

STEM CAREERS REVIEW

Report to the Gatsby Charitable Foundation

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I. EXECUTIVE SUMMARY

ABOUT THIS REPORT

In February 2010, the Gatsby Charitable Foundation agreed to fund a short review of STEM careers, led by John Holman, then National STEM Director. This work arose following the publication of the Report¹ of the Science for Careers: Science and Society Expert Group, chaired by Diana Garnham, and seeks to explore next steps.

The review covers provision of STEM careers education, information, advice and guidance in England. By 'STEM Careers', we mean careers that are available for people with qualifications in science, technology, engineering and mathematics. There is a focus on secondary and further education, though we have recommended the need to commence careers related work from an early age. We have considered how careers support for this age group fits within an all-age service.

The evidence base for this report is detailed in Appendix I. It comprises:

- A literature review drawing on UK and international studies
- Nineteen interviews with key stakeholders in the careers guidance profession and STEM community
- Meetings with the Skills Minister John Hayes MP and senior officials in The Department for Education (DfE) and The Department for Business, Innovation and Skills (BIS)
- An online survey of the STEM and careers guidance communities, with 105 respondents representing 95 institutions
- Two workshops, one for educators and careers professionals, and one for employers.

The report has fifteen recommendations for improving access by students and their parents to high quality information and guidance on STEM careers. Some of the recommendations are to the Government and its agencies, some to the careers guidance profession, some to the STEM community² and some to independent funders.

WHY STEM CAREERS?

People with skills in science, technology, engineering and mathematics (STEM) are important to the UK economy. They have better job prospects and a wider choice of rewarding careers. STEM careers and the opportunities they generate are important drivers of social mobility in our society.

INTERNATIONAL COMPARISONS

International studies underline the importance of careers guidance professionals understanding labour markets and having access to information based on high quality, up to date labour market intelligence. England is particularly weak in providing clear, simple and impartial guidance on vocational routes.

THE CAREERS GUIDANCE PROFESSION

¹ Science for Careers: Report of the Science and Society Expert Group, Diana Garnham, BIS, Feb 2010; <http://interactive.bis.gov.uk/scienceandsociety/site/careers/files/2010/03/BIS-R9199-URN10-767-WEB.pdf>

² In this report, 'the STEM community' refers to the key stakeholders in Science, Technology, Engineering and Mathematics, particularly academia, the learned societies and science based industry.

The careers guidance profession is in flux. Government proposes that it should become an all-age service. Schools and colleges are likely to move to becoming purchasers in a mixed market of careers guidance, with some provided in house and some bought in. This has implications for quality and consistency (Recommendation 8).

The Careers Profession Task Force, chaired by Dame Ruth Silver, has published its independent report: *Towards a Strong Careers Profession*³, in which it states the need for 'professionalisation of careers professionals'. Such a move represents an opportunity to make STEM careers information a part of every professional's initial and in-service training. We are recommending the development of a flexible STEM careers training module (Recommendation 4).

Impartiality is a fundamental tenet of careers guidance. At its heart, impartiality means providing information with the interests of the student as the sole consideration. Yet impartiality has sometimes been interpreted as meaning 'all subjects and qualifications are of equal worth', which is clearly untrue. A clearer definition and interpretation of impartiality is needed (Recommendation 5).

SUBJECT TEACHERS

Dedicated careers guidance lessons do not have a good reputation in schools. We recommend that teachers of science, mathematics and design & technology should take opportunities where appropriate to embed elements of STEM careers awareness to contextualise their teaching and help bring their subject to life. This should become second nature to the teacher and appear seamless with the subject content by students. This creates a training need in both initial and in-service training, and we recommend that the STEM careers training module should be available for use in the initial and in-service training of STEM teachers (Recommendation 4).

During 2008-11, the Department for Education is funding a package of STEM careers initiatives. These provide a range of teaching resources, strategic planning activities and exemplars of good practice, which should become part of a physical and online STEM Careers Collection residing in the National STEM Centre. The STEM Careers Collection should include information and data as well as teaching resources, and be readily accessible by subject teachers and careers professionals, with a section targeted at school and college leaders (Recommendation 7).

EMPLOYERS AND UNIVERSITIES

Employers and universities are often vociferous about the need for STEM skills and qualifications among those leaving schools, yet they do not articulate their wishes clearly to students and their parents. They need to be transparent about their preferences if they are to send the right signals to students. This is particularly important for students who have no inside knowledge of universities or the employment market (Recommendations 11 and 12).

Employers and universities can show students what it is like to have a STEM career or to study STEM at university by sending role models into schools and colleges. This kind of activity should be consolidated around the STEM Ambassador scheme (Recommendation 15).

³ *Towards a strong careers profession*: An independent report to the Department for Education, the Careers Profession Task Force, chaired by Dame Ruth Silver

LABOUR MARKET INFORMATION

High quality careers guidance, based on accurate labour market information about the careers available to people with STEM qualifications and skills, is important if all young people – especially those with no immediate family with STEM qualifications – are to keep open the option of following STEM careers.

At present, labour market information is fragmented, inconsistent and difficult for students, parents, teachers and even careers guidance professionals to access. There are good overseas models for the creation of a single database of LMI which can readily be accessed by all groups (Recommendation 10).

VOCATIONAL ROUTES TO QUALIFICATIONS

The routes that lead to university are far better known and understood by students, parents, teachers and careers professionals than those leading to apprenticeships and employment. Simplifying and clarifying these is a key task for the Government following the announcement of Professor Alison Wolf's investigation into vocational qualifications (Recommendation 13). It would be worth investigating the possibility of developing a web-based interactive guide to vocational routes that leads students through the available choices (Recommendation 14).

2. SUMMARY OF RECOMMENDATIONS

THE CAREERS GUIDANCE PROFESSION

The careers guidance profession does not yet enjoy the respect that it needs to have, among education professionals, employers and the STEM community. As part of its move in the direction of becoming a strong and autonomous profession, as recommended in the Careers Profession Task Force report: *Towards a Strong Careers Profession*, careers professionals will need support to improve their understanding of STEM, careers arising from STEM and sources of information about them.

Recommendation 1

The Government's proposed move to an all-age careers guidance profession should be made as quickly as possible.

[To Government]

Section 6, p23

Recommendation 2

The Government should support the implementation of clear professional standards during the initial and in-service training of careers professionals.

[To Government and the careers guidance profession]

Section 6.1, p23

Recommendation 3

The careers profession should move towards the provision and mediation of high quality information on careers and the labour market, and away from the focused support of the minority of individuals at risk of unemployment, which should be the responsibility of local authorities.

[To Government and the careers guidance profession]

Section 6.1, p24

Recommendation 4

Careers professionals need to be well informed about careers available to people with STEM qualifications and skills, and familiar with the sources of information about such careers. The National STEM Centre, with support from the STEM community and independent funders, should produce a high quality STEM careers training module (comprising both online and face-to-face support) designed for use in the initial and in-service training of careers professionals.

[To Government, National STEM Centre and STEM community]

Section 5, p19

In addition, following the proposals in the Careers Profession Task Force report, the STEM and careers guidance communities should work together to introduce a specialist Advanced Careers Practitioners qualification in STEM.

[To the careers guidance profession and the STEM community]

Section 6.1, p23

Careers professionals should have access to high quality information about STEM Careers: see Recommendation 7. Section 6.1, p24

Recommendation 5

Government and the proposed Careers Profession Alliance should clarify the interpretation of 'impartiality' in school/college careers guidance to ensure that advice should always be given in the interests of the student, and not the institution. However, impartiality must not prevent advice being given that some subjects and qualifications (in particular, science and mathematics) have greater value in the labour market than others. Impartial advice requires consideration of the student's best interests and knowledge of the labour market.

[To Government and the proposed Careers Profession Alliance] Section 6.2, p25

TEACHERS AND SCHOOLS

Careers guidance professionals cannot be expected single-handedly to provide students with the information they need. Teachers of science, mathematics and other STEM subjects in secondary schools and FE colleges should be better equipped with knowledge of STEM careers and the pathways to them. They should understand the value of external careers guidance and know where to direct students. Careers awareness should be embedded seamlessly into the teaching of STEM subjects, especially science and mathematics. Awareness of careers in STEM should begin in primary school.

Recommendation 6

The initial and in-service training of teachers of science and mathematics should increase teachers' knowledge and understanding of STEM careers. The STEM careers training module (Recommendation 4) should be made available to initial teacher education (ITE) establishments and to the Science Learning Centres, National Centre for Excellence in Teaching of Mathematics (NCETM) and other providers of continuing professional development to science and mathematics teachers. Its use should be promoted by the Training and Development Agency for Schools, and the Department for Education.

[To DfE, TDA, ITE establishments and CPD providers to science and mathematics teachers]

Section 6.3, p27

Recommendation 7

A STEM Careers Collection, for the use of teachers of science and mathematics and careers guidance professionals, should be built at the National STEM Centre, and linked to the STEM careers training module (Recommendation 4). This collection should provide strategic planning tools, information and teaching resources, and should be accessible online through the Centre's eLibrary. It should be built with the support of the STEM community, and should include the best resources produced by the

DfE's STEM careers awareness programme. The National STEM Centre should work closely with the Science Council in the development of this collection.

A section of this collection should be targeted specifically at school and college leaders to provide them with the headline facts about the benefits of STEM qualifications.

[To DfE, National STEM Centre, STEM community and independent funders] Section 6.4, p28

Recommendation 8

With careers guidance services increasingly being bought-in by schools and colleges, quality assurance becomes even more important. As Ofsted defines its new inspection framework, the quality of careers guidance, including the interpretation of impartiality, should be made a more explicit requirement for inspection. We also support the recommendation by the Careers Profession Task Force, that Ofsted should carry out a thematic review of careers guidance for young people, to identify excellent practice, to use this as a baseline, and carry out a further review within three years.

[To Government and Ofsted] Section 6.2, p25

Recommendation 9

The funding and accountability systems within which schools and colleges operate can create perverse incentives, guiding students away from science and mathematics towards 'softer' subjects, even though this may not be in students' best interests. In its review of the school and college accountability framework, Government should seek to remove these perverse incentives by giving schools and colleges credit for guiding students towards the choices that are in their best interests for their future career, whether it be by an academic or vocational route. More work needs to be done, perhaps by an independently funded body, to develop and pilot such a 'progression indicator'.

[To Government and independent funders] Section 2.1, p12

ACCESS TO INFORMATION

Students and their parents, as well as teachers and careers advisers, need much better access to information about careers and the qualifications that are needed to enter them, and to high quality labour market information (LMI). The internet offers some striking opportunities for providing this information.

