportionately expensive, but this option has so far been rejected for FE.

The same logic applies to apprenticeships. From 2013, anyone over 24 wanting to undertake a level 3 apprenticeship will have to take out a loan to cover half the cost. The loan is limited to 50 per cent of the cost, since it is assumed that the employer will meet the other 50 per cent; but while employers certainly incur costs when offering apprenticeships, there is little evidence of their making cash contributions to training providers.

Other policy changes

There are a number of other policy changes that could affect the demand for Stem provision in the post-16 sector. Several of these were spontaneously identified by participants in the focus groups and are reflected in the online survey. They include:

- Increasing the age of compulsory participation in learning until the age of 17 in 2013 and the 18th birthday in 2015. Learning could include a programme of at least 540 hours a year in a school or college, an apprenticeship or full-time work with day release.
- Changes recommended by the Wolf review of vocational education⁴ for those aged 14–19. These include a greater emphasis on achievement in English and mathematics; a move to funding schools and colleges on the basis of pupil numbers, not qualifications; greater freedom to offer non-qualification programmes; an emphasis on ‘substantial’ vocational qualifications for the 16–19 age group; and the removal of most vocational programmes from the league tables for 14 to 16-year-olds.
- The developments of new types of institutions: academies and free schools, as well as university technical colleges and studio schools. These latter institutions will allow pupils to specialise in a vocational area, though not to undertake a curriculum narrowly focused on work skills.
- The transfer of responsibility for careers information and guidance to schools. Many feel that this will result in a loss of impartial advice and the promotion of sixth-form study at the expense of other options.
- The promotion by the Department for Education (DfE) of the English Baccalaureate (EBacc), a set of traditional academic subjects seen by some as the mark of a ‘good’ education. This has led to a loss of participation in some vocational courses pre-16.

4 Wolf, Prof A, 2011. *Review of Vocational Education: The Wolf Report*. London: BIS.

Project objectives and methodology

This 'Stem in FE' project aimed to develop a better understanding of the financial challenges further education colleges face in designing and delivering a vocationally based Stem curriculum at level 3 and above, and to make recommendations to support the delivery of high-quality, vocational Stem provision.

Specifically, it aimed to:

- enable a better understanding of the costs of Stem provision at level 3 and above in FE colleges
- provide an understanding of how decisions about Stem provision are made by FE colleges (i.e. what factors other than funding and delivery costs are taken into account in curriculum planning)
- identify the possible impact of a number of different FE policy changes on the provision and take-up of Stem provision
- identify key recommendations.

The project established a steering group, comprised of representatives from the 157 Group, the Gatsby Foundation, AoC, the National Science Learning Centre, the Royal Academy of Engineering and the Institution of Civil Engineers. The steering group agreed that the project would focus on all areas of Stem provision; cover all ages of learner from 16 upwards; and include all levels of provision, but with a focus on levels 3 and above.

Stem definitions

The project used the same definitions as the FE Stem data project (see www.thedataservice.org.uk/statistics/other_statistics_and_research for reports), i.e. Stem qualifications are those that are “deeply rooted in science or mathematics, engineering and/or are of technical or technology application/use nature”.

Science programmes include biology, chemistry, physics, psychology, geography and geology, animal care and management, vet nursing, agriculture and horticulture, environmental science, sport science, anatomy/physiology, dental nursing and pharmacy.

Technology programmes include IT and ICT, CAD and CAM, electronics, interactive media, music technology, design and technology, and production technology.

Engineering and construction programmes include construction and the built environment, engineering, manufacturing and product design, and automotive.

Mathematics programmes include numeracy, functional skills, mathematics, and accounting.

A project working group of eight colleges (157 Group members and non-members) was established and, in order to facilitate input from as many colleges as possible, an online survey was also developed with the AoC and distributed via 157 Group and AoC channels. The survey focused on a number of areas:

- Colleges' incentives for providing Stem courses
- The changes colleges expect to see in their Stem provision over the next two years as a result of a range of different influences
- The main challenges faced by colleges for the successful design and delivery of vocational Stem provision at levels 3 and above.

As well as providing information on course costs, participating colleges ran focus group discussions with key college staff to review and debate the project findings and validate them against their own college experience, and to identify subsequent recommendations for a range of stakeholders.

Useful feedback and observations were also obtained from a number of the 157 Group networks that exist to support peer development across member colleges, specifically from the curriculum and finance networks.

