MARCH 2012

SCIENCE FOR THE WORKPLACE

A SURVEY OF STEM EMPLOYER VIEWS ON THE PRACTICAL SKILLS OF SCHOOL LEAVERS

GATSBY

INTRODUCTION

The Gatsby Charitable Foundation has been supporting projects that strengthen the science, technology, engineering and mathematics (STEM) sector for over twenty years. Established in 1967 by Lord Sainsbury of Turville, the trust has a particular interest in supporting STEM education in UK schools and colleges.

As part of this ongoing work, Gatsby is interested in reviewing the health of practical work in secondary school science in order to understand how best to support it in the future, and ensuring that it remains central to science teaching. This review of practical work began in August 2011 and will take into account the views of students, teachers, parents, educationalists, higher education institutions and employers.

This piece of research has been carried out to establish if practical work in schools, in particular within science A level qualifications, provides students with the practical skills they need to successfully pursue a career in the STEM sector.

The short online survey was written in conjunction with Edexcel and the National STEM Centre, and then circulated to a range of STEM employers. In February 2012 Edexcel extended this work by organising a seminar entitled 'Science for the Workplace', where preliminary results from the survey were explored in more detail with a group of STEM employers.

OBJECTIVES

1) To assess the proportion of employers that are recruiting school leavers into roles that involve science skills, and if/why this might have changed over the last 5 years.

2) To explore STEM employers' understanding of the term 'practical skills' and the importance of these skills to their organisation.

3) To establish the expectations STEM employers have of the practical skill level of new science staff being recruited with science A levels, and if/why this might have changed over the last 5 years.

4) To give STEM employers the opportunity to identify the practical skills they feel should be taught and assessed in science A levels.

KEY FINDINGS

- Science skills are used, at some level, within almost all of the STEM organisations surveyed (97.9%), and all felt that practical skills were important to their organisation.

- STEM employers' understanding of the term 'practical skills' is broad, but a significant proportion include dexterity, 'hand-skills' and lab work within their definition.

- Over 70% of employers surveyed are employing science staff with A levels (or below) as their highest qualification, and over 50% recruit individuals directly from school or college.

- Just over 40% of STEM respondents report that their organisation has recruited graduates for previously non-graduate positions over the last 5 years.

- 'Analysing and interpreting data to provide good evidence', and 'taking and recording measurements with accuracy and precision', were identified as skills that are essential for school leavers recruited into science staff roles.

- In addition to using application forms and interviews, 46.2% of organisations use a practical test at interview to assess the knowledge and skills of new recruits.

- Despite over 80% of respondents claiming that the practical skills of school leavers meet all or some of their organisation's needs, 41% felt there had been a decline in skills over the last 5 years and almost all (94.6%) provide training in practical skills to new recruits.

- Being able to apply practical skills to new situations is the skill that employers feel would be of most value to be taught through A levels.

- Employers identify practical skills as their second greatest concern for being able to find high quality recruits in the future.

METHODOLOGY

In October/November 2011 an online survey was designed to examine the views of science, technology, engineering and mathematics (STEM) employers on the practical skills of new employees. The survey was carried out using Survey Monkey and included 26 questions which were a mix of multiple choice and free response questions. Questions were organised into 4 broad categories: employer information; workforce demographic and recruitment; required practical skills; and expectations and requirements of science A level qualifications.

The survey was open from November 2011 to March 2012 and circulated directly to 74 STEM employers using the Gatsby Charitable Foundation Employer database, as well as 12,376 STEM employers on the LBM business contact file. In addition, the survey link was circulated by Sector Skills Councils, learned societies, STEM education networks and to members of relevant trade associations.

Responses were received from 138 individuals, producing 96 valid responses from 93 different STEM employers. Not all questions were answered by every individual.