Recommendation 10

We recommend the creation of a single, comprehensive and constantly updated database and portal of careers opportunities and LMI across all employment sectors. This database should have a web portal with different interfaces for students and their parents; for employers; and for teachers and careers professionals. The interface for students and parents should link to the Science Councils' Future Morph portal. Decisions about the design and functionality of this portal should be made in the light of

research already underway by the United Kingdom Commission for Employment and Skills (UKCES) and examples of good practice from overseas. There will need to be a training programme for careers professionals in the use of the portal.

[To Government, UKCES and sector skills councils]

Section 7.2, p33

Recommendation 11

Employers favour STEM skills and qualifications for a range of careers, and these qualifications have real currency at all levels from GCSE to technical, apprentice and graduate qualifications. This reality needs to be made clear to students, parents, teachers and careers advisers. The CBI and other employer organisations should work with their members to ensure that a transparent message about the value of STEM qualifications to employers is disseminated at local and regional as well as national level.

[To CBI and employers]

Section 7.1, p31

Recommendation 12

Similar transparency about the value of STEM qualifications should extend to university admissions. The successor organisation to the Higher Education Funding Council should work with the University and Colleges Admissions Service (UCAS) and Universities UK to ensure that all universities are transparent about their preferred qualifications.

[To HEFCE successor body, UCAS, UUK]

Section 7.1, p31

Recommendation 13

The routes to apprenticeships and technical qualifications are more opaque and less well understood than the academic career paths that lead to university. In the longer term, government policy should focus on simplifying and clarifying vocational routes and making transparent the careers available at the end.

[To Government and the Wolf review of vocational education]

Section 7.3, p36

Recommendation 14

In the shorter term, there should be a study, by government or an independent organisation, of the feasibility of producing a comprehensive, attractive and user-friendly web-based guide that focuses on vocational routes leading to apprenticeships and employment and seeks to simplify and clarify the complex landscape. This guide could draw on similar sites for university entrance such as *bestCourse4me.com*, and should be linked to the LMI database in Recommendation 10.

[To Government and independent funders]

Section 7.3, p36

ROLE MODELS AND AMBASSADORS

Recommendation 15

There are a number of valuable schemes that provide and train ambassadors to visit schools and colleges. These individuals tell students what it is like to take advanced STEM study, and to work in STEM industries. These schemes (including Research Councils UK's 'Researchers in Residence') should be amalgamated under a single STEM Ambassadors scheme. In deciding the next phase of STEMNET, Government should ensure that its brief is to focus principally on STEM Ambassadors, which should be further expanded with a strengthened emphasis on quality assurance.

[To Government, STEMNET and RCUK]

Section 2.2, p14

3. OVERVIEW

In February 2010, the Gatsby Charitable Foundation agreed to fund a short review of STEM careers, led by Professor Sir John Holman, National STEM Director. This work arose following the publication of the Science for Careers: Report of the Science and Society Expert Group, chaired by Diana Garnham, and seeks to explore next steps, such as the development of more accessible and comprehensive labour market information (LMI) on the demand for STEM-skilled workforce, and making a priority to ensure that there is consistent messaging on the value of STEM careers from Government and stakeholders.

This review, independent of government, explores current activity in STEM careers arising from a number of events and initiatives, including:

- The major overhaul of the Connexions programme
- The approaching conclusion of the Department for Education (DfE) funded STEM Careers Awareness programme
- Extensive activity linked to the Coalition Government's wider education programme
- The establishment of the National STEM Centre

OBJECTIVES⁴

- To carry out an audit of current activity aimed at improving awareness of STEM careers, including schemes funded by the Department for Education (DfE) and Department for Business, Innovation and Skills (BIS)
- To identify what has been the impact on schools and Further Education colleges of these schemes
- To gain understanding about how present activity has been coordinated and how this coordination could be improved.
- To identify potentially helpful activity that could be carried out by an independently funded programme
- To identify which areas could be looked at if a larger scale review were to be carried out
- To offer advice to an incoming government about future priorities for STEM careers

SCOPE

The review covers provision of STEM careers education, information, advice and guidance in England. There is a focus on secondary and further education, though we have recommended the need to commence careers related work from an early age. We have considered how careers support for this age group fits within an all-age service.

⁴These original objectives have adapted over the duration of the review to reflect our increasing understanding of the issues at stake and to accommodate changes in the policy backdrop to the review.

2.1 INTRODUCTION

The previous Government's *Science and innovation investment framework 2004–2014: next steps* document identified the policy priority to 'work with the science base and industry to improve young people's and their parents' awareness of the benefits of studying science and the career opportunities available'. It committed the Government to 'work with key stakeholders to develop ways to improve the awareness of young people and their parents and teachers of the benefits of studying science and the career options available to those with science, engineering and maths degrees and other qualifications'.

In recent years the UK has seen an unprecedented rise in the interest of Government, industry and others in the uptake of STEM subjects in schools and colleges. This has been driven by the need to ensure that young people gain the skills and aspirations to contribute to building the UK's economy and to help them participate in an increasingly scientific and technological society.

In his report *Set for Success*, Sir Gareth Roberts noted the complexity of factors that too often lead to a narrowing of young people's subject preference in schools. Roberts drew particular attention to the culture of careers guidance within secondary schools:

*'The views of parents, teachers, careers advisers and society in general towards study and careers in science and engineering can play a significant role in shaping pupils' choices as to whether to study these subjects at higher levels. Regrettably, and incorrectly, pupils often view the study of science, mathematics and engineering as narrowing their options, rather than broadening them. A contributing factor is that careers advisers often have little or no background in the sciences, and that science teachers are often unwilling to advise pupils on future options.'*⁵

One consequence is a significant shortage of individuals with the skills required by industry. The Confederation of British Industry (CBI)⁶ finds that nearly 6 out of 10 employers expect difficulty recruiting people with STEM skills in the next three years. The CBI reports STEM skills shortages in all areas – not just the obvious science, engineering and high-tech sectors: 47% of retail employers for example, say they are seeking scientific and mathematically qualified staff.

As the Government seeks to rebalance the economy towards the private sector, especially knowledge industries, economic recovery is critically dependent on there being enough people choosing to continue their study of STEM subjects (especially science and mathematics) past the end of compulsory schooling.

Indeed, it is not only graduates and postgraduates in STEM who are in demand. The UK Commission for Employment and Skills (UKCES) in its audit of skills needs⁷ reports: 'One of the most striking themes to emerge from the Audit is the growing importance of technicians, especially in specialist STEM areas'. STEM

⁵ SET for success: The supply of people with science, technology, engineering and mathematics skills, The report of Sir Gareth Roberts' Review, 2002

⁶ CBI Education and Skills Survey, May 2010

⁷ Skills for jobs: Today and Tomorrow, UKCES, 2010

skills shortages extend to technicians and qualified apprentices as well as graduates, and greater clarity is required in promoting routes to these occupations.

Employers value people with STEM qualifications not only for their specific knowledge and skills, but also for the advanced skills that STEM qualifications typically bring: technical competence, analytical and problem-solving skills, numeracy and intellectual rigour⁸. Young people – and their teachers and parents – often do not appreciate that STEM qualifications are valued for these transferable skills.

This is not just about the needs of industry and the economy: it is about the futures of individual young people too. STEM qualifications make people more employable, and provide them with more options for the future. The graduate premium⁹ for engineering graduates is nearly £250,000 compared to £50,000 for humanities graduates. There are equivalent earning premiums for people with non-graduate STEM qualifications. Teachers, young people and their parents need to have access to better general information about the lifetime opportunities that open up to people with STEM qualifications at every level.

As well as young people themselves, and their parents, it is particularly important that careers advisers, teachers of STEM subjects and – perhaps most important of all – head teachers and school managers understand the value of STEM qualifications in transforming young people's life chances. Currently, in secondary schools and colleges there are real disincentives that discourage students from choosing science and mathematics. These subjects are perceived as difficult and, although the Qualifications and Curriculum Development Authority and the previous Government maintained they are no more difficult than other subjects at A level, a statistical analysis has suggested that on average, subjects such as physics, chemistry and biology were a whole grade harder than drama, sociology or media studies, and three-quarters of a grade harder than English, RE or business studies.¹⁰

This creates a disincentive for schools and colleges to advise students to choose STEM subjects, because in terms of league table performance, it is not in the interest of the institution to advise a student to take a subject in which they are less likely to achieve a high grade. In the face of these disincentives, evidence that STEM qualifications work in the interests of young people's futures will help persuade school and college leaders to counsel students in this direction.

So another theme of this report is the need to win the hearts and minds of teachers, careers advisers and school leaders by giving them access to better information about the value of STEM qualifications.

For better informed choice, there is abundant evidence of the need to start young – much younger than the careers advisory service is currently configured towards. Of course, high quality careers advice is needed right through to adulthood, but the evidence is clear that decisions about directions of travel are often made

⁸ CBI Education and Skills Survey, May 2010

⁹ Pooled Labour Force Survey, 2000-2005 The 'graduate premium' is the gross additional lifetime earnings that can be expected by a graduate, compared with someone with two or more A levels.

¹⁰ *Related difficulty of examinations in different subjects*, Coe, Searle, Barmby, Jones, Higgins, CEM Centre, Durham University, SCORE 2008, www.cemcentre.org/attachments/SCORE2008report.pdf

at a very early age.¹¹ Children begin in primary school to form a picture of what their future lives will be like, leading to the first of a series of formal decisions made by the age of 14. So it is critically important that the work of building general awareness of STEM careers begins in primary schools and at key stage 3, when students make subject and qualifications decisions, so that they do so in the light of good information about their long-term value.

Formal decisions to continue with science and mathematics may be made at ages 14 or 16, but in people's minds they are often made much earlier. So the message, 'sticking with science and mathematics keeps open the pathways to rich and rewarding careers' needs to go out very early. While acknowledging the importance of adult careers advice, the recommendations in this report mainly relate to primary and secondary schools and colleges.

Finally, the 'stick with science and mathematics' message is not only about subject choice – it is also about persevering. Many young people find science and mathematics difficult, and are tempted to give up trying long before they take public examinations. If the value of science and mathematics to future careers is better known, there will be incentives for younger students to persevere.