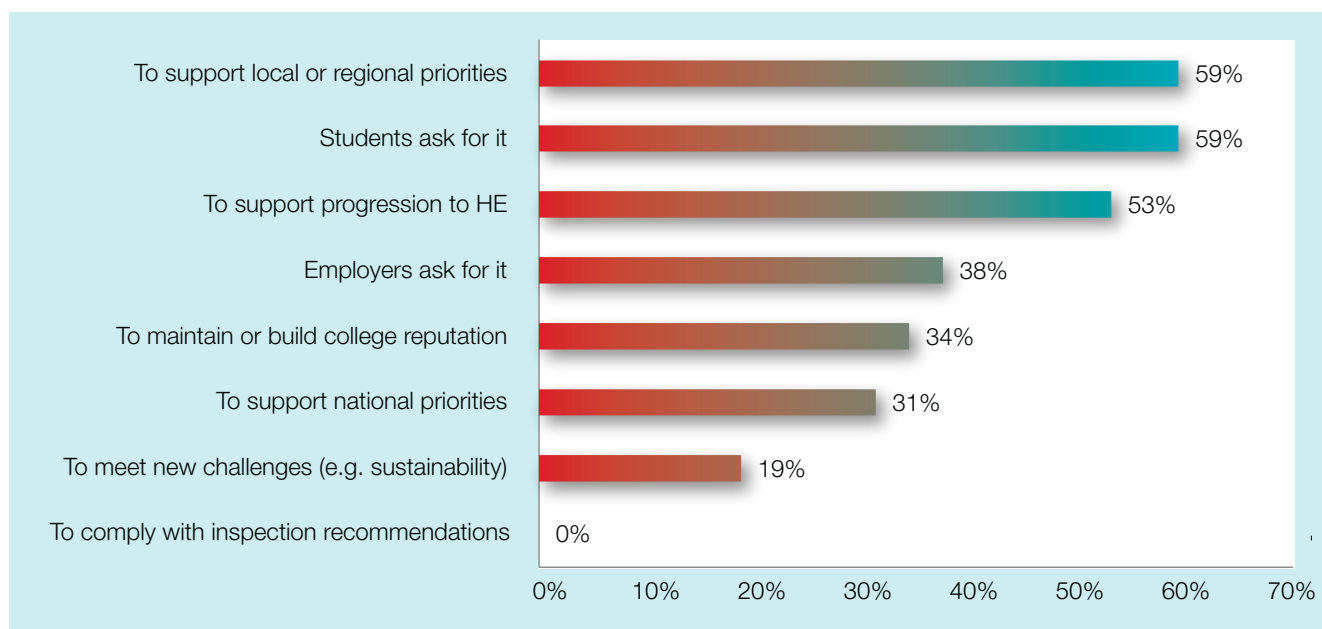
The challenges FE colleges face in delivering vocational Stem provision at levels 3 and above

The online survey was completed by 36 colleges (i.e. 10 per cent of all colleges), with a broad spread across all the English regions. Nearly a third, (30 per cent or 61,636) of all students (part-time and full-time) in the 32 colleges that responded to this question were on a predominately Stem programme of study (in 2010–11).

When asked about the main drivers for their college’s Stem provision, 13 survey respondents out of 32 (41 per cent) said the main reason for providing Stem was to support local and regional priorities. Seven (22 per cent) said it was in response to student demand and the remainder said it was either to support progression to HE (four respondents, 13 per cent); respond to employer demand (three responses, 9 per cent); or maintain or build college reputation (three responses, 9 per cent). These responses were strongly supported by the feedback gained from the focus group and 157 Group network discussions.

When looking overall at the three main drivers for Stem provision, survey responses were as shown in the graph below.

Figure 1. Three main drivers for your Stem provision



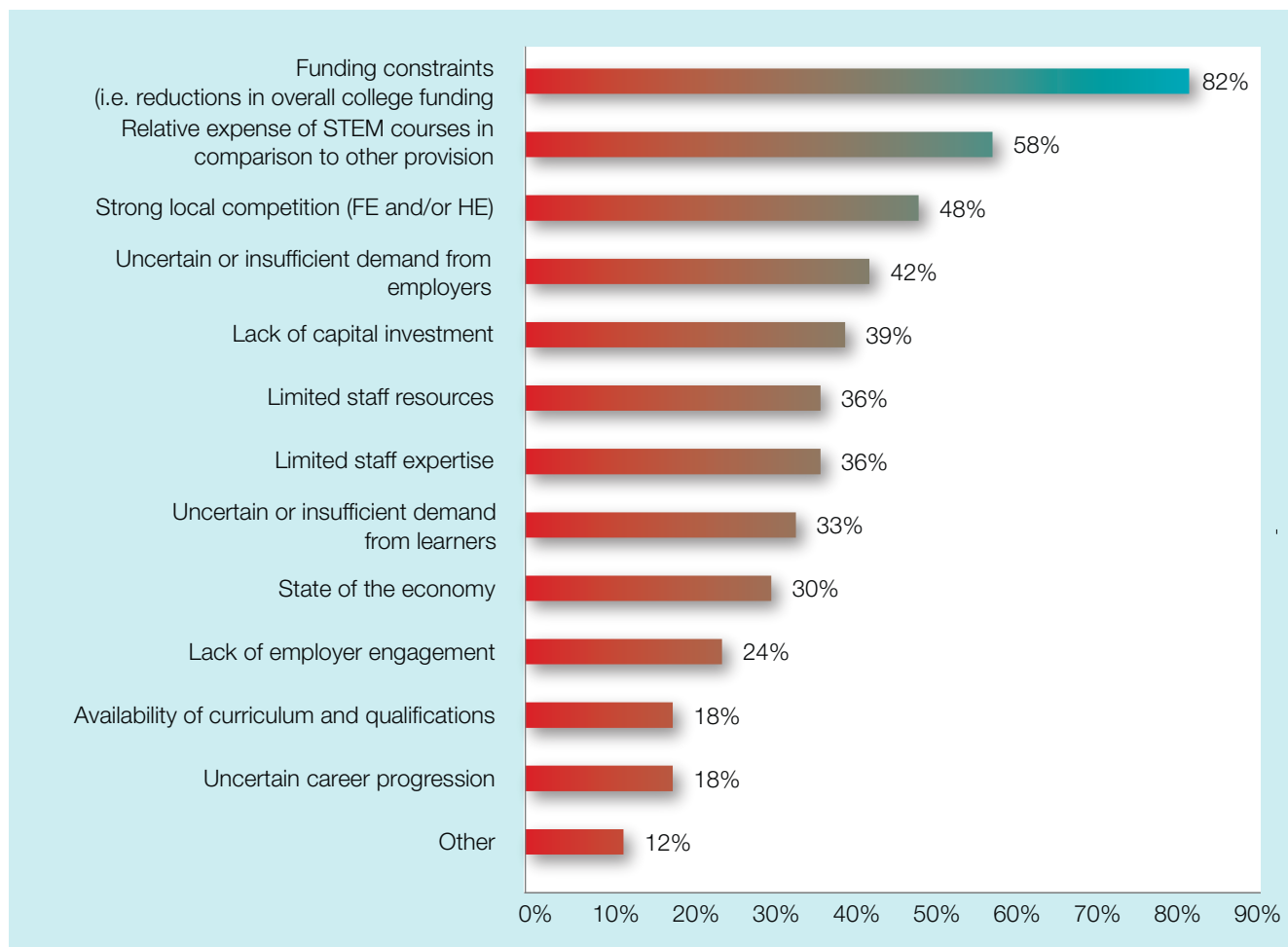
When asked to identify the main challenges for the successful design and delivery of vocational Stem provision at levels 3 and above, survey respondents (totalling 33) identified the main challenges as:

- funding constraints (79 per cent)
- relative expense of Stem courses in comparison to other provision (15 per cent)
- strong local competition from FE or HE (9 per cent)
- uncertain or insufficient demand from employers (9 per cent).

The results suggest that pressure from funding constraints is likely to force colleges to review their current curriculum offer. This could mean that colleges no longer feel that the **rate** of funding is adequate to meet the cost of Stem programmes. It could mean that the overall **allocation** of funds is insufficient to meet all the needs that are identified. If Stem provision is a priority, as it is for many colleges, they may decide to retain it at the expense of other provision. In other colleges, where Stem provision is less of a strategic priority – or where funding constraints are greater – Stem may become the victim of curriculum prioritisation.

When asked in more detail about the main challenges for the successful design and delivery of vocational Stem provision at levels 3 and above, it became clear that overall reductions in allocations were the major issue, but there was also implicit concern about rates. The survey responses were as shown in the graph below.