PROFILE OF RESPONDENTS

The profile of people responding to the survey is as follows:

NUMBER OF YEARS IN CURRENT ORGANISATION

Years	% response (n=94)
1 – 5 years	25.3
6 – 10 years	15.8
11 – 15 years	23.2
16 – 20 years	11.6
21 – 25 years	11.6
26 – 30 years	4.2
31 – 35 years	2.1
36 – 40 years	5.3
40 + years	1.1

INVOLVEMENT WITH NEW EMPLOYEES

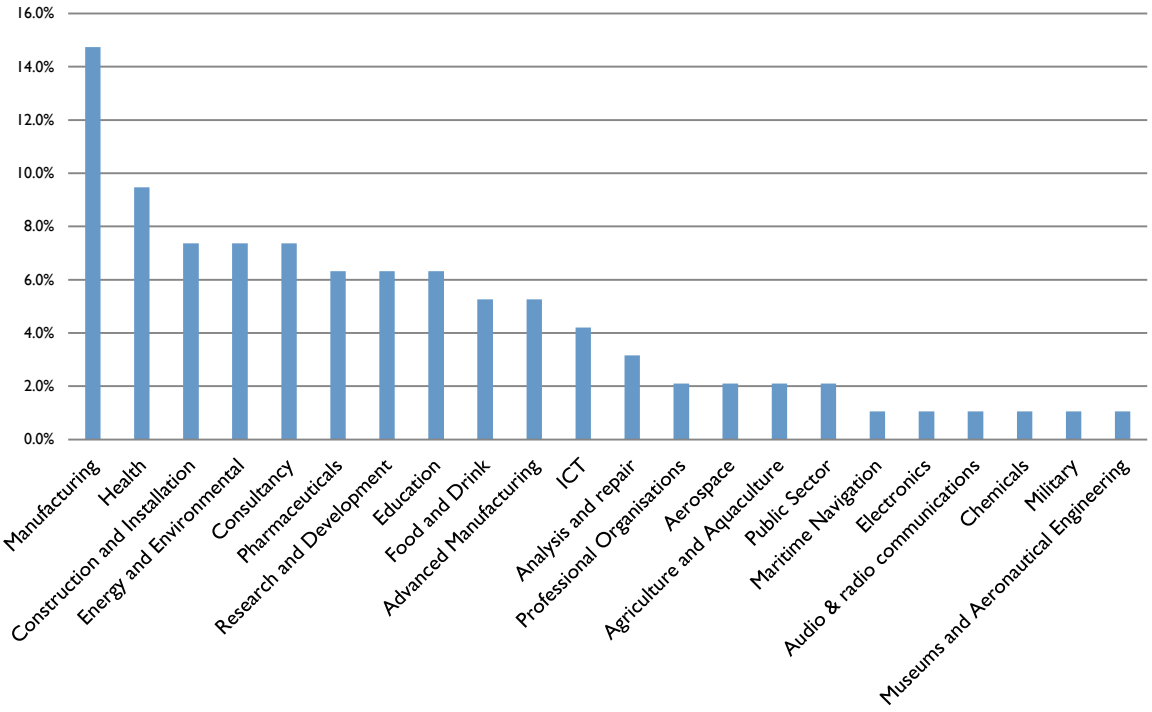
Involvement	Count (n=94)
Training	24
Recruitment	60
Mentoring and/or management	71
Other	22
None	4

Multiple response question.

The majority of individuals responding to the survey held senior positions within their organisations, with the majority of respondents classifying themselves as Managing Directors (33.7%) or Managers (22.1%). A small number of respondents were Engineers (7.4%), Advisors and Consultants (6.3%) or Chief Executives (2.1%).

The responses received were not proportionally representative of the STEM sector, with a greater proportion of responses being received from the manufacturing (14.7%) and health (9.5%) sectors.