2.2 IS STEM A SPECIAL CASE?

The demand for people with STEM skills and training is likely to increase. Moreover, the greater the number, the greater the level of innovation, which in turn will drive our future economic success. A report by the Brookings Institution highlights why STEM occupies a unique place in our modern technologically advanced society:

“Ultimately, all increases in standards of living can be traced to discoveries of more valuable arrangements for the things in the earth's crust and atmosphere... No amount of savings and investment, no policy of macroeconomic fine-tuning, no set of tax and spending incentives can generate sustained economic growth unless it is accompanied by the countless large and small discoveries that are required to create more value from a fixed set of natural resources.”¹²

Careers professionals tend not to have a scientific background and are therefore not well placed to present the full range of options to young people. This has been compounded by the fact that in the UK there has been a reduction in the amount of careers advice available to the general population, brought about by a focus on those young people at risk of not continuing their education or moving into employment or training (NEETs). The result has been a more general youth advisory service, which has influenced the skills set of careers professionals away from knowledge of labour markets. Developments in science and engineering move at a rapid pace and qualifications, courses and careers are ever-changing, so even the minority of careers professionals with a background in STEM subjects struggle to stay informed about jobs, qualifications and training. Meanwhile, science and mathematics as subjects are perceived as 'hard' by both students and their parents. Both these factors contribute to a reduced likelihood that an individual student will have the opportunity to discover the breadth of STEM qualification paths and career opportunities.

¹¹ For example, *Taking a Leading Role*, Royal Society, 2004

¹² Paul M. Romer and Zvi Griliches (1993), *Implementing a National Technology Strategy with Self-Organizing Industry Investment Boards*, Brookings Institution.

Some three-fifths of respondents to an online survey developed to inform this work^{13 14} felt that STEM does warrant special treatment. In part the careers professionals, industry and business representatives and educationalists who responded, suggested it was STEM's central role in economic development and growth that confers upon it special status. There was also a feeling amongst a significant number, that STEM is disadvantaged by perverse incentives within the system, such as the emphasis on examination pass rate alone rather than the breadth of subjects studied. Comments included:

"STEM is a strategically important area of focus for the UK as a whole. Public funding for education should be sympathetic to the ongoing strategic needs of the wider society."

"I take special status to imply balancing knowledge of STEM opportunities, given that many teachers do not have this background and/or lack experience of STEM industries"

Given the central importance of STEM for the UK's future prosperity, is it legitimate to single STEM out for special treatment to overcome the challenges identified above? The task force set up by DfE on the careers profession, chaired by Dame Ruth Silver, has deliberated on whether there needs to be separate STEM careers specialists. It concluded that it is better if *all* (careers) advisers understand why STEM is important and where they can get more information. We therefore recommend that in taking this work forward, the STEM community will need to work with, and in support of, careers professionals as they develop these skills. In particular STEM employers should help careers professionals gain access to and make use of high-quality accessible and attractive labour market information.

RECOMMENDATION

The funding and accountability systems within which schools and colleges operate to create perverse incentives, guiding students away from science and mathematics towards 'softer' subjects, even though this may not be in students' best interest. In its review of the school and college accountability framework, Government should seek to remove these perverse incentives by giving schools and colleges credit for guiding students towards the choices that are in their best interests for their future career, whether it be by an academic or vocational route. More work needs to be done, perhaps by an independently funded body, to develop and pilot such a 'progression indicator'.

RECOMMENDATION

There are a number of valuable schemes that provide and train ambassadors to visit schools and colleges. These individuals tell students what it is like to take advanced STEM study, and to work in STEM industries. These schemes (including Research Councils UK's 'Researchers in Residence') should be amalgamated under a single STEM Ambassadors scheme. In deciding the next phase of STEMNET, Government should ensure that its brief is to focus principally on STEM Ambassadors, which should be further expanded with a strengthened emphasis on quality assurance.

¹³ STEM Careers online survey of stakeholders, May 2010 n=105

¹⁴ See Appendix I for list of participating organisations

2.3 WHAT ARE THE PUSH AND PULL FACTORS?

Traditionally, careers advice systems have been 'based on a model of careers progression which assumes that individuals possess a set of traits or talents that can be measured objectively and matched to occupational environments that coincide with their profiles.'¹⁵ This is referred to as a 'matching' approach, and contrasts with a more developmental 'process' model, adopted by most careers professionals which takes into account the individual's needs, the changing nature of work and more complex constructs involving attitudes and behaviours linked to work.

Though most careers professionals largely subscribe to a more progressive model, some of the difficulties that appear to impede progress include the existence of what has been described as a fragmented profession, the absence of a single representative professional body and the lack of clear professional standards and qualifications. Consequently careers professionals are often poorly paid and are seen by teachers and employers as having lowly status. These factors have conspired to generate what is considered by some to be a 'siege mentality'. In our view, this inward focus has led to heightened concern over ideological nuance and less about the practical needs of the people who are served by the system. We also feel that the focus of the Connexions Service on NEETs has exacerbated this issue, with increased attention on being a general youth service, rather than focusing on routes into careers and qualifications themselves.

Employers tend to be focused on more immediate matters, though at national level, their representatives subscribe to the values inherent in generating a confident and flexible workforce for the future. At local level and for individual companies or sectors, concerns over recruitment of STEM graduates, technicians and others generates a degree of frustration with what is offered by their experience of careers provision.

This difficulty in bringing different stakeholders together over what is the essential purpose of careers education is highlighted in Watts and Herr's 'Four approaches to careers education'.¹⁶

	Focus on society	Focus on individual
Change	Social change (radical)	Individual change (progressive)
Status quo	Social control (conservative)	Non-directive (liberal)

There are two interacting variables that lead to four approaches to careers education and guidance. The first is the degree to which the focus is on the individual or society, the second being the extent to which careers interventions attempt to enact change or maintain the status quo.

Employers tend towards the conservative model, while careers professionals span radical and progressive approaches. Careers academics, who are responsible for setting the main qualification for careers professionals, also straddle liberal and progressive approaches. Those who give advice on careers but who would be considered not to be professional careers advisers (teachers, careers coordinators, work experience placement organisers in schools) may be likely to favour a more liberal approach.

¹⁵ Bimrose J., Institute for Employment Research, University of Warwick, 2009, Beyond Current Horizons, www.beyondcurrenthorizons.org.uk/careers-guidance-identity-and-development/

¹⁶ Rethinking Careers Education and Guidance: Theory, Policy, and Practice, Ruth Hawthorn, Jennifer M. Kidd, John Killeen, Bill Law, A. G. Watts, Routledge, 1996

This means that amongst stakeholders there are a range of potentially conflicting notions of what a careers service is for. For example, STEM employers and their representatives place current and future skills shortage at the forefront of their approach to careers education and see no reason not to promote STEM qualifications and careers options. Careers professionals, on the other hand, are more likely to see careers information advice and guidance as instruments of personal development and social change. They see autonomous, informed decision-making and the development of wider life skills as essential in providing young people with the capability to face an uncertain future in a fast-changing world.

Interviews with key players together with survey data, also demonstrated the issues related to perceptions of status and trust between careers professionals and STEM teachers/FE lecturers. The STEM community is perceived by careers professionals as powerful and well-resourced. Teachers are clear in their own role and status, and do not always value the careers community - who have fewer career progression opportunities and therefore less security in theirs - meaning that there may be a tendency to focus within their sector rather than how it is perceived from the outside.

"I have been a careers professional in Connexions, for an FE College and now, for a school. In every case I find that many teachers/lecturers do not consider careers professionals and careers education to be important or of equal value.....[but] Careers professionals should also be more willing to take on challenges: e.g. I frequently provide CPD to the teachers in school but Connexions advisers, despite being requested, will not join in with this." (Survey respondent)

4. METHODOLOGY

The review took place in three overlapping stages, starting in February 2010:

Stage 1: Literature review and interviews

Stage 2: Survey and workshops

Stage 3: Synthesis and reporting

Details of the evidence base are given in Appendix I.

LITERATURE REVIEW AND INTERVIEWS

During the first phase of the work, we carried out a review of prominent reports and papers from a range of sources. We have carried out a series of face-to-face and telephone interviews with a range of key stakeholders and experts.

SURVEY

A request to complete an online survey was sent to STEM contacts and was advertised in the Institute for Careers Guidance weekly email newsletter. Some 105 respondents including careers professionals, teachers and lecturers, industry representatives, researchers and consultants and business professionals completed the survey which comprised closed and open-ended questions. The format of the closed questions included Likert scale and multiple choice responses.

WORKSHOPS

Drawing on the findings of the survey, in June 2010 we convened two expert workshops at the Wellcome Collection in London. Twenty participants took part in each of the events - the first workshop consisting of STEM employers and their representative organisations, the second comprising careers professionals, teachers and FE lecturers.

SYNTHESIS AND REPORTING

An interim report was produced in July 2010, and was the basis for further discussions, including the Coalition Government's Skills Minister John Hayes MP; senior officials in DfE and BIS; and Dame Ruth Silver as she finalised her report on the Careers advice profession.

5. INTERNATIONAL COMPARISONS - WHERE IS GOOD PRACTICE TO BE FOUND?¹⁷

The approach adopted in the Organisation for Economic Co-operation and Development (OECD) Career Guidance Policy Review¹⁸ and by all European countries¹⁹ is one of *Lifelong Guidance*. Lifelong Guidance is predicated on the rationale that an individual will require professional careers support throughout their working life as they construct and reconstruct a career path. What are the options open to UK policymakers and the careers community to ensure that careers guidance matches the changing nature of work?

The two key questions currently under consideration are:

1. Whether the service is 'all-age' or 'age-specific'; and
2. Whether the service is best delivered through a partnership between an external agency and school or primarily the school's responsibility.

All-age approaches are thought to be more cost-effective, better able to link careers guidance with public policy and to:

*'...think more broadly and more systematically about the nature and applicability of their [the professionals within the system] professionalism, the allocation of their resources across the whole population.'*²⁰

Other features include coherence and continuity and the removal of 'rigid cutoff points'. It is our belief that STEM will benefit from the streamlined and continuous all-age system, which is being considered by the Coalition Government. An example might be in highlighting how each stage of the careers guidance process maps onto professional growth. Ministers have stated in various forums that they are moving towards an all-age careers service.

In England, there has been substantial criticism levelled at Connexions, the youth service set up in 1999. This is perhaps best illustrated in the Final Report of the Panel on Fair Access to the Professions,²¹ chaired by Alan Milburn MP. The Panel recommended that the Government remove careers responsibility from the service and reallocate the estimated £20 million to schools and colleges to give them freedom to tender for careers services from a range of providers. What might be the consequences for an increasingly devolved system without a significant governmental careers agency at its heart?

International studies have shown that placing buying power for careers guidance in the hands of head teachers and college principals leads to unevenness of practice and erosion of quality. In New Zealand in the

¹⁷ We are indebted to Professor Tony Watts, National Institute for Careers Education and Counselling, who has enabled us to place our findings and recommendations in a UK-wide and international context. He is responsible for a number of influential international comparative studies of guidance systems and has advised OECD, the Council of Europe, UNESCO and the World Bank.

¹⁸ Organisation for Economic Co-operation and Development (OECD). (2003). OECD review of career guidance policies: United Kingdom country note. Paris: OECD

¹⁹ Including EU, EEA (European Economic Area) and EU candidate countries

²⁰ Watts, A. G. (2010) National all-age career guidance services: evidence and issues, *British Journal of Guidance & Counselling*, 38: 1, 31 — 44

²¹ *Unleashing Aspiration: The Final Report of the Panel on Fair Access to the Professions*, The Cabinet Office, 2009,

mid-1990s, the system changed from one based around interviews from external careers advisers to a devolved model where schools would buy in their own services through funding that was not ring-fenced. By 2006 the Education Review Service found that only 12 percent of secondary schools provided high-quality careers education and guidance. A similar shift from national to market provision occurred in The Netherlands at approximately the same time. A report produced by OECD in 2002, on provision in The Netherlands, commented that the reforms had placed:

“...purchasing power in relation to guidance services in the hands not of the demand side but of the supply side: not of individuals but of institutions with their own agendas and priorities.”

Schools in The Netherlands have much in common with their English counterparts, notably a strong focus on examination success, which ultimately becomes the major driver for spending priorities. Funding models for a revised careers service should take into account the how the chosen funding model could affect the likelihood of improvement in delivery at school and college level.

International initiatives related to promoting vocational education and training (VET) may offer some promise yet may be hard to transplant to the UK in general, and England in particular, where they would struggle to take root in less-than-fertile soil. The ‘distinctive’ and often quoted German system, which encourages ‘academically able’ students to go down these routes, is not readily transportable to England where the education system is so academically focused. However a further OECD commissioned review of vocational education and training²², highlights the key expectations within the German careers guidance system, including:

- Students are provided with basic information on the functioning of the economy and the labour market, on different occupations and on the principles of career choice
- Schools work with local employers to offer students insights into the world of work and arrange contacts for practical training
- Employment offices inform students about the requirements of different occupations and provide students with up-to-date information on the state of the labour market, on apprenticeship and higher education opportunities, as well as options for direct labour market entry after school.

In Germany, joint career counselling starts at least two years before the end of any school programme and counselling takes place in schools during class hours or during special events on the premises of local employment offices, either on an individual basis or in groups.

A further criticism made of careers guidance systems in OECD countries resonates with the English experience. A focus on personal and social guidance has attracted counsellors who have received their education in tertiary academic institutions rather than in a context that might have informed them about labour markets. The report shows how Switzerland has addressed this through establishing, what has been described in the OECD Reviews of Vocational Education and Training as a ‘strong system of vocational careers guidance and counselling’.

²² Learning for Jobs OECD Reviews of Vocational Education and Training, OECD, 2009

Key features of the Swiss system include:

- Attendance at career guidance and information sessions is mandatory for students in compulsory secondary education
- All teachers receive some training in labour market opportunities so that they are knowledgeable about the labour market
- In lower secondary schools, students learn from their (trained) teachers about their career options
- Then students are introduced to the main institutions for guidance and counselling, where individuals can see generalist counsellors, and may then be directed to specialists with more knowledge of specific institutions.

In the development of an all-age service for England, consideration should be given to specific findings from these international studies, in particular:

1. Careers education is best delivered through a partnership between external organisations and the school or college, drawing on members of school teaching staff who will have received some training in, for example, making use of labour market information and vocational routes.
2. If a system is adopted whereby resources are devolved to schools and colleges to enable them to choose who delivers the service, effective quality assurance is essential. Inevitably competition with other school priorities acts to the detriment of careers.
3. Government should be the source of core labour market information, including supply and demand data, which other agencies could then make use of and append. The USA experience has shown that maintaining and updating this information is costly, but that the benefits far outweigh any costs.
4. An emphasis on personal and social guidance in careers services experienced in OECD countries is deemed to have attracted careers guidance counsellors who are not always informed about labour markets. In England, where careers services have, over the past decade had a particular focus on young people not in education, employment or training (NEETs), policymakers and careers organisations should enshrine as a major priority that all careers professionals understand labour markets.
5. International comparisons related to vocational education and training are hard to make as attitudes to non-academic routes appear to be heavily influenced by widely held national attitudes. The UK in general, and England in particular, has been identified as being too academically focused. The proposed review of vocational education by the Coalition Government should draw on the examples of good practice from countries such as Germany and Switzerland (see Section 7.3) whilst forcefully challenging culturally negative views about vocational training and making these routes more transparent and attractive for parents and young people.

RECOMMENDATION

The Government's proposed move to an all-age careers guidance profession should be made as quickly as possible.

RECOMMENDATION

Careers professionals need to be well informed about careers available to people with STEM qualifications and skills, and familiar with the sources of information about such careers. The National STEM Centre, with support from the STEM community and independent funders, should produce a high quality STEM careers training module (comprising both online and face-to-face support) designed for use in the initial and in-service training of careers professionals.

The STEM and careers guidance communities should work together to introduce a specialist Advanced Careers Practitioners qualification in STEM.

6. PUSH FACTORS

6.1 CAREERS EDUCATION, INFORMATION ADVICE AND GUIDANCE

Careers education and guidance in the UK has been based on a partnership model between schools and colleges and an external service. In England the young people's careers service has been delivered through Connexions. Criticisms of Connexions included that its broad remit and resource constraints were limiting its ability to deliver careers guidance to many young people. The policy focus on supporting those not in education, employment or training (NEETs) was at the core of criticisms levelled at the service by the Panel on Fair Access to the Professions:

*"We can only conclude that its focus on the minority of vulnerable young people is distracting it from offering proper careers advice and guidance to the majority of young people. This is simply not good enough and the service requires a radical rethink."*²³

Coalition Ministers have stated in various forums that they are moving towards an all-age careers service that will take over the role of Connexions and its adult counterpart, Next Step. It is not anticipated that the new service will simply extend the remit of Connexions to incorporate Next Step or vice versa.

The proposed service will be independent of learning institutions and sharply focused on careers only. It is likely that many of the recommendations of the Career Profession Task Force are to be taken forward by the Government. This Task Force sought to establish how best to:

- Attract well-qualified people from all backgrounds to the profession
- Retain and motivate effective careers professionals already in the workforce
- Ensure that professional practice is of a high standard
- Ensure that the profession is diverse and reflects the makeup of the working population
- Ensure that careers professionals receive the CPD, support and guidance they need for continuous improvement
- Strengthen integrated working of careers professionals with other members of the youth (and adult) workforce.

The Careers Profession Task Force has stated the need for 'professionalisation of careers professionals'. In its report to Government²⁴, the Task Force welcomes the establishing by the careers professional associations of an overarching group for the membership bodies, the Careers Profession Alliance, as a 'single authoritative voice' which will be responsible for developing common professional standards and a code of ethics adhered to by all members.

Additionally, the Task Force considered whether all career specialist professionals should hold a specialist qualification and, specifically whether to develop the profession of careers advisers with specialist STEM

²³ *Unleashing Aspiration: The Final Report of the Panel on Fair Access to the Professions*, Alan Milburn, The Cabinet Office, 2009

²⁴ *Towards a strong careers profession: An independent report to the Department for Education, the Careers Profession Task Force*, chaired by Dame Ruth Silver

CPD. Higher professional standards and treatment of STEM as a special case were also a recommendation of the Science For Careers Expert Group²⁵, chaired by Diana Garnham, stating that there exists:

“...a need for comprehensive careers education and information advice and guidance service with an integrated science strand, and within its actions to support a ‘professional’ body for Careers IAG with a strong STEM sub-sector.”

The importance of STEM in careers is indicated by its prominence within the report and in the consideration given to STEM as a special case. The Task Force recommended that initial training and continuing professional development (CPD) should include a focus on labour market information (LMI), information and communications technology (ICT), and science, technology, engineering and mathematics (STEM), all of which it deemed:

“...crucial to all members of the careers profession in delivering high-quality career guidance; and that, through CPD, there should be opportunities for further development of ‘specialisms’, leading towards the concept of an Advanced Careers Practitioner.”

The STEM community including professional bodies and industry should consider how to support careers professionals in this training and in the development of a STEM careers training module, possibly leading to an accredited qualification that would recognise the special nature of STEM and an awareness of up-to-date sources of information.

RECOMMENDATION

The Government should support the implementation of clear professional standards during initial and in-service training for careers professionals.

RECOMMENDATION

Careers professionals should have access to high quality information about STEM Careers

RECOMMENDATION

The profession should move towards the provision and mediation of high quality information on careers and the labour market, and away from the focused support of the minority of individuals at risk of unemployment, which should be the responsibility of local authorities.

²⁵ Science for Careers: Report of the Science and Society Expert Group, Diana Garnham, BIS, Feb 2010; <http://interactive.bis.gov.uk/scienceandsociety/site/careers/files/2010/03/BIS-R9199-URN10-767-WEB.pdf>

6.2 IMPARTIALITY

There is wide consensus that careers advice and guidance should be impartial, so that options presented to a young person are not affected by the needs of the educational institution in which they study. The underlying belief is that careers guidance from an independent source is likely to present a broader range of options, yet there is also some uncertainty about what is meant by impartiality beyond a system for preventing schools from recruiting students to stay in their sixth form. We have also identified a degree of confusion over this interpretation of impartiality and how it affects the extent to which facts about STEM can be promoted. There is a widely held view that STEM should not be given special status, as doing so could be construed as directive and contravene the principle of impartiality. Several responses to questions on impartiality in the stakeholder survey illustrate this point:

“CEIAG should not promote one route above another nor should it promote one group of occupations above another. Impartiality requires that young people are encouraged to explore options which are the right ones for them.”

“I work in an impartial way and feel that it is counterproductive to promote one subject over another unless the young person requests more information.”

We believe that narrow interpretations of impartiality particularly affect STEM subjects and careers for the following reasons:

1. There already exist perverse incentives that mitigate against wider take up of STEM
2. STEM subjects are perceived as difficult, so students (and their parents) may need to be more aware of the incentives to pursuing study of STEM subjects and embarking on STEM career routes
3. Though strict interpretations of impartiality may be desirable for a system in which young people have a well structured and continual programme of support, what is its effect when these structures are not in place?

The assumption too is that all young people are independent confident seekers of knowledge and that immersing them in a non-directive careers setting will lead to the best choice outcomes. In reality, many struggle with decision-making and it is those who are fortunate to have access to other forms of guidance (e.g. knowledgeable or well-positioned relatives) who appear to do well within the system.

A further inference is that impartiality is being used to disguise a lack of knowledge about STEM careers more generally:

“There is a tension between IAG and STEM. Advisers are not there to push particular careers. But my observation would be I don’t want you to push the STEM agenda but I do want you to be informed enough to give appropriate impartial advice.”

Government and the proposed Careers Profession Alliance should require the interpretation of impartiality in careers information advice and guidance to be more explicit in meaning broadening and challenging thinking and providing high quality labour market information. The interpretation of impartiality should not

prevent advice being given that some qualifications, particularly sciences and mathematics, have greater value than others in the labour market.

RECOMMENDATION

Government and the proposed Careers Profession Alliance should clarify the interpretation of 'impartiality' in school/college careers guidance to ensure that advice should always be given in the interests of the student, and not the institutions.

However, impartiality must not prevent advice being given that some subjects and qualifications (in particular, science and mathematics) have greater value in the labour market than others. Impartial advice requires consideration of the students' best interests and knowledge of the labour market.

RECOMMENDATION

With careers guidance services increasingly being bought-in by schools and colleges, quality assurance will be even more important. As Ofsted defines its new inspection framework, the quality of careers guidance, including the interpretation of impartiality, should be made a more explicit requirement for inspection.

We support the recommendation by the Careers Profession Task Force, that Ofsted should carry out a thematic review of careers guidance for young people, to identify excellent practice, to use this as a baseline, and carry out a further review within three years.

6.3 THE ROLE OF THE SUBJECT TEACHER

The DfE Careers Information Advice and Guidance Strategy set out by the previous Government proposed that:

"...subject specialist teachers should be able to relate their subject to future learning pathways and the world of work, and give advice about progression in those subjects."²⁶

The DfE's STEM Careers Awareness initiative includes a number of piloted activities that set out to establish how teachers of STEM subjects might address STEM careers within the curriculum. It has also generated research into the feasibility of embedding STEM careers in the wider school curriculum and school calendar. This research showed that some 48% of Key Stage 3 students gain their information about jobs and careers from their subject teachers. This source of careers advice compares with family (78%), careers teachers (50%), form teachers (23%) and careers advisers (20%).²⁷

A range of stakeholders was asked their views on the role of subject teachers in relation to careers education, both through interviews and by way of the online survey. Survey data indicated that STEM subject teachers were thought to be well placed to relate their subject(s) to future learning pathways (61%), but only considered able to link their subject to the world of work by 35% of respondents. Some 46% considered STEM teachers to be 'fairly well placed' to offer advice on progression. Interviews and workshop outputs showed that there is real variability in labour market knowledge by individual STEM teachers, and concerns that despite being a major potential influence and role model, many teachers have not had the experience that enables them to reflect the diverse opportunities for the students.

Teachers and lecturers should be able to draw upon learning and professional development materials, case studies and video programmes, developed as part of the Government funded STEM careers work to date, together with the extensive resource provision of the National STEM Centre. The Centre is building the largest collection of curriculum resources for teachers of STEM subjects in the UK.

Some STEM teachers have expressed concern, shared elsewhere, that it is not their role to deliver careers education, since they do not have the expertise and it is a distraction from their role as subject educators. Discussions suggested that there is a role for ensuring that STEM subject teachers have sufficient knowledge about academic and vocational routes arising from studying the subjects they teach. We are not, however, advocating STEM teachers leading dedicated careers lessons or that subject teachers should take over the role of IAG professionals. We feel that STEM subject teachers and lecturers should embed examples of a wide range of careers, and applications of their subject to careers, in their teaching. From initial teacher education onwards, STEM teachers, including primary teachers should be encouraged to consider the relevance of careers within their teaching so that it becomes second nature. This view resonates with survey respondents, some 90% of whom felt that it was *important* to 'ensure that career routes and qualifications form an intrinsic part of all (STEM) courses studied'. To achieve this will require a partnership approach at the level of curriculum design from both careers professionals and teachers. There is a role here for the

²⁶ Quality, Choice and Aspiration: A strategy for young people's information, advice and guidance, Department for Children Schools and Families, 2009 <http://publications.education.gov.uk/eOrderingDownload/IAG-Report-v2.pdf>

²⁷ Hutchinson, J., Stagg, P. and Bentley, K. (2009) STEM Careers Awareness Timelines, Attitudes and Ambitions Towards Science, Technology, Engineering and Maths (STEM at Key Stage 3). Derby: International Centre for Guidance Studies, University of Derby.

National STEM Centre both to facilitate the development of courses and in their delivery both nationally and locally.

Data from interviews and the survey highlighted the need for CPD opportunities in this area for all subject teachers and lecturers (69% saw this as very important in the survey). There was also a belief that new mechanisms should be put in place for (STEM) subject specialists to work with careers professionals (63%), which could be achieved through the implementation of some of the recommendations by the DfE Career Profession Task Force.

RECOMMENDATION

The initial and in-service training of teachers of science and mathematics should increase teachers' knowledge and understanding of STEM careers. The STEM careers training module should be made available to initial teacher education (ITE) establishments and to the Science Learning Centres, National Centre for Excellence in Teaching of Mathematics (NCETM) and other providers of continuing professional development to science and mathematics teachers. Its use should be promoted by the Training and Development Agency for Schools and the Department for Education.

6.4 DfE STEM CAREERS INITIATIVES

In May 2007 the Government announced proposals to improve careers information advice and guidance to young people about what was on offer through studying STEM subjects. The national programme aimed to increase numbers studying STEM subjects to meet future economic and skill needs and promote STEM careers, working in close partnership with educationalists, universities, employers and practitioners. STEM Careers Awareness sat within the £140 million STEM programme as Action Programme 8: *Improving the quality of advice and guidance for students (and their teachers and parents) about STEM careers, to inform subject choice*. The activity focused on the value in keeping school subject options open, through the campaign slogan:

"Science and maths, see where they can take you"

Along with a three year communications campaign, including targeted cinema and radio advertising, the campaign set out to bring about greater take up of science and mathematics subjects, post-16. The main activities consisted of the following:

- **Development of websites**
 - *Future Morph* led by the Science Council and set up with £500K contribution from Government, aimed at 11-19 years olds demonstrating the huge range of careers available to those pursuing the subjects post-16
 - *Mathscareers* site produced and maintained by the Institute of Mathematics and its Applications, with support from The London Mathematical Society and The Royal Statistical Society and Government funding. It offers support for students, teachers and careers IAG professionals.

- **Careers Awareness Resources** – online activity complementing the public-focused elements through supporting teachers, schools, careers education and Information, Advice and Guidance professionals. This work is led by the Centre for Science Education (CSE), Sheffield Hallam University and Babcock Enterprise (formerly VT)
- **National STEM Careers Coordinator**, Dr Kate Bellingham was appointed in late 2008 to this role with responsibility for engaging with the diverse range of stakeholders. The STEM Careers Coordinator role is overseen by CSE.
- **Careers Awareness Timeline Pilot** – designed to establish a more coherent structure for young people to learn about careers relating to science and mathematics during Key Stage 3. The timeline work is led by the Centre for Education and Industry (CEI) at the University of Warwick, in partnership with the International Centre for Guidance Studies (University of Derby) and Isinglass Consultancy Ltd.

The establishing of the National STEM Centre provides a location to house the products of the programme, and its eLibrary to act both as a repository and a portal to other sites.

The 'Timeline' project has provided insight into how and why schools respond in practice to the availability of learning resources and external mentoring support. The project has confirmed the level of difficulty associated with promoting change in schools and how the culture of schools mitigates against this kind of top-down strategy. It especially highlights the importance of buy-in from school senior leaders to such a scheme, and the value of a school STEM coordinator's post. The CEI-led team is working with its partners and the National STEM Centre to produce two online planning tools that it hopes will help schools to implement a STEM-conducive school infrastructure and to help science, mathematics and design and technology departments organise STEM (careers) activity throughout key stage 3 and beyond.

The extensive activity carried out by CSE, Sheffield Hallam University has generated a positive response and led to significant progress in addressing the low level of STEM careers awareness that existed at the start of the project. The *Future Morph* and *Mathscareers* websites offer a mechanism for making use of labour market information and translating it into an accessible format for young people, their parents and teachers.

The impact of this work is currently best described in terms of the more detailed outputs set out in Appendix 2. Its potential legacy comprises:

1. Helping schools to set up strategies, policies and systems that make it easier and productive for them to embed STEM (careers)
2. Offering pragmatic and proven approaches to taking forward STEM careers work in schools
3. Potential to support careers professionals to improve their professional knowledge about STEM careers
4. In helping teachers to embed STEM careers within their subject teaching and learning, through initial teacher training and teachers' continuing professional development
5. Supporting the extension of STEM careers activity to younger and older age groups

6. Encouraging the use of accessible and transparent data about STEM careers by careers professionals, teachers and lecturers, students and their parents
7. In promoting technical and vocational routes into STEM careers.

RECOMMENDATION

A STEM Careers Collection, for the use of teachers of science and mathematics and careers guidance professionals, should be built at the National STEM Centre, and linked to the STEM careers training module (Recommendation 4). This collection should provide strategic planning tools, information and teaching resources, and should be accessible online through the Centre's eLibrary. It would be built with the support of the STEM community, and would include the best resources produced by the DfE's STEM careers awareness programme. The National STEM Centre should work closely with the Science Council in the development of this collection.

A section of this collection should be targeted specifically at school and college leaders to provide them with the headline facts about the benefits of STEM qualifications.

7. PULL FACTORS

7.1 WHAT DO EMPLOYERS AND UNIVERSITIES REALLY WANT?

Employers and universities need to send clear messages to students, parents and teachers about the skills and qualifications that they value. The Confederation of British Industry's (CBI's) annual Education and Skills surveys regularly provide evidence of the value and scarcity of people with STEM qualifications, especially in science and mathematics. Yet while this message is articulated well at national policy level, it does not necessarily reach all young people at local level. Such messages from industry – and from universities – about the value of STEM qualifications are important 'pull' factors in attracting students towards STEM qualifications and careers.