Figure 2. The main challenges for the successful design and delivery of vocational Stem provision at levels 3 and above



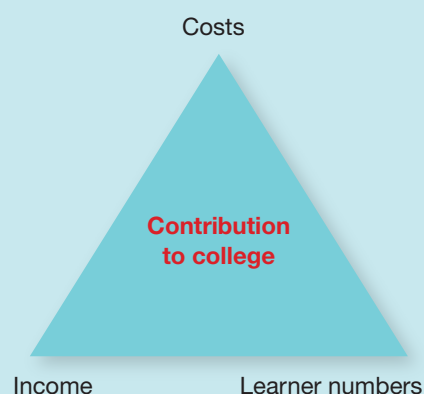
Curriculum planning methodologies and the costs of Stem provision

It is worth pointing out that although the project focused on looking at the costs of Stem provision in FE colleges, we acknowledge the critical influence of quality issues on provision and curriculum planning processes. In trying to identify the costs of Stem provision, it is clear that cost is linked to quality: for example, costs can be cut by using fewer staff or providing less equipment in laboratories. The objective of the project was not to focus on the 'cheapest' way to provide Stem programmes, but rather to attempt to provide an evidence-based account of the relative costs (compared to non-Stem provision) incurred by colleges in delivering high-quality Stem teaching and learning.

At the start of the project, the curriculum planning and costing methodologies employed in a number of 157 Group colleges were reviewed. The methodologies used are different for each college, with some colleges using sophisticated online tools to support their analysis of course costs and income. It is clear that colleges look at a range of costs, including staffing (at different levels and continuing professional development (CPD) requirements), equipment and accommodation, learning resources, validation, exams and marketing.

14

The critical financial issue affecting curriculum planning is the **contribution** a course can make to the college, rather than the absolute course cost.



For any college to be viable, the income from public and private sources for its courses **on average** has to cover direct costs and a proportionate share of college overheads. The key elements therefore are the funding rate per student, the number of students and the programme costs. A change in any of these factors will have an impact on the potential financial contribution and it is the relationship between them that affects the size of the possible contribution that can be made to the college. For the majority of colleges that provided feedback, contributions to the college are calculated on a school or directorate level, rather than at the level of an individual course. This enables colleges to offer courses which, on an individual basis, appear less viable or more expensive, as they are in effect subsidised by other less expensive courses within that directorate.

Other things being equal, however, those courses that do not make a sufficient contribution are the more vulnerable when resources are restricted. In this respect, it should be noted that, for many Stem courses, there is a fixed limit on the possible group size due to health and safety regulations or restrictions on the availability of space and equipment in laboratories. This means, in effect, that the potential contribution to college overheads that some Stem courses can make has a ceiling.

It should also be noted that colleges use different methods, and include different elements, in their internal assessments of costs and income. This adds a further layer of complexity to the challenge of attempting to acquire information on comparable costs and financial contributions between colleges. It is not simply a matter of asking for a routine report, but asking colleges to identify and present data in a manner that is consistent across the project but probably different from the way they normally report.

There are many factors, in addition to cost, that influence decisions made in curriculum planning – some of these were evidenced in the review of the curriculum planning methodologies as well as in the college focus groups, and include:

- demand from learners and employers, both current and expected
- supporting the local economy
- supporting government priorities
- being able to offer progression to higher levels of study or employment⁵
- being able to offer a diverse and inclusive curriculum
- broadening the HE offer.

Clearly, college curriculum planning is not influenced only by the cost of delivery. It is a complex picture and relates to colleges' social mission to support their local communities, rather than merely operating as profit-making organisations. Nevertheless, colleges cannot operate if they cease to be financially viable, however worthwhile their activities.

It has been difficult to collect consistent information on the cost of courses for this project. At the outset, it was hoped that the project would collect information on the costs for individual courses that could then be compared across subjects and colleges. It was then decided by the group of participating colleges that a more appropriate method would be to collect cost information for cluster areas of Stem provision (i.e. for health science, engineering, etc), but again this proved problematic for many of the participating colleges.

Due to the complexity of colleges using different methodologies for collecting course cost information, it was agreed that a pragmatic way forward would be to develop a common template (based largely on the format used by one of the participating colleges) that could be shared with the project group for them to complete, enabling comparisons among colleges to be made on the ratios of Stem to non-Stem costs. This template calculated a total cost for provision of a specific subject based on the sum of the following costs: teaching staff, technician staff (both enhanced for on-costs), equipment replacement, IT replacement (both at 20 per cent a year), consumables (general and specific), and energy, maintenance and cleaning.

The numbers of learners per course were also recorded, allowing a cost per learner to be calculated. While this method allows comparisons between subjects in the colleges concerned, the figures are not comparable with the costings used by funding agencies to develop national funding rates. Also, since the cost per learner calculation is based on the numbers actually recruited rather than necessary variations in group size, they need to be treated with a degree of caution. Nevertheless, the figures reinforce the evidence of the higher costs of delivering Stem subjects.

It should be noted that this template, and subsequent analysis, looked only at annual running costs of Stem provision and did not factor in the initial set-up costs, which are often significant. For the colleges involved in the project, these investment costs are not included in their analysis of course costs and contribution to the college, hiding the true extent of the expense of Stem provision.

A number of colleges were able to supply information on their course costs for Stem and non-Stem provision. Using the data below, it is possible to calculate how much more expensive it is to deliver certain Stem qualifications compared to non-Stem qualifications, and to compare this ratio to the programme weighting that colleges receive for providing more expensive practical subjects.

5 In one of the college focus group discussions, it was commented that there is a college commitment to providing courses which move people into employment and there are clearer links in Stem subjects to employment than there are in non-Stem subjects. For example, it was stated that Access to Humanities recruits fewer students than Access to Science and Nursing, because applicants can see a clear progression route from the latter course.

College A	Biology A level	Chemistry A level	Physics A level	Non-Stem A level
Total cost ⁶	£71,000	£71,000	£71,000	£52,000
Relative cost compared to non-Stem A level	1.37	1.37	1.37	1.0
Ratio of average cost per learner, science to non-Stem at A level	1.35	1.36	1.35	1.0

The current programme weighting for science is 1.12, which means the government has calculated that science costs 1.12 times more to deliver than a non-practical subject; but the results from this college suggest it costs 1.37 times as much to deliver a science A level than a non-Stem A level.

College B	Biology A level	Chemistry A level	English A level
Total cost ⁶	£51,000	£48,000	£38,000
Relative cost compared to non-Stem A-level	1.34	1.26	1.0
Ratio of average cost per learner, science to non-Stem at A level	1.07	1.17	N/A

College B again suggests that the relative costs of delivering science A levels are higher than the current programme weighting of 1.12. However, this college has recruited well on to its science courses (compared to English) and so when comparing the ratio of the costs per learner, their provision appears affordable using the current weightings.

College C provided data illustrating the costs of delivering the extended diploma at level 3 in engineering, science, IT and business.

College C	Extended diploma level 3 engineering	Extended diploma level 3 science	Extended diploma level 3 IT	Extended diploma level 3 business
Total cost	£89,000	£73,000	£91,000	£62,000
Relative cost compared to business	1.44	1.18	1.47	1.0
Ratio of average cost per learner, Stem to business at level 3 extended diploma	1.25	1.30	1.13	1.0
Current programme weighting	1.3	1.12	1.3	1.0

Again, this table suggests that the relative costs of delivering these courses are higher than the programme weightings used by the Skills Funding Agency and Education Funding Agency. The variation in cost per learner reflects different levels of recruitment, which are in part random effects.

⁶ Note: The variation in total cost between colleges will reflect the number of groups offered, as well as the total numbers of students on the course.

College D provided information for the total cost of all its non-Stem provision, over a range of levels (from level 2 to levels 4 and 5), therefore no direct comparison could be made in terms of the relative expense of its Stem provision to non-Stem provision. But the table below suggests that the type of Stem course that is offered also makes a difference to the cost of delivery, with more practical vocationally related subjects being more expensive than academic qualifications. It is not clear, however, how group size impacts upon the calculations.

College D	
Qualification	Cost per learner
A levels	
Biology	£660
Chemistry	£500
Physics	£500
Psychology	£440
Vocationally related qualifications	
BTec level 3 in applied medical science	£886
BTec level 3 in forensic science	£1,708
Foundation degree level 4 or 5 in psychology with sociology	£1,409
Foundation degree level 4 or 5 in human biosciences	£2,554

These figures suggest that there is very considerable cost involved in providing some Stem programmes. The data also suggests that the current programme weightings for science, engineering and IT may not sufficiently reflect the difference in the costs of delivering these subjects compared to non-practical subjects.

The conclusion that the resource-intensive nature of Stem provision makes it expensive to deliver, and that the current programme weightings do not cover the costs of all Stem courses, was supported in discussion with the project group and college focus groups. Although it is acknowledged that there are huge variations in the costs of Stem courses, and that some Stem courses (e.g. mathematics) are not more expensive than non-Stem courses, the focus groups concluded that greater recognition should be given to Stem provision and that a review of current programme weightings is required.