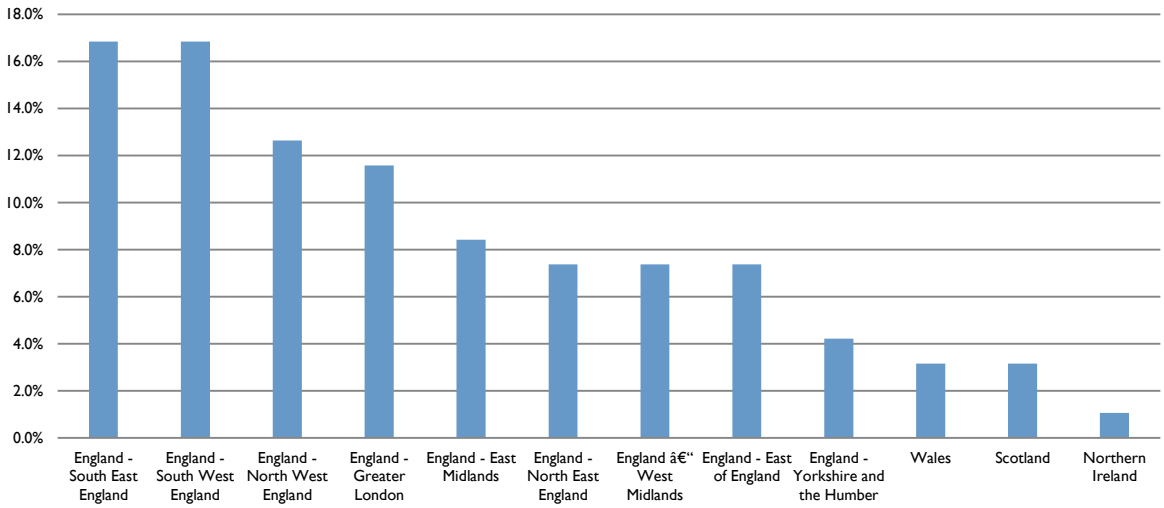
Proportion of survey responses across different STEM sectors (n=94)



Just under half of the organisations represented in the survey are classified as large organisations with over 250 workers (42.1%). A similar proportion of responses were received from small organisations with less than 50 workers (40%), with the remaining 17.9% of responses being received from organisations that have between 50 and 250 workers.

The majority of responses to the survey were received from the South of England, although responses were received from all UK regions.

Proportion of survey responses across UK regions (n=94)



FINDINGS

IMPORTANCE OF PRACTICAL SKILLS

Almost all of the STEM employers surveyed employ at least a few staff who use scientific skills at some level (97.9%), with over two thirds (69.4%) stating that all or most employees have jobs which require scientific skills.

PROPORTION OF WORKFORCE EMPLOYED IN JOBS WHICH USE SCIENTIFIC SKILLS AT ANY LEVEL

Proportion of workforce	Percentage (n=93)
All	10.5%
Most	58.9%
Some	14.7%
A few	13.7%
None	2.1%

Respondents were asked to define the term 'practical skills'. The 81 responses vary from definitions describing specific sector related skills to more general employability skills.

"Ability to perform skilled lab manual techniques like volumetric and gravimetric analysis accurately, and experience with a range of different instrumental techniques, titrating"

"Computer literate, numerate, articulate"

Definitions which include references to dexterity and hand skills are most frequent (11%), followed by hands on experience of specific equipment (10.3%) and experience in the sector or workplace (8.8%). In addition, several responses also make specific reference to laboratory skills (7.4%), engineering (5.1%), problem solving (6.6%) and confidence (2.9%).

Respondents were asked to what extent practical skills were important to their organisation. 93.5% of employers feel that practical skills are important to their organisation.

THE IMPORTANCE OF PRACTICAL SKILLS TO ORGANISATIONS

Importance	Percentage (n=93)
Very important	81.7%
Quite important	11.8%
Fairly important	5.4%
Not at all important	0%

RECRUITMENT OF SCIENCE STAFF

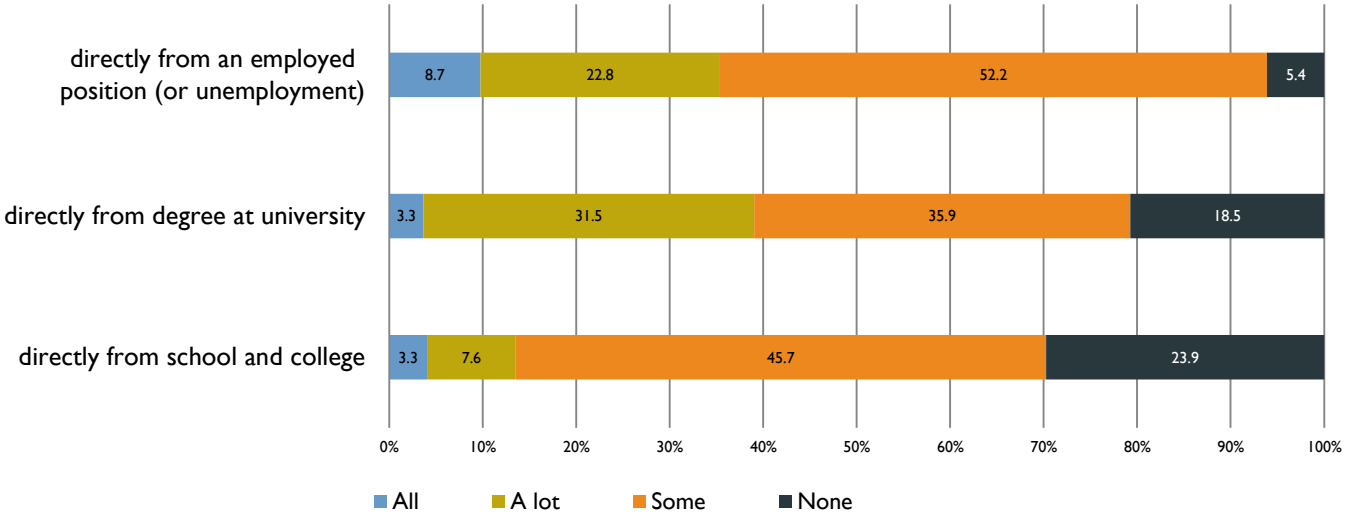
For over two thirds (71.3%) of STEM employers the lowest entry requirement for science staff, defined as employees working in roles which use scientific skills and/or knowledge, is A level or below.

LOWEST ENTRY REQUIREMENT FOR SCIENCE STAFF

Qualification	Percentage (n=94)
No qualification	10.6%
GCSE's or equivalent	30.9%
A levels or equivalent	29.8%
Honours Degree or equivalent	23.4%
Other	5.3%

In terms of the recruitment routes of these science staff, a greater number of respondents said they employ 'all' or 'a lot' of their new science staff directly from employment (31.5%) or from degrees at University (34.8%), rather than directly from school or college. However 56.3% of STEM employers recruit at least some of their science staff from this route.

Recruitment routes into science staff positions over the last 5 years (n=93)



Participants were asked if a graduate had ever been recruited for a previously non-graduate position over the past 5 years. Just under half (41.9%) of employers said that this never happens, however the same proportion said that it happens often or sometimes within their organisation.

THE VALUE OF PRACTICAL SKILLS

Survey respondents were asked to rank a set of practical skills, classifying them as either; Essential, Very important, Useful, Might be useful or Unnecessary. The table below shows the top five practical skills most frequently ranked as Essential.

TOP 5 PRACTICAL SKILLS RANKED AS ESSENTIAL FOR NEW RECRUITS

Practical skill	Frequency ranking skill as essential (n=84)
Use correct and appropriate units of measurement and terminology	48
Carry out standard procedures and tests	47
Analyse and interpret data to provide good evidence	46
Take and record observations and measurements and with accuracy and precision	45
Apply existing knowledge in a new practical situation	42

The skills most frequently listed as unnecessary were; conducting an experiment with appropriate controls (8); formulating scientific questions and testable hypotheses (8); and evaluating experimental methodologies (7).

Respondents were also asked to identify, from the same list of practical skills, the three skills that they felt were most valuable for their organisation and that they expected school leavers to have. The skills most frequently listed are below.

THE TOP 3 MOST VALUABLE PRACTICAL SKILLS TO AN ORGANISATION

Practical skill	Frequency (n=84)
Analyse and interpret data to provide good evidence	26
Take and record observations and measurements and with accuracy and precision	25
Use mathematical skills and knowledge effectively in a scientific context	23

There is significant overlap between the most valuable skills for an organisation and the skills deemed essential for new recruits for an organisation.