"The primary goal of the education system must be to prepare young people for leading successful and fulfilling lives."²⁸

(Fulfilling Potential: The business role in education, CBI, 2010)

The CBI report identifies the need for UK schools to work as 'a committed partner with business' to adapt to the changing world of work. It highlights the importance of a strong grounding in science and mathematics and the importance of accessing a range of academic, vocational and applied learning options, leading to qualifications that are recognised, understood and valued by business.

The report emphasises the essential role of careers guidance in contributing to improving the skills base of the UK arguing that a lack of information and effective guidance is detrimental to young people, to those supporting them and to taxpayers and industry:

"...through wasted provision in the publicly funded skills system...[and it] burdens employers with a heavy indirect cost"

To address this, the CBI has set out five principles on which careers guidance should be based:

1. Careers information, advice and guidance should be an integral part of the school curriculum from year 7 onwards.
2. High-quality information on the careers destinations of different education and training choices should be made available to students.
3. This information needs to be supported by unbiased and personalised advice and guidance for all young people, delivered by properly trained careers advisers and teachers.
4. Involving employers is essential to supporting young people to make informed decisions about their future career options.
5. There should be a seamless transition between pre-19 and post-19 careers services

²⁸ Fulfilling Potential: The business role in education, CBI, 2010

Most of these principles match recommendations found elsewhere in this report and in the likely changes to the careers service currently under discussion. To ensure involvement of employers in supporting young people, commitment and messages at national level need to transmit to the level of local branch and individual businesses.

Employer organisations should contribute to the development of the new careers service and encourage members and partners to support the five CBI principles.

Universities also act as a pull on young people, and they too need to be clear in the messages they send out about the qualifications they prefer. Given that some qualifications, particularly in science and mathematics, are perceived to be (if not actually are) harder than others, universities should leave young people and their parents in no doubt about which qualifications they prefer.

Such clarity of messaging from employers and higher education is particularly important for families which have little experience of higher education or employment in the STEM sector.

RECOMMENDATION

Employers favour STEM skills and qualifications for a range of careers, and these qualifications have real currency at all levels from GCSE to technical, apprentice and graduate qualifications. This reality needs to be made clear to students, parents, teachers and careers advisers. The CBI and other employer organisations should work with their members to ensure that a transparent message about the value of STEM qualifications to employers is disseminated at local and regional as well as national level.

RECOMMENDATION

Similar transparency about the value of STEM qualifications should extend to university admissions. The successor organisation to the Higher Education Funding Council should work with the University and Colleges Admissions Service (UCAS) and Universities UK to ensure that all universities are transparent about their preferred qualifications.

7.2 DATA AND TRANSPARENCY

The provision of accessible and clear information must lie at the heart of any strategy to promote better STEM careers education. Effective impartial careers guidance is predicated on access to high quality information, as highlighted in the following quotation from the final report on the Skills Commission's inquiry into Information, Advice and Guidance (IAG):

"Individuals need high quality information on labour market opportunities in order to make informed choices."²⁹

Over time the plethora of STEM organisations attempting to attract more employees into their sector or into STEM more broadly, have produced a multiplicity of sources of information that collectively may have overwhelmed rather than informed. This point was highlighted in the Science for Careers Report:

"We noted that a diverse range of agencies produce a mass of information in various formats, from which direct and historical comparison is often not possible. Neither the reports nor the outputs are readily accessible to careers advisors or other primary users and they certainly do not lend themselves to wider communication and dissemination to key audiences."³⁰

The report also asserts the need for better labour market information (LMI) on the demand for STEM-skilled workforce and raising awareness about the full range of STEM careers, notably those in SMEs and in emerging technologies.

What constitutes labour market information can be broken down into the following list produced by the Institute for Employment Research, as part of a study³¹ funded by the UK Commission for Employment and Skills (UKCES):

- Information on general employment trends (e.g. historical trends, future demand)
- Data on the structure of the labour market (i.e. what jobs exist, how many, which sectors, which occupations);
- Information about the way the labour market functions (i.e. how people get into jobs and move between employers, etc.)
- The interaction between labour demand and supply (i.e. mismatches – as reflected in unemployment rates, skills gaps, skills shortages, etc.)
- Data on national, regional and local labour markets variations (i.e. size of workforce, prominent sectors, etc.)
- Data focusing on equality and diversity (i.e. which individuals are employed in different sectors and at what levels?)
- Information on progression routes (i.e. career structure, earnings, transferability of skills).

²⁹ Skills Commission (2008) *Inspiration and Aspiration: Realising our Potential in the 21st Century*. London: Policy Connect. Retrieved March 10, 2010 from: <http://www.policyconnect.org.uk/fckimages/Inspiration%20and%20Aspiration.pdf>

³⁰ Science for Careers: Report of the Science and Society Expert Group, Diana Garnham, BIS, Feb 2010; <http://interactive.bis.gov.uk/scienceandsociety/site/careers/files/2010/03/BIS-R9199-URN10-767-WEB.pdf>

³¹ Labour Market Information (LMI), Information Communications and Technologies (ICT) and Information, Advice and Guidance (IAG) *The way forward?* Bimrose & Barnes, The Institute for Employment Research, UKCES www.ukces.org.uk/upload/pdf/424721%20LMI%20report_2.pdf

The Government has expressed interest in facilitating a website that would provide an array of LMI and would be useful to parents, students, careers professionals and teachers. UKCES has commissioned studies on robust mechanisms for communicating labour market information nationally.

Some of the best current practice is to be found in Australia and the USA where both federal governments provide extensive core information, including supply and demand data. Two US schemes worthy of note are O*Net OnLine (OOL)³² and the Occupational Handbook³³. O*Net is the primary source of occupational information for the United States. The site supports public and private sector efforts to identify and develop the skills of the American workforce, and provides a common language for defining and describing occupations and job requirements.

The Occupational Handbook includes information about the nature of work, working conditions, training and education, earnings, and job outlook for hundreds of different occupations. The Handbook is released biennially with its companion publication the Career Guide to Industries. Typically, a user might find out about a single occupation, browse through lists of related occupations or access an alphabetical list.

The UK Sector Skills Councils could, as a condition of their renegotiated contracts, be tasked with contributing and updating LMI based on an agreed template, for a resource that resembled O*Net or the Occupation Handbook. The information provided could be externally quality assured to meet the needs of potential users and to ensure that the different sectors were accurately represented.

Responding to questions about the type of information that would be valuable, the stakeholder survey considered 'employability prospects for an extensive number of qualifications' to be very important (71%), and 'attractiveness to a broad selection of employers for a range of qualifications' (61%). Lifetime earnings and earning differentials between different types of careers were thought of as 'important', but less so than those already stated.

With regard to information from Higher Education, in 2009 the United Kingdom Commission on Employment and Skills (UKCES) proposed that the collection and publication of destination and earnings data should be mandatory for all colleges and universities in receipt of public funding.³⁴ A review of the Destinations of Leavers from Higher Education Survey (Early DLHE) is currently underway. It is a fundamental examination of the survey and supporting systems and processes in advance of 2011/12 implementation.³⁵ The review asks questions such as when is the best time, in terms of being an accurate predictor of later outcomes, to survey leavers following the completion of their studies.

Though the provision of clear and meaningful LMI is empowering, our research suggests that it needs to sit alongside highly professional advice and guidance, to mediate and promote its use. Further consideration

³² O*NET OnLine is created for the U.S. Department of Labor; Employment & Training Administration, by the National Center for O*NET Development. <http://online.onetcenter.org/>

³³ Bureau of Labor Statistics, www.bls.gov/oco/

³⁴ Ambition 2020: World Class Skills and Jobs for the UK, UKCES, 2009 www.ukces.org.uk/upload/pdf/UKCES_FullReport_USB_A2020.pdf

³⁵ Higher Education Statistics Agency (HESA) www.hesa.ac.uk/

should be given to how a national LMI website will interface with 'entry sites' such as *Mumsnet.com*, *Future Morph* or the National STEM Centre eLibrary. Parents, students and teachers are more likely to navigate their way to a national LMI site from this type of location. Furthermore, what is the potential for the latest Web 2.0 and 3.0 technologies to provide more intelligent and personalised careers guidance based on, say, the LMI data and the interests and talents of an individual?³⁶

As England moves towards an all-age careers service, it is even more important that professionals have access to high quality labour market information, particularly relating to careers available to those with STEM qualifications. We recommend further research into the features of the most effective methods identified internationally and into the skills and training required to ensure that professionals are able to make best use of them.

RECOMMENDATION

We recommend the creation of a single, comprehensive and constantly updated database and portal of careers opportunities and LMI across all employment sectors. This database should have a web portal with different interfaces for students and their parents; for employers; and for teachers and careers professionals. The interface for students and parents should link to the Science Councils' Future Morph portal. Decisions about the design and functionality of this portal should be made in the light of research already underway by the United Kingdom Commission for Employment and Skills (UKCES) and examples of good practice from overseas. There will need to be a training programme for careers professionals in the use of the portal.

³⁶ *Careering through the Web*, T. Hooley, J. Hutchinson and A.G. Watts, iCeGS, commissioned by UKCES, 2010
<http://www.ukces.org.uk/upload/pdf/424720%20-%20Careering%20through%20the%20web.pdf>

7.3 ROUTES AND QUALIFICATIONS

The routes to pre-university qualifications (especially A level) are well understood by most students and parents, and all teachers – not surprisingly, since this is the route that the large majority of teachers took themselves. In contrast, the routes to vocational qualifications, and indeed these qualifications themselves, are much less clearly understood. This is partly because there are so many vocational qualifications. The Royal Academy of Engineering report that 350,000 learners began an engineering qualification in further education in September 2009 (compared with 26,000 in HE), and these learners were signed up for one of 605 engineering qualifications.

In the face of such complexity, it is hard to give students a clear overview of the vocational options that are available to them in STEM. While the UKCES reports that looming shortages exist at the level of technicians, especially in specialist STEM areas, the routes to such occupations are poorly understood.

The Secretary of State for Education has identified the importance of meaningful vocational educational routes. Previous efforts to overhaul technical and vocational routes have not succeeded in developing clear systems and challenging deeply rooted cultural prejudices.

The previous Government's White Paper, 'Skills for Growth: The national skills strategy', characterised the challenge for a careers service that better serves vocational education and training in suggesting that:

"...Britain has not completely shed its historic weaknesses at advanced technician and vocational levels. Compared to our international competitors, too few of our young adults acquire advanced vocational skills after leaving school. Employers face a workforce with insufficient skills at the intermediate technician, associate professional and skilled occupation levels which are critical to many of the industries of the future."³⁷

This picture was reproduced vividly in the views arising from our interviews and those expressed by survey respondents when asked how well served are young people in England to help them find out about routes into STEM qualifications and careers. Though 76% felt that young people are well served about academic routes only 16% considered them to be 'very well served'. However, this contrasted markedly with the 36% who felt that vocational routes into STEM were well served. This time only 3% considered young people 'very well served' with 64% suggesting that they were either 'not very well served' or not served 'at all'.

As we have seen (Section 5), the successful models of vocational education and training (VET) found in Germany and other European countries are unlikely to transfer readily to the UK. In the longer term, government policy should focus on simplifying and clarifying vocational routes and making transparent the careers available at the end, and this should be one of the goals of the review of VET being carried out by Professor Alison Wolf of Kings College London.

³⁷ Skills for Growth: The national skills strategy, Department for Business, Innovation and Skills 2009
www.bis.gov.uk/assets/BISCore/corporate/docs/S/09-1467-skills-strategy-command-paper

In the shorter term, we have been impressed by the potential of web-based tools, such as 'bestCourse4me.com', which offer students interactive online guidance to choosing universities and courses. We believe there may be potential to do something similar to provide guidance on vocational routes, and this might be investigated further.

RECOMMENDATION

The routes to apprenticeships and technical qualifications are more opaque and less well understood than the academic career paths that lead to university. In the longer term, government policy should focus on simplifying and clarifying vocational routes and making transparent the careers available at the end.

RECOMMENDATION

In the shorter term, there should be a study, by government or an independent organisation, of the feasibility of producing a comprehensive, attractive and user-friendly web-based guide that focuses on vocational routes leading to apprenticeships and employment and seeks to simplify and clarify the complex landscape. This guide could draw on similar sites for university entrance such as *bestCourse4me.com*, and should be linked to the LMI database.

APPENDICES

APPENDIX 1: EVIDENCE BASE

LITERATURE REVIEW

- Ambition 2020: World Class Skills and Jobs for the UK, UKCES, 2009
- Beyond Current Horizons*, Bimrose J., Institute for Employment Research, University of Warwick, 2009
- Careering Through The Web*: The potential of Web 2.0 and 3.0 technologies for career development and career support services, T. Hooley, J. Hutchinson and A.G. Watts, iCeGS June 2010, UKCES
- CBI Education and Skills Survey, May 2010
- Discovering talent, developing skills*: Helping STEM employers engage with schools and colleges, Kate Bellingham, March 2010
- Fulfilling Potential: The business role in education, CBI, 2010
- How do Young People Make Choices at 14 and 16?* Blenkinsop, McCrone, Wade and Morris. NFER. 2006
- Implementing a National Technology Strategy with Self-Organizing Industry Investment Boards, Brookings Institution. Paul M. Romer and Zvi Griliches (1993)
- Inspiration and Aspiration: Realising our Potential in the 21st Century*. London: Policy Connect. Skills Commission (2008) Retrieved March 10, 2010
- Labour Market Information (LMI), Information Communications and Technologies (ICT) and Information, Advice and Guidance (IAG), Institute for Employment Research and authored by Jenny Bimrose and Sally-Anne Barnes.
- Learning for Jobs* OECD Reviews of Vocational Education and Training, OECD, 2009
- Lengthening Ladders, Shortening Snakes*, Embedding STEM Careers Awareness in Secondary Schools, Centre for Education and Industry, Oct 2009
- Moving through the system – information, advice and guidance*, Ofsted, March 2010
- National 14-19 IAG initiatives and Potential Links with the STEM choice and Careers Project
- National all-age career guidance services: evidence and issues*, Watts, A. G. (2010), British Journal of Guidance & Counselling, 38: 1, 31 — 44
- Organisation for Economic Co-operation and Development (OECD). (2003). OECD review of career guidance policies: United Kingdom country note. Paris: OECD
- Pooled Labour Force Survey, 2000-2005
- Quality, Choice and Aspiration - A strategy for young people's information, advice and guidance*, DCSF, Jan 2010
- Relative difficulty of examinations in different subjects*, Coe, Searle, Barmby, Jones, Higgins, CEM Centre, Durham University, SCORE, 2008
- Rethinking Careers Education and Guidance: Theory, Policy, and Practice*, Ruth Hawthorn, Jennifer M. Kidd, John Killeen, Bill Law, A. G. Watts, Routledge, 1996
- Science and Mathematics Secondary Education for the 21st Century*, Report of the Science and Learning Expert Group, Mark Walport, Feb 2010
- Science for Careers*: Report of the Science and Society Expert Group, Diana Garnham, BIS, Feb 2010; <http://interactive.bis.gov.uk/scienceandsociety/site/careers/files/2010/03/BIS-R9199-URN10-767-WEB.pdf>
- Self-Organizing Industry Investment Boards, Brookings Institution Press.
- SET for success*: The supply of people with science, technology, engineering and mathematics skills, The report of Sir Gareth Roberts' Review, 2002

Skills for Growth: The national skills strategy, Department for Business, Innovation and Skills 2009

Skills for jobs: Today and Tomorrow, UKCES, 2010

STEM Careers Awareness Timelines: Attitudes and ambitions towards science, technology, engineering and maths (STEM at Key Stage 3), J. Hutchinson, P. Stagg and K. Bentley, ICeGS, University of Derby (2009)

STEM Subject Choice and Careers Project, Careers IAG Resources Interim Mapping Report, Centre for Science Education, Sheffield Hallam University
www.nationalstemcentre.org.uk/eLibrary/collection/371/stem-subject-choice-and-careers-project

The way forward? Bimrose, J. & Barnes, S-A. (2010) 'Labour Market Information (LMI), Information Communications and Technologies (ICT) and Information, Advice and Guidance (IAG). London: UK Commission for Employment and Skills

Towards a strong careers profession: An independent report to the Department for Education, the Careers Profession Task Force, chaired by Dame Ruth Silver; October 2010

Unleashing Aspiration: The Final Report of the Panel on Fair Access to the Professions, Alan Milburn, The Cabinet Office, 2009

INTERVIEWS AND MEETINGS

John Hayes MP, Minister of State for Further Education, Skills and Lifelong Learning (jointly with BIS and DfE)

Anna Paige (Head of the Quality, Support and Guidance Division DfE)

Adam Micklethwaite (Deputy Director, Adult Advancement, FE Directorate, BIS)

Dame Ruth Silver, Learning and Skills Improvement Service (LSIS)

Professor Tony Watts, National Institute for Careers Education and Counselling

Dr Kate Bellingham, National STEM Careers Co-ordinator

Richard Parsons and Clare Jones, DfE IAG Strategy

Mark Stockdale DfE STEM

Dr Pat Morton and Ken Mannion, CSE Sheffield Hallam University

Peter Stagg, CEI, University of Warwick

Caroline Hurren, Science Learning Centres

Mervyn Dadd, Cogent

Nicola Hannam, The Science Council

Pat Langford and Kirsten Bodley, STEMNET

Claire Nix, Babcock Enterprise

Jo Hutchinson, International Centre for Guidance Studies, University of Derby

Jenifer Burden, National STEM Centre

Ruth Wright, The Engineering Council

Professor Peter Main & Charles Tracy, Institute of Physics

Dr Sandra McNally, Centre for Economic Performance, LSE

ORGANISATIONS RESPONDING TO SURVEY

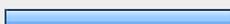
Abbey College	Hills Road Sixth Form College, Cambridge	Science Learning Centre South East
ABPI	iCeGs, University of Derby	Science Museum/National Museums of Science and Industry
ACER	Ignite!	SCORE
ACME Head of Secretariat	Ignition*	SELEX Galileo Ltd
Aircelle Ltd	Institute of Careers Guidance	Semta,
Alstom UK	Institute of Mathematics and its Applications	Sheffield Futures and Connexions
Association for Science Education	Institution of Mechanical Engineers	Sheffield Hallam University
Association of Teachers of Mathematics	Institute of Physics	Society of Biology
AstraZeneca	Intel	St Mary's CB Grammar School Belfast
Bishop Grosseteste University College Lincoln	London Mathematical Society	St Thomas More RC High School
BP	MAESTRO - Merseyside Engineering Science and Technology Regional Organisation	Stratford upon Avon Grammar School for Girls
British Science Association	Mathematics Promotion Unit	Suffolk County Council
BT plc	MEI	The National Centre for Excellence in the Teaching of Mathematics
Camden Connexions/VT	National Centre for Excellence in the Teaching of Mathematics	The Operational Research Society
Careers education and IAG Consultant, VT Group	Natural History Museum	The Royal Academy of Engineering
CASCAID Ltd	National STEM Centre	The Royal Institution of Great Britain
Castle View School Canvey Island	Natural Environment Research Council	The Royal Society
Centre for Education and Industry, University of Warwick	New Engineering Foundation	The Royal Statistical Society
Chemical Industries Association	Northern Ireland Careers Service	The Science Council
Chemical Industry Education Centre	Performing Arts Labs	The Sixth Form College Colchester
Cogent Sector Skills Council	Primary Engineer incorporating Secondary Engineer; Primary and Secondary Advanced Leaders Award for STEM	The Thomas Hardy School
Collingwood College, Durham University	QinetiQ	The UKRC (UK Resource Centre for Women in Science, Engineering & Technology)
Cramlington Learning Village	Ridgewood School	UCL
Derbyshire Education Business Partnership - STEM Team	Rochester Grammar School	University of Reading
Engineering Council	Runshaw College	VT Group
EngineeringUK	SCE	VT4S
Haringey Sixth Form Centre	Science Learning Centre East of England	Wilmington Grammar School for Girls
Harton Technology College	Science Learning Centre London	WISE
HE STEM Programme	Rolls-Royce plc	Worcester Sixth Form College
	Royal Institution of Great Britain	
	Royal Society of Chemistry	

SUMMARY OF SURVEY RESULTS

STEM Careers Review Stakeholder Survey

1. Your name:	
	Response Count
	104
<i>answered question</i>	
	104
<i>skipped question</i>	
	1

2. Your organisation and/or affiliation	
	Response Count
	104
<i>answered question</i>	
	104
<i>skipped question</i>	
	1

3. Which of the following best describes your job/role?		
	Response Percent	Response Count
Careers professional 	15.8%	16
Teacher/lecturer 	14.9%	15
Industry representative 	10.9%	11
Researcher/consultant 	7.9%	8
Business professional 	5.9%	6
Other 	44.6%	45
Other (please specify)		51
<i>answered question</i>		101
<i>skipped question</i>		4

4. How important is each of the following as an objective of careers education, information, advice and guidance in schools and FE colleges?					
	Very important	Fairly important	Not important	Rating Average	Response Count
To describe what careers are available and the likely competition for jobs	88.3% (91)	10.7% (11)	1.0% (1)	1.00	103
To be a source of impartial information, advice and guidance	89.2% (91)	10.8% (11)	0.0% (0)	1.00	102
To ensure young people have access to a full range of opportunities	93.2% (96)	6.8% (7)	0.0% (0)	1.00	103
To promote a range of routes into careers based on national workforce requirements	50.0% (51)	42.2% (43)	7.8% (8)	1.00	102
To challenge stereotypes and encourage greater diversity across the workforce	68.9% (71)	30.1% (31)	1.0% (1)	1.00	103
To provide support particularly for those young people least likely to get a job or continue in education or training once leaving full-time education	65.7% (67)	29.4% (30)	4.9% (5)	1.00	102
If you think there are other reasons why careers education is important, please indicate here					37
				answered question	103
				skipped question	2

5. The Department for Education Careers Information, Advice and Guidance Strategy states that: “...subject specialist teachers should be able to relate their subjects to future learning pathways and the world of work and give advice about progression in those subjects”. In your experience, how well placed are (STEM) science, technology, engineering and mathematics teachers to fulfill this requirement in three areas?					
	Well placed	Fairly well placed	Not well placed	Differs between STEM subjects	Response Count
In relating subject to future learning pathways	10.5% (10)	50.5% (48)	29.5% (28)	9.5% (9)	95
In relating subject to world of work	5.3% (5)	29.5% (28)	49.5% (47)	15.8% (15)	95
In offering advice about progression	5.3% (5)	46.3% (44)	40.0% (38)	8.4% (8)	95
If you answered 'differs between STEM subjects' please state which STEM subject(s) and why					32
				answered question	95
				skipped question	10

6. In your opinion how important would each of the following be in helping to embed careers in school and FE curricula?				
	Very important	Fairly important	Not important	Response Count
Ensure that career routes and qualifications form an intrinsic part of all courses studied	50.5% (49)	39.2% (38)	10.3% (10)	97
Raise the profile of routes to qualifications and into careers in initial teacher education	48.0% (47)	48.0% (47)	4.1% (4)	98
Ofsted to inspect on how well individual schools incorporate consideration of careers in the wider curriculum	41.2% (40)	45.4% (44)	13.4% (13)	97
New ways of working with careers education, information, advice and guidance staff	62.9% (61)	36.1% (35)	1.0% (1)	97
Provide extensive continuing professional development opportunities in this area for all subject teachers/lecturers	69.4% (68)	26.5% (26)	4.1% (4)	98
You may wish to elaborate on your response here or to identify another action not listed.				36
<i>answered question</i>				98
<i>skipped question</i>				7

7. In your experience, how well served are young people in being able to find out about vocational and academic routes into STEM qualifications and careers?					
	Very well	Fairly well	Not very well	Not at all	Response Count
Vocational	3.4% (3)	33.0% (29)	61.4% (54)	2.3% (2)	88
Academic	16.1% (15)	60.2% (56)	23.7% (22)	0.0% (0)	93
<i>answered question</i>					93
<i>skipped question</i>					12

8. Employers maintain that there is a real shortage of technically trained staff across a range of industries, and that these shortages will get worse. Click on the following options that might be adopted to increase the number of technicians

	Strongly agree	Agree	Disagree	I don't have a view on this	Response Count
Be more explicit in promoting routes into technical careers for young people with aptitude and skills in this area	60.4% (58)	36.5% (35)	3.1% (3)	0.0% (0)	96
Run a communications campaign that will promote vocational courses as a sound alternative to graduate careers	34.0% (33)	48.5% (47)	13.4% (13)	4.1% (4)	97
Ensure that every young person receives independent and impartial careers information, advice and guidance to help their skills in choosing qualification and career routes	72.9% (70)	26.0% (25)	0.0% (0)	1.0% (1)	96
Develop a comprehensive and easy to use website that will direct young people technical career routes	26.0% (25)	53.1% (51)	17.7% (17)	3.1% (3)	96
More case studies made available about people who have developed their careers along a vocational/technical route.	36.1% (35)	57.7% (56)	3.1% (3)	3.1% (3)	97
You may have further suggestions or comments about routes to vocational/technical careers					32
<i>answered question</i>					97
<i>skipped question</i>					8

9. Which of the following statements best describes how you feel about STEM subjects and careers in schools

	Response Percent	Response Count
STEM subjects/careers should not have special status in schools and should be treated like other subjects/career paths	39.6%	38
STEM subjects/careers should have special status in comparison to other subjects	63.5%	61
STEM subjects/careers already have too much prominence in schools	1.0%	1
You may wish to elaborate on your answer here		44
<i>answered question</i>		96
<i>skipped question</i>		9

10. Recent research has shown that young people, aged 11-14, obtain their careers information from their families (78%), careers teachers (50%) subject teachers (48%) friends (36%), form tutors (23%) and careers guidance professionals (20%). In your view how well placed is each source of information to help advise young people about STEM careers?

	Very well placed	Adequately well placed	Not well placed	Rating Average	Response Count
Families	7.6% (7)	20.7% (19)	71.7% (66)	1.00	92
Careers teachers	15.1% (14)	52.7% (49)	32.3% (30)	1.00	93
Subject teachers	16.1% (15)	50.5% (47)	33.3% (31)	1.00	93
Friends	1.1% (1)	11.8% (11)	87.1% (81)	1.00	93
Form tutors	2.2% (2)	35.9% (33)	62.0% (57)	1.00	92
Careers guidance professionals	34.4% (32)	44.1% (41)	21.5% (20)	1.00	93
Please include comments or observations raised by this question					52
answered question					95
skipped question					10

11. How important is it to make the following information available to pupils, parents, schools, employers etc?

	Very important	Important	Not important	Response Count
Lifetime earnings and earning differential between careers	42.6% (40)	52.1% (49)	5.3% (5)	94
Employability prospects for an extensive number of qualifications	70.5% (67)	28.4% (27)	1.1% (1)	95
Attractiveness to a broad selection employers of a range of qualifications	61.3% (57)	37.6% (35)	1.1% (1)	93
National data on progression from school into a range of careers	26.9% (25)	64.5% (60)	8.6% (8)	93
Progression into study, training and employment from individual schools and colleges	37.9% (36)	42.1% (40)	20.0% (19)	95
Is there any other information that you would wish to be made widely available?				25
answered question				95
skipped question				10

WORKSHOPTASKS

QUESTION PROMPTS

1. The relationship between STEM and careers education

- Arguments for STEM having special status in relation to careers education in schools
- Arguments against STEM having special status in relation to careers education in schools
- Practical ways for STEM teachers and careers information, advice and guidance professionals to work together

2. Addressing careers within STEM subjects

- How could initial teacher education and continuing professional development contribute to better subject based (STEM) careers education?
- How could schools inspections contribute to better careers education experience?

3. How to make better use of data for STEM careers

- How to go about establishing better online sources of information about STEM careers?
- How could such data be best used to support parents, siblings, subject teachers, etc. currently identified as major sources of information?
- How could we make data on earnings, employability linked to qualifications, progression into qualifications and careers, more easily available and accessible?

4. STEM careers, entitlement and social mobility

- What is the potential of STEM career paths to challenge stereotypes and promote diversity?
- Do STEM qualifications offer greater potential than others for social mobility? If so, how might this be made use of in promoting STEM careers to school leaders?

5. The challenge for encouraging young people to consider technical and vocational career paths

- Why would it appear that young people are less well served in finding out about vocational routes into STEM than academic ones?
- How might we increase the opportunity for every young person to receive high quality careers information, advice and guidance?
- What role does 'impartiality' play in encouraging young people to consider technical and vocational career paths?

6. Recommendations on how to take forward STEM careers activity

- In light of current political and economic developments, what practically viable steps should we be considering taking forward to ensure that the momentum gained to date is maintained?

APPENDIX 2: DEPARTMENT FOR EDUCATION STEM CAREERS AWARENESS PROJECT OUTCOMES

The following has been provided by the individual project organisers.

FUTURE MORPH

- 140,000 visits since launch in November 2008 from 107,000 users with an average visit duration of 5 minutes and 5 pages viewed.
- 10,000 items downloaded - including teaching resources, materials for careers advisers and leaflets for pupils.
- The most popular content areas are the audience landing pages for 11-14, 16-19 and then 14-16 year olds, demonstrating a good fit with its key audiences.
- Anecdotally, awareness of Future Morph is growing amongst school and careers professionals who have welcomed the provision of a STEM-wide resource
- CPD courses run on a number of occasions for teachers based on the Key Stage 3 resources Science within Work.

MATHSCAREERS

- 48,000 visits to the site in the eight months of its first operational year (2010)
- High profile presence at national education events such as 'Big Bang' in 2009 and 2010
- Strategic relationships with Queen Mary University of London and the Centre for Science Education, Sheffield Hallam University for the provision of further resources

STEM CAREERS AWARENESS RESOURCES

- Production of science careers focused curricular materials delivered through the Science upd8 website (9500 downloads to date), maths curriculum materials through the mathscareers site and the development of design and technology curriculum materials, delivered in partnership with DATA
- Some 620 teachers and 120 student teachers have engaged in STEM careers related continuing professional development - through the Science Learning Centre network, with the Specialist Schools and Academies Trust CPD, and through teacher conferences and events
- 8 Teachers TV programmes, each downloaded on between 1000 and 7000 occasions
- Resource packs to support a range of pathways, including: equality and diversity issues (1000 downloads), mentoring approaches and the use of role models - with over 400 schools engaged through the project's *Digital Storecupboard*
- Coordination of the STEM Action Programme 8 strands by the National STEM careers coordinator
- Supporting employer engagement with schools and colleges through a route map and report *Discovering talent, developing skills*
- Over 1000 careers professionals reached through dedicated events - more through email newsletters and websites

STEM CAREERS AWARENESS TIMELINE

- Placing the school STEM strategic planning tools on the National STEM Centre website
- Comparative survey of pupil attitudes to STEM over duration of the project with 4000 responses in first phase, second phase completed at the end of 2010
- Five stakeholder conferences comprising 147 participants, including representatives from 19 pilot schools, 9 other schools and representatives from careers and STEM education communities
- Interim reports published and disseminated in October 2009
- Co-production of two Teachers TV programmes produced the role of STEM career choices on economic wellbeing and an exploration of future STEM related skills by successful professionals in different careers
- Three practitioner workshops designed to test the school planning resources