Expected changes in Stem provision

From the survey, colleges report the following expected changes to their Stem provision over the next two years.

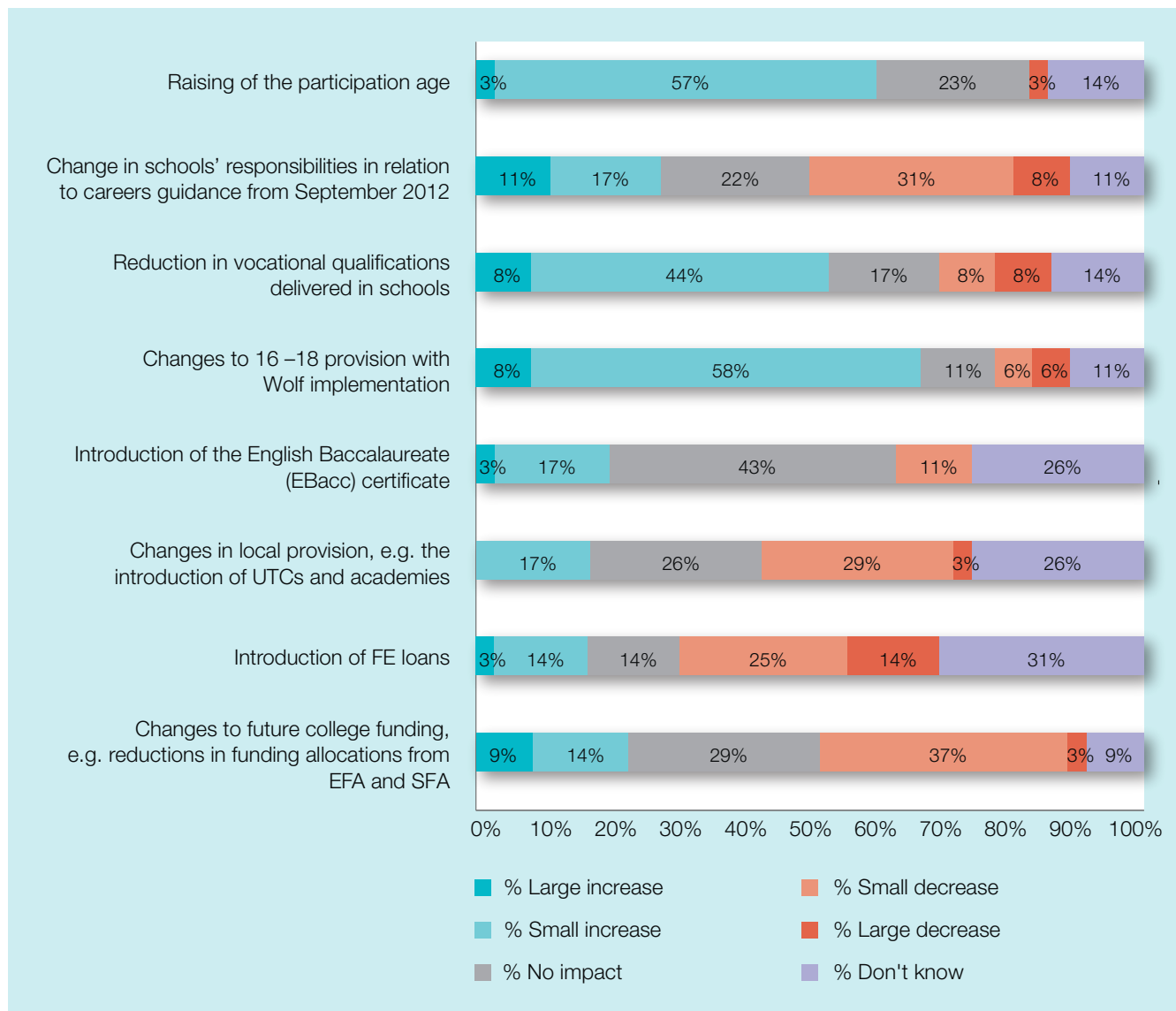
Most respondents expect either a small change or no change in their Stem provision for 16 to 18-year-olds. Additional points of interest include:

- **Science:** 24 colleges (70 per cent) expect an increase in their level 2 provision and 27 colleges (80 per cent) expect an increase in their level 3 provision. A number of colleges stated that they expect a rise in demand from students due to the perceived greater value of science-based subjects, reinforced by the introduction of the EBacc. Some colleges report growth in their provision, including new A levels, GCSEs and applied BTecs.
- **Technology:** 26 colleges (74 per cent) expect an increase in their level 3 provision, with a number of colleges reporting an expected increase in demand for apprenticeships from employers.
- **Engineering:** Nine colleges (31 per cent) expect large increases in their provision at level 2 and eight colleges (28 per cent) expect large increases in their provision at level 3. A number of colleges report an expected increase in demand for apprenticeships from employers.
- **Maths:** At level 2, nine colleges (25 per cent) expect a large increase in provision. The Wolf recommendation for level 2 will see increased demand (including for GCSE resits); this may also have a knock-on impact on level 1 provision.

Similarly, for Stem provision for those aged 19 and over, most colleges expect a small increase in provision or for provision to remain the same.

In the survey, respondents were asked to identify the expected impact (in terms of number of courses offered or the numbers of learners recruited) of various factors on the college's Stem provision at levels 3 and above. Responses are shown in the graph on the next page.

Figure 3. Expected impact (on the number of courses offered or the number of learners recruited) of each of the following on the college's Stem provision at level 3 and above



The factors most respondents expect to result in a **decrease in their Stem provision** are:

- changes to college funding (40 per cent expect this to cause a decrease in their Stem provision)
- the introduction of FE loans (39 per cent; with 14 per cent expecting this to result in a large decrease in their provision)
- changes in schools' responsibilities in relation to careers guidance (39 per cent)
- changes in local provision (32 per cent).

The factors that most respondents expect to result in an **increase in their Stem provision** are:

- changes to 16–18 provision with Wolf implementation (66 per cent expect this to result in an increase in their Stem provision)
- the raising of the participation age (60 per cent)
- the reduction in vocational qualifications delivered in schools (52 per cent).

Interestingly, there was a considerable degree of uncertainty about the impact of a number of influencing factors, particularly the introduction of FE loans, changes in local provision and the introduction of the EBacc (with 31 per cent, 26 per cent and 26 per cent of respondents respectively responding "Don't know" to the question of the expected impact of these factors on their Stem provision).

Feedback from focus group discussions

The college focus groups enabled groups of college staff to review the project findings (i.e. the cost information obtained and the survey results) and for these to be validated against the specific colleges' own experience. Feedback below is structured into two main areas – costs and challenges.

Costs

The cost challenges were reiterated in the college focus group discussions, with college staff commenting on the costs associated with:

- establishing and maintaining specialised Stem learning spaces (e.g. laboratories, etc)
- specialised consumables and equipment, including classroom technology to ensure that provision is responding to the needs and expectations of learners
- higher levels of staffing and the requirement for more contact hours
- creating and developing a programme of Stem enrichment and enhancement (e.g. Stem promotion, Stem clubs, etc).

It was acknowledged that a significant financial challenge is obtaining the necessary investment to set up high-quality Stem provision and that these initial investment costs are not included in colleges' calculations of ongoing running costs – they are a 'hidden' cost of Stem provision. Colleges are being encouraged to broaden their Stem offer, but this requires substantial investment. For example, in one focus group it was reported that the estimated cost of establishing a renewables centre is £1m. Recognising this, it was suggested that a Stem growth and investment fund should be established by the government to support the development of new Stem provision in a way that is responsive to national and regional employer demands for skills.

Engineering was cited as an example of a programme area offering a variety of courses that were limited in the number of students that could be physically accommodated, due to the requirement for practical components, experiments and so forth, and are therefore more expensive to run. The programme weightings are not as high as, for example sport and art, so these subjects often have to subsidise the more expensive Stem ones.

In one of the college focus group discussions, it was noted that college fees may continue to be set on the basis of unweighted costs. This has the benefit of making all courses of equal cost to potential fee-paying learners, but has the significant downside of not enabling the college to draw in the 'weighted' element from fee-paying learners, i.e. learners will pay a standard fee that does not reflect the additional costs of delivering Stem provision, thereby leaving colleges to cover this income versus costs 'gap' themselves. Since colleges will rely more on fee contributions, this may have a considerable impact on income from Stem provision.

It was also noted that changes to the funding arrangements will mean learners aged 19 and over who are in receipt of fee remission can no longer be charged for any essential course-related resources. This will have a bigger impact on those Stem programmes, where fieldwork is an essential part of the course.

Challenges

Colleges recognise that high-quality provision needs to facilitate learners' access to expensive and up-to-date specialist equipment and technology. Effective employer engagement is essential and supports the potential for the sharing and donation of equipment and expertise. It was suggested that this could be encouraged more through the development of specific incentives for employers. Active employer engagement also enhances the opportunities for work placements, apprenticeships and so forth, and can facilitate increased employer involvement in curriculum design and review, and teaching and assessment activities. Examples of effective Stem employer engagement should be shared and promoted.

The challenge of ensuring that learners receive effective and impartial information, advice and guidance (IAG) was widely acknowledged. Colleges recognise that they need to partner effectively with schools to ensure that school pupils are receiving timely and high-quality IAG and to support progression into Stem. Colleges also acknowledge that there is a need to make Stem attractive to potential learners, demonstrating that Stem programmes equip learners with transferable skills that they can take to other sectors if they decide not to work in a Stem area. One group noted the particular importance of promoting Stem study and careers to female students.

Even in cases where the costs of provision may be comparable with non-Stem provision (maths, for example), colleges may have to pay higher-than-average salaries to recruit and retain good quality staff. Colleges need to compete with schools and sixth-form colleges, as well as industry, for staff and need to be able to provide a competitive salary package. The cost of providing high-quality Stem CPD for staff was also reported as a challenge in focus group discussions and this problem extended to finding the funds to allow staff time to use their learning for quality improvement in the college.

The focus groups reported that colleges need to be able to provide a broad curriculum of academic and vocational Stem courses, and demonstrate clear Stem career pathways from age 14 onwards. Progression for Stem learners post-18 must not be limited to university courses, and learners need to be able to pursue respected, alternative pathways at FE colleges.

College staff were also concerned that the increase in HE fees would have a negative impact on learners' participation in Stem subjects, although it was acknowledged this may also stimulate greater interest in foundation degrees.

Conclusions and recommendations

The government is keen to promote Stem subjects and careers, and FE colleges play a vital role in ensuring that learners are equipped with the relevant, high-quality Stem vocational skills required to ensure UK businesses are productive and competitive. On the whole, it is expected that demand from learners for Stem provision will increase as these programmes and skills are perceived to be in demand by employers and lead to employment. However, significant funding pressures on colleges are threatening their ability to continue to offer high-quality, vocational Stem provision at levels 3 and above.

The project has demonstrated the broad challenges faced by FE colleges in designing and delivering high-quality vocational Stem provision at levels 3 and above. The lack of a common methodology for assessing course costs made it difficult to make comparisons across colleges, although some broad observations on the relative expense of Stem provision, as compared to non-Stem provision, can be made, confirming the extra costs reflected in programme weightings .

Recommendations

1. In the continuing DfE consultation on the funding of 16–19 programmes, proper consideration should be given to ensuring that the weightings for Stem provision truly reflect the cost of delivery.
2. The Skills Funding Agency and the Department for Business, Innovation and Skills (BIS) should give further consideration to the costs of Stem qualifications for adult learners and introduce measures to ensure that the introduction of adult loans does not discourage adults from upskilling or reskilling in Stem.
3. The government should consider how the protection offered to strategic and vulnerable subjects in HE can be extended to the FE sector.
4. The government should establish a Stem growth and investment fund, which can be accessed by colleges that demonstrate they are working with and responding to national and regional employer demands for skills.
5. The government should work with colleges and employer bodies to review how employers might be incentivised (for example, through tax breaks) to support Stem provision in colleges by providing equipment, personnel or other expertise.
6. Employers need to engage with FE colleges to ensure that Stem programmes are industry-relevant, as well as to promote opportunities for work placements and industry linkages (both for learners and college staff). Professional bodies should play an active part in brokering these relationships. The 157 Group welcomes the news that the Gatsby Charitable Foundation will be supporting engineering professional bodies to work with FE providers and employers to strengthen the pathways to technician roles.
7. Colleges should further develop networks to support each other, to share best practice in Stem provision and to help keep up to date with curriculum changes etc. Such networks would also provide an opportunity to undertake joint activities, such as staff development programmes and internal process reviews. These partnerships could focus on identifying practical mechanisms for the sharing of specialist equipment and making the most effective use of available teaching resources, and could be supported by employers and local enterprise partnerships (LEPs).

The 157 Group and the colleges involved in this project look forward to working together with other key stakeholders, including the Gatsby Charitable Foundation, to take these recommendations forward.

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Contact us

The 157 Group Limited
P O Box 58147
London
SW8 9AF

www.157group.co.uk
info@157group.co.uk

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Lynne Sedgmore CBE

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