Respondents were asked about how they assess the knowledge and skills of new recruits entering their organisation. The most common response was through discussion at interview (83.9%), but interestingly a significant proportion, just under half (46.2%), use a practical test at interview.

ASSESSING PRACTICAL SKILLS

Importance	Frequency
Discussion at interview	83.9%
Other evidence on CV and/or application form	71.0%
Rely on qualifications from school/college	53.8%
Practical test at interview	46.2%

Multiple response question.

ARE THE PRACTICAL SKILLS OF NEW RECRUITS FIT FOR PURPOSE?

The majority of respondents felt that the practical skills of school leavers meet all or some of their organisation's requirements (81.3%).

THE EXTENT TO WHICH THE PRACTICAL SKILLS DISPLAYED BY NEW SCIENCE STAFF MEET ORGANISATIONAL NEEDS

Importance	Percentage (n=91)
Most of the time	29.7%
Some of the time	51.6%
Very seldom	4.4%
Hardly ever	14.3%

Despite this positive response, when respondents were asked whether there had been a decline in the practical skills of those entering their organisation over the last 5 years, just under half (41.05%) agreed that there has been a decline over this period.

DECLINE IN PRACTICAL SKILLS OF NEW RECRUITS OVER THE LAST 5 YEARS

	Percentage (n=95)
Yes	41.1%
No	36.8%
Don't know	22.1%

In addition, the majority (94.6%) of respondents reported that they have to provide training in practical skills to new recruits so they can perform necessary tasks.

THE RELEVANCE OF PRACTICAL SKILLS IN A LEVEL QUALIFICATIONS

Respondents were asked specifically about science A level qualifications and the benefit that they feel they gain from employing individuals with A levels. A smaller proportion of individuals responded to this question (72), and17 individuals stated that they did not recruit people with this qualification. These responses have been excluded from this analysis.

Of the 5 benefits from which respondents could select, having a good level of knowledge (38), a keenness to continue learning (29), and having a good attitude to work (24), are the most frequently selected benefits. The two benefits relating to practical work are selected less frequently than those relating to knowledge and attitude.

BENEFITS OF EMPLOYING INDIVIDUALS WITH A LEVELS

Benefit	Percentage (n=55)
They have a good level of knowledge	69.1%
They are keen to continue learning	52.7%
They have good attitudes to work	43.6%
They have a useful practical skill set	34.5%
They are able to apply their knowledge in practical situations	25.4%

Multiple response question

Respondents were also asked to reflect on the skills important to their organisation, and to identify what they think science A levels should include. Participants were given a list of seventeen skills from which they could select up to three they felt should be included in A levels.

Numeracy and literacy are the most important skills. The ability to apply practical skills also ranks highly, including: problem solving (43.4%); practical skills in real life situations (38.2%); and exposure to equipment and techniques relevant to employment (32.9%). The ability to understand and use what in schools is considered to be the scientific method is not thought to be as important for A levels, for example: planning and conducting a scientific experiment (14.5%); and the understanding of basic of experimental design and processes (5.3%).

EMPLOYER VIEWS ON THE CONTENT OF A LEVELS

Skill	Percentage (n=76)
Mastery of appropriate levels of numeracy and literacy	46.1%
Proficiency in problem-solving in practical situations	43.4%
Experience of applying practical skills to real-life problems	38.2%
Exposure to equipment and techniques they will meet in employment	32.9%
Mastery of basic skills and procedures using practical equipment	25.0%
Efficacy in verbal and written communication	25.0%
Efficacy in working in a team	17.1%
Experience of using IT as part of a scientific experiment	14.5%
Proficiency in observing and measuring	13.2%
Proficiency in planning and conducting a scientific experiment	11.8%
Proficiency in record keeping and report writing	11.8%
Efficacy in working independently	10.5%
Understanding of basic experimental design and processes	5.3%

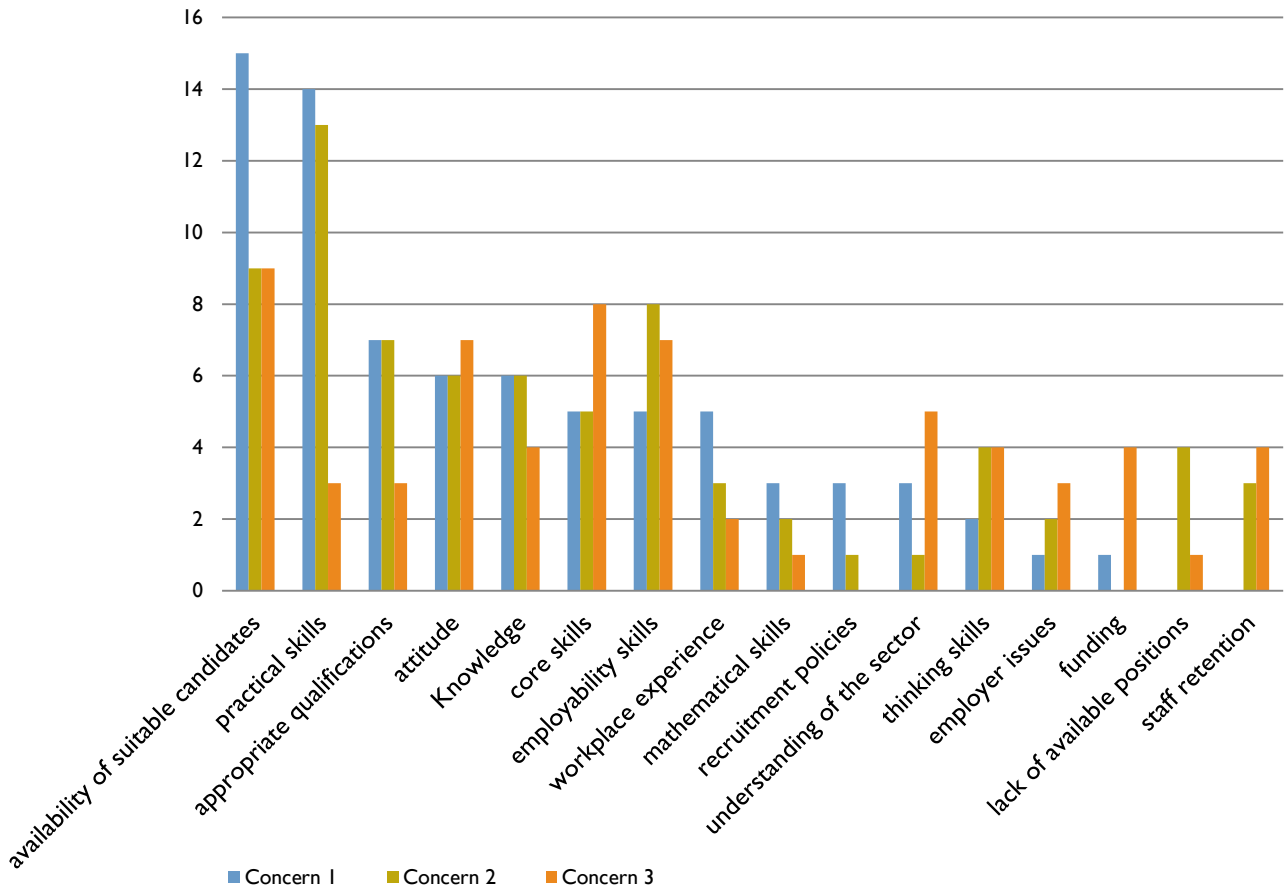
Multiple response question

When asked whether it was more important to assess the planning, or the carrying out, of an experiment at A level, there was a divide amongst respondents: exactly half feel that the planning of experiments is more important, and half feel that it is more important to assess the carrying out of the experiment.

FUTURE CONCERNS

Respondents were given the opportunity to outline, in order of importance, the three main concerns they have regarding their ability to recruit high-quality recruits in the future. The answers to this open response question were coded, and 16 categories identified. The most common concerns are the availability of suitable candidates, practical skills and appropriate qualifications.

Employer concerns regarding the ability to recruit high-quality recruits in the future (n=76)



Author: Beth Jones, Gatsby Foundation, 2012