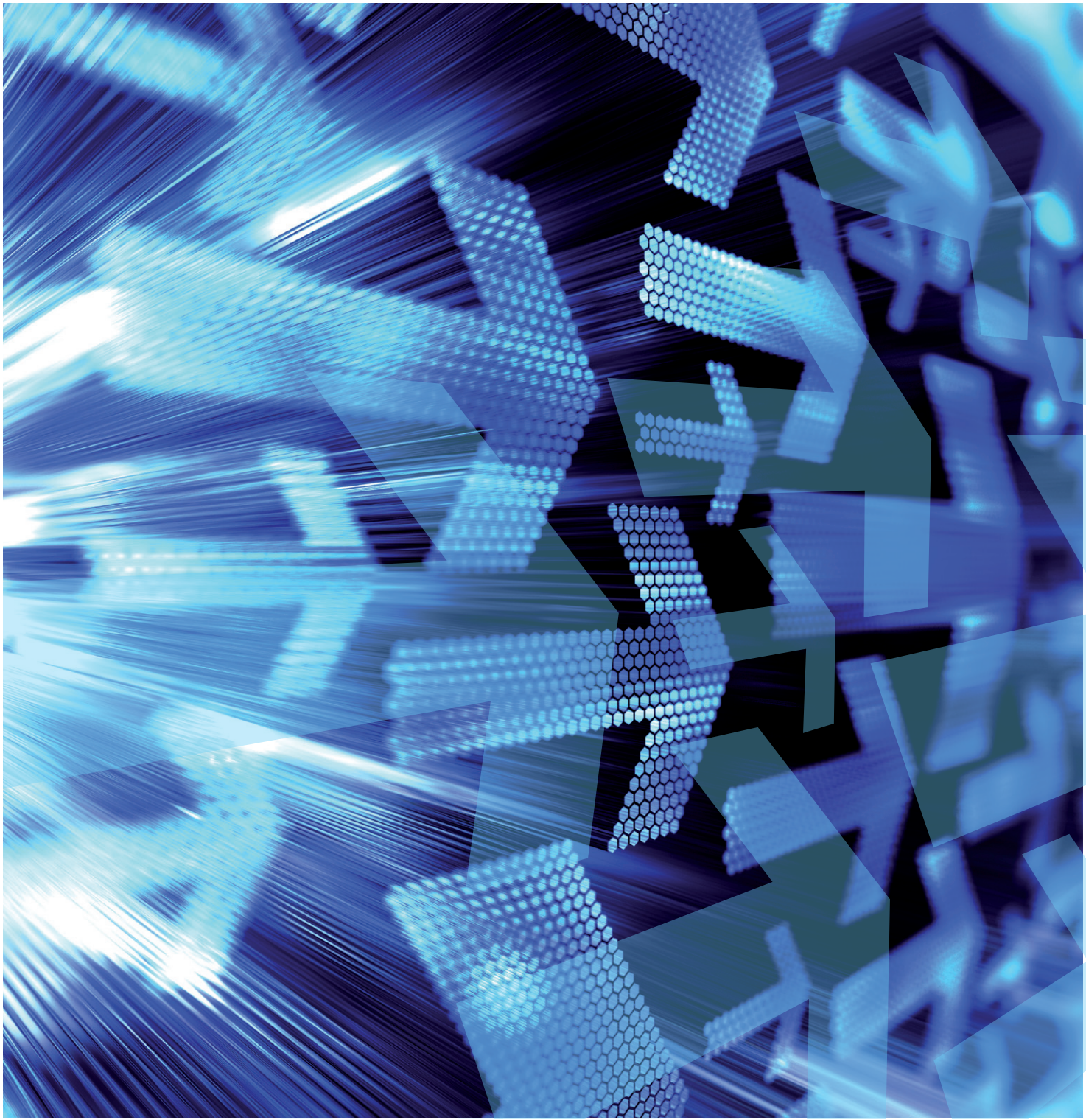

National **HE STEM** Programme

HE STEM Employability Skills Review

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Aim

The National **HE STEM** Programme is an initiative funded by the Higher Education Funding Councils for England and Wales through an activity grant to the University of Birmingham in June 2009. The programme is co-ordinated through six regions, each represented at universities including the Universities of Bath, Birmingham, Bradford, Manchester Metropolitan, Southampton and Swansea), and works in partnership with four Professional Body Partners (The Institute of Mathematics and its Applications, The Institute of Physics, The Royal Academy of Engineering, and the Royal Society of Chemistry)

Working across the higher education sector with a particular focus upon the disciplines of Chemistry, Engineering, Mathematics and Physics. The National **HE STEM** Programme supports higher education institutions in encouraging the exploration of new approaches to recruiting students and delivering programmes of study. It enables the transfer of best practice across the higher education STEM sector, facilitates its wider adoption and encourages innovation. Through collaboration and shared working, the Programme focuses upon sustainable activities to achieve long-term impact within the higher education sector. As part of this philosophy The National **HE STEM** Programme actively disseminates project outcomes and evidence based good practice to HEIs beyond those involved in the project.

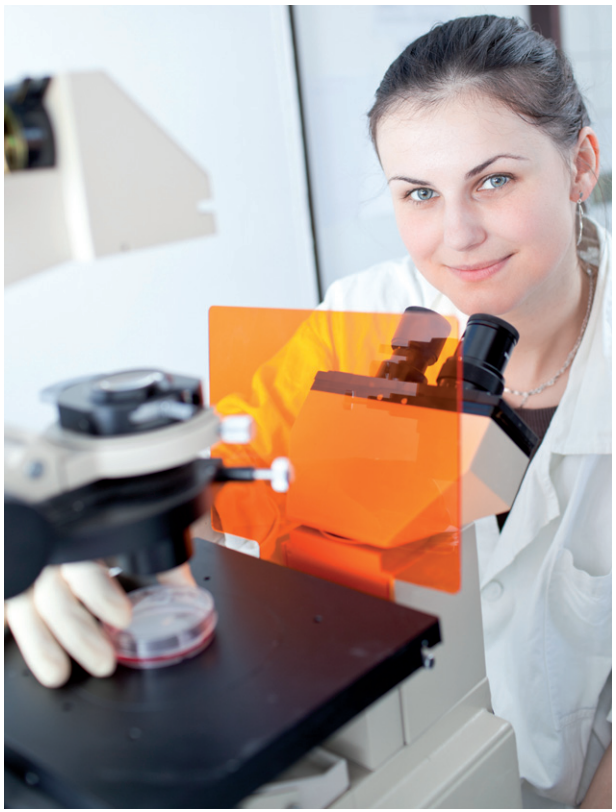
Introduction

An adequate supply of graduates into the labour market with STEM (Science, Technology, Engineering and Maths) skills underpins the ability of the UK to position itself against global competitors, increase its capacity for innovation, and for enterprise. As economic growth gradually returns, the focus is on current and future employer demand for these skills. The hi-tech, science and IT sectors are all reporting difficulties in recruiting STEM graduates and predicting even greater difficulty in future years. These employers rate STEM graduates highly, not only for their technical competency but also because of the analytical, problem-solving, numeracy and intellectual rigour skills that they bring with them.

The National **HE STEM** Programme is focusing its effort on STEM and upon the four disciplines of Chemistry, Engineering, Mathematics and Physics, which have been identified as 'strategically important' by HEFCE and as such requiring some kind of assistive intervention in order to facilitate their provision. Where such an intervention is necessary to address an imbalance between supply and demand the subject is designated a Strategically Important and Vulnerable subject (SIVS).

This report highlights many of the key findings that have emerged from various UK agencies and bodies actively engaged in understanding and articulating the needs of employers in SIVS relevant sectors of UK industry, in particular those reported gaps between employability skills expectations of employers and those articulated by graduates. The study originally set out to deliver an academic template for subject-specific records tailored to address employability. However, to take into account work that has already been done in this respect and also to address the emerging need to consolidate the additional wealth of information and key messages to HEIs from the wider STEM relevant employment sectors, this review seeks to identify the key messages and the potential options for HEIs in response to this agenda.

By responding to the skills needs of employers, HEIs can help to ensure that undergraduates, recent graduates, and those already in the workforce, are motivated not only to take up a STEM subject but that they are also equipped with the relevant employability skills to pursue a successful career within their chosen discipline.



Graduate Skills Challenges: generic and technical

In recent years, the increase in schools outreach activities has contributed to increasing both STEM awareness and the numbers of students taking STEM subjects at A Level[1]. This combined with HE reports of increased uptake of relevant undergraduate degree programmes is encouraging. However, even this improvement in what has been an average steady-state supply of 4,000 graduates per year, will need to be accelerated if the further 60,000 required between 2005 and 2020 to meet targets set by Leitch and other sector specific targets are to be achieved[2]. However, this is not a picture made up solely around issues of supply and demand. Additional concerns have emerged in recent years as to the work readiness of new graduates entering a recruitment market that is arguably more challenging than that faced by many of their predecessors.

Within this context both generic and technical skills needs have emerged as part of a wider recognition of the growing importance of 'T-shaped' skill sets where the depth of the functional or disciplinary skill is enhanced by the horizontal ability to apply knowledge across various work-based situations. Industry is now not only demanding a high level of knowledge and skills in STEM disciplines but is also indicating an increasing need for this in combination with management, leadership and entrepreneurial skills. These skills are no longer a 'nice to have' addition to a potential new graduate recruit's portfolio of expertise but are increasingly being acknowledged as critical to UK employers in hi-tech, science-based industries; industries that must continually respond and adapt to rapid change. HEIs can help to close this skills gap, perceived or otherwise, by offering students the opportunity to develop and ability to articulate, generic and other employability skills that can be applied in a professional capacity to address challenges. Many of these challenges require the flexibility to work across disciplines to stimulate innovations in systems and processes.

The UK Commission for Employment & Skills[3] highlights an existing and anticipated future demand for the provision of higher level skill sets for managers, professional, associate professionals and in technical roles. The following key areas are identified as requiring attention:

- Management and leadership skills
- Professional skills
- Technical and equivalent skills
- Intermediate and vocational skills
- Customer service and employability

Further evidence suggests that the UK HE sector is not supplying graduates with the ability to demonstrate breadth and depth in generic key skills areas. In the latest CBI survey[4], 80% of those companies surveyed identified generic 'employability skills' as a non-discipline specific priority for business when recruiting graduates and indicated that STEM graduates in particular were not 'demonstrating' these at recruitment. These generic skills as defined by the CBI are:

- **Self-management** – readiness to accept responsibility, flexibility, time management, readiness to improve own performance
- **Teamworking** – respecting others, co-operating, negotiating/persuading, contributing to discussions
- **Business and customer awareness** – basic understanding of the key drivers for business success and the need to provide customer satisfaction
- **Problem solving** – analysing facts and circumstances and applying creative thinking to develop appropriate solutions
- **Communication and literacy** – application of literacy, ability to produce clear, structured written work and oral literacy, including listening and questioning

[1] http://www.nationalstemcentre.org.uk/news/a-renaissance-in-science-and-maths-but-better-career-guidance-needed
[2] Technically Higher: Securing Skills for Science and Innovation, Cogent SSC 2009
[3] Skills for Jobs: Today and Tomorrow, UKCES, National Strategic Skills Audit for England 2010
[4] Ready to Grow: business priorities for education and skills, Education and Skills Survey, CBI 2010

- **Application of numeracy** – manipulation of numbers, general mathematical awareness and its application in practical contexts

- **Application of information technology** – basic IT skills, including familiarity with word processing, spreadsheets, file management and use of internet search engines

For the purposes of this review, the skills outlined above will be referred to as generic skills for employability, which contribute to industry and business competitiveness[5].

The Sector Skills Councils (SSCs) are employer-led and work within defined industry footprints to research, and forecast skills needs. They collect, process, and disseminate information on skills needs in key sectors and markets relevant to STEM and SIVS in particular. COGENT SSC reports that employers have encountered problems in attracting, recruiting, and retaining quality STEM skilled graduates. A recent COGENT report also raises wider concerns about the lack of graduates with suitable levels of technical skills, broader competencies such as mathematical capability and practical work experience[6].

A recent report by the The Royal Society of Chemistry (RSC)[7] has identified a number of key generic and technical skills areas that the 2007 graduate cohort, now in employment, have indicated that they would in retrospect have liked more opportunity to develop as part of their undergraduate career, of which the top five are:

- Oral presentation skills

- Planning and design of experiments

- Skills with chemical instrumentation

- Analytical techniques

- Time management / organisation

The RSC report recommends that additional opportunities for developing generic skills should be considered when undergraduate chemistry degree programmes are being revised; with a particular emphasis on oral presentation skills.

A 2008 survey of the some of the UKs largest pharmaceutical and biomedical employers, reaffirms the more general concern around graduate practical skills with a perceived 'lack' of laboratory skills and basic ability to use, for example, balances and pipettes[8]. For a more detailed list of technical skills and capabilities highlighted by this survey, see Appendix A. In addition, certain mathematical skills are vital to the development of new medicines, such as statistics for clinical studies. In many other areas a basic level of mathematical competence is required, particularly in STEM, in order to develop and deploy the higher-level concepts needed by industry. The provision of preparatory L4 mathematics courses for HEI science students is on the increase because of reluctance by HEIs to require post-16 levels of attainment[9].

Finally, evidence also suggests that there is an increasing need to address low numbers of graduates that enter industrial sectors directly linked to the discipline that they have studied[10]. These traditional discipline-specific graduate destination sectors, such as pharmaceutical, are now in competition with other industry sectors that also recognise the value of STEM graduates. This is not to detract from the demonstrable value of STEM graduates to other sectors, such as the service sector[11]. SEMTA SSC is calling for the image and attractiveness of the these traditional discipline sectors to be improved to attract a greater share of potential new entrants to address current and future predicted increases in rates of attrition.

5 'Generic Skills for Employability': Educational Colonisation or Educational Opportunity?, Jill Sanguinetti, School of Education, Victoria University, Melbourne, Australia
6 http://www.cogent-ssc.com/Higher_level_skills/Publications/EmergingHigher.pdf
7 Skills required by new chemistry graduates and their development within degree programmes, HEA UK Physical Sciences Centre and Royal Society of Chemistry Education Division, 2010
8 Skills Needs for Biomedical Research, Creating the Pools of Talent to Win the Innovation Race, ABPI, 2008
9 The Five Decade Challenge: A wake up call for UK science education?, Royal Society of Chemistry 2008
10 Skills and the Future of UK Science, Engineering and Manufacturing Technologies, 2009
11 Hidden Wealth, The Royal Society, 2009

Having reviewed the employability challenges within STEM skills this report now highlights repositories of guidance and other supporting material therein contained, concerning employability and sector skills gaps that resides within agencies such as the Sector Skills Councils, professional bodies and HEA Subject Centres. An overview of this information is presented in an attempt to further improve HE sector awareness as well as understanding graduate skills and employer recruitment needs.

Subject Benchmark Statements & Employability

In considering a response to the STEM graduate skills issues highlighted by the CBI and others on behalf of employers, it is worthwhile in the first instance reviewing the guidelines that HEIs currently operate under in relation to the development of discipline specific provision.

The Quality Assurance Agency for Higher Education (QAA) guides the development of Higher Education provision through subject benchmark statements. In addition to describing the nature and characteristics of Higher Education Programmes the statements also provide a discipline specific guide as to the 'attributes and capabilities' that a designated level of graduate should be able to demonstrate.

As acknowledged above, in recent surveys of employers, a significant level of concern has been raised with regard to the ability, in particular of STEM graduates, to demonstrate the attainment of generic and technical skills for employability which are evidentially attributes and capabilities of key importance to employers. The majority of employers are increasingly expecting that potential recruits evidence these skills as part of their wider skills portfolio.

A review has been made of the current QAA benchmark statements for Chemistry, Physics, Maths (MSOR) and Engineering in terms of their reference to generic employability statements as a means of illustrating how these statements currently reflect the theme of employability. The methodology used in this process has been to filter the QAA statements for explicit employability skills terminology as defined by the recent CBI survey, mentioned earlier. In searching for explicit reference to this terminology, the exercise does not consider possible inferences within statements, which may or may not be open to interpretation. Table 1 on page 7 illustrates how each subject scored relative to each other.

Table 1: QAA statements filtered for CBI defined employability skills

Generic Employability Skills[a]		QAA Benchmark Statements			
		Chemistry	Mathematics	Engineering	Physics
Self Management					
	Readiness to Accept Responsibility	X[b]		X	
	Flexibility			X	
	Time Management	X	X		X
	Readiness to Improve Own Performance				
Teamworking		X	X	X	X
	Respecting Others				
	Co-operating			X	
	Negotiating/Persuading	X			
	Contributing to Discussions	X	X	X	
Business and Customer Awareness				X	
	Basic Understanding of Key Drivers for Business Success			X	
	Provision of Customer Satisfaction				
	Positive Attitude to Work				
Problem Solving		X			X
	Analysing Facts and Circumstances	X	X	X	X
	Applying Creative Thinking		X	X	
	Developing Appropriate Solutions	X	X	X	
Communication and Literacy			X	X	
	Application of Literacy	X			X
	Ability to Produce Clear, Structured Written Work	X	X		X
	Oral Literacy	X			
	Listening and Questioning				X
Application of Numeracy		X	X		
	Manipulation of Numbers		X		X
	General Mathematics Awareness		X	X	
	Application to Practical Concepts		X		
Application of Information Technology			X	X	X
	Basic IT skills	X	X		
	Familiarity with Word Processing		X		
	Familiarity with Spreadsheets				
	File Management				
	Use of Internet Search Engines		X		X

[a] List of generic employability skills as identified by CBI
[b] Matching reference in QAA benchmark statement

As the table on page 7 illustrates, when searching for explicit references to generic employability skills terminology, the most significant gaps appear in references to 'Business and Customer Awareness', 'Application of Numeracy' and 'Self-Management'. Starting with the lowest and descending in order of increasing matches to these CBI defined employability skill sets, the order is as follows:

1. Business & Customer Awareness
2. Self-management
3. Application of Numeracy
4. Application of IT
5. Communication & Literacy / Teamworking
6. Problem-solving

Business and Customer Awareness terminology was absent in all but the engineering statements. One possible reason for this may be the status of engineering as a more applied discipline, where the need for business awareness skills are perceived as being more immediately relevant to user industries. However, for engineering, gaps in terminology exist in other areas, namely; in skill sets referring to Communication, Application of Numeracy and Application of IT.

Overall, Mathematics achieved the highest score in terms of explicit terminology matches although this may be due to an expected emphasis on problem solving and numeracy within the statements. Mathematics scored second lowest in references to Teamworking, and joint lowest with Physics in Self-management.

This analysis highlights the challenges when attempting to match the language of employers with that of academia. Whilst a reasonable number of matches were uncovered for all employability terms, these tend to be embedded in broader statements and as such, the employability theme is less explicit than it could potentially be.

Priorities for action

As inferred already, the most employable and effective new recruit to a business is one that can apply both theoretical and practical knowledge to real industrial problems: this is reflected in the concept of T-shaped skill sets where employees have the depth of scientific and technical understanding in combination with other key business process skills. This issue is of particular relevance to the SIVS and the Higher Level Skills strategy of the National **HE STEM** Programme.

The production of graduates with a suitable combination of employability skill sets will require an appropriate level of employer engagement in HE. As a consequence employers (and HEIs) will be required to make a further commitment to collaborative activities that enable the articulation of their needs to HEIs in as precise a manner as possible so as to achieve maximum impact and benefit within STEM subjects, where enhancements to discipline specific provision can be developed and implemented.

Careers Awareness building

HE faculties and departments have an important role in facilitating an improved awareness amongst undergraduates and staff of the importance of the link between developing employability skills and accessing STEM career opportunities. Whilst acknowledging that the quality, range, and accessibility of information advice and guidance can be variable[12], opportunities do exist for HEIs and employers to collaborate on this agenda either directly and / or indirectly through third party suppliers. The relevant professional bodies, Higher Education Academy Subject Centres, and Sector Skills Councils are sources of valuable information and guidance to those requiring input on graduate skills requirements.

Undergraduates should be supported and encouraged to develop a good understanding of the world of work, including the expectations that employers have before they enter the jobs market[13]. At faculty, departmental or sub-departmental level this can be achieved by incorporating awareness building activities as part of any graduate skills development strategy. A key enabler in this is collaboration with university careers services. The main responsibility for providing careers information and guidance rests with these services rather than individual departments. In addition, scope also exists to provide support to students as part of a teaching programme. In either case, departments should consider how they more effectively dovetail with the activities of the careers services. Careers services representatives can be a key lynchpin in this process and departments HEIs should consider establishing such functions where it does not already exist.

As an example, a model adopted by Manchester Metropolitan University (MMU) has been to establish 'employability Faculty representatives' to work with Careers and Employability advisors. The Faculty of Science & Engineering at MMU has recently established a Personal Development Plan (student) and Employability Working Strategy group. This group is chaired by the Faculty representative, populated by Faculty 'champions' and include liaison links with the MMU Careers and Employability Service.

Self-awareness and skills articulation

In tandem with the need for wider faculty and departmental awareness, is the need for undergraduates to develop their own self-awareness and ability to articulate employability skills. The professional bodies are in the process of developing and making available discipline specific materials to help encourage and support students to become aware, and take ownership of, their own employability skills portfolio through, for example, monitoring and recording skills developed: applying the concept of the academic record or progress file.

The RSC has developed the concept of the Undergraduate Skills Record (USR) in a follow-up to its experience with the Postgraduate Skills Record. The USR is a framework for skills recording and development throughout undergraduate study. The tool contains a skills audit, a skills profile and career planning material. The skills audit is in three phases of study across an undergraduate's career. A key aim of completing the USR is to help students improve their employability skills by identifying gaps and areas that require development. The skills profile developed serves as an aid to completing application forms and constructing CVs. These resources, aimed at helping students to manage their personal development, are available online[14]; a PDF of the USR is included as an addendum to this report, see Appendix B.

The Institute of Physics' (IoP) online learning centre contains a wealth of tips, advice and information to help members polish up their generic employability skills. Aimed at those already in the workforce, there are 23 courses available through distance learning, ranging from networking to negotiation and coaching to customer service[15]. All courses are free of charge to members of the Institute.

[12] Science for Careers, Report of the Science & Society Expert Group, March 2010
[13] Briefings on Employability 1, Issues for Employers, 2003, Harvey, L., and Knight, P.. York: ESECT
[14] www.rsc.org/Education/HEstudents/personaldevelopment.asp
[15] www.iop.org/membership/cpd/training/learning/page_38201.html

The Institute for Maths and its Applications (IMA) along with the London Mathematical Society (LMS) and Royal Statistical Society (RSS) support a website on careers in mathematics called Maths Careers[16]. The site provides information relevant to persons interested in finding out about employability, work and jobs associated with mathematicians, and includes a series of videos produced as part of the Curriculum Impact project based in the School of Mathematical Sciences, Queen Mary University of London[17].

The IMA also devotes a section of its website to careers and careers advice for students at all levels[18]. Of particular relevance to employability is the section offering advice to undergraduates which maps the skills developed through studying Mathematics against various employability skills, competencies and attributes valued by recruiters as highlighted by the Council for Industry and Higher Education assisted by the Higher Education Academy Subject Centres, see Appendix C.

Following on from a mini-project sponsored by the Engineering Subject Centre, the University of Northampton has produced a set of on-line PDP materials for undergraduate engineers[19]. This resource is to help students identify and fill gaps, in personal and continuing professional development, as well as to encourage skills articulation, critical reflection, self-awareness, and self-presentation skills.

Work experience

The increased provision of relevant work experience or industrial placements encourages students to pursue a STEM-based career and provides an effective method of allowing students to develop valuable business and technical skills. The largest skills gaps in employer satisfaction with graduates are in commercial awareness and relevant work experience – underlining the concerns in placement uptake and supply, see Engineering Graduates for Industry report[20]. The report provides case study evidence of the background to, and resultant benefits of, developing an 'experience-led teaching' approach in enabling universities to develop provision that better matches the needs of industry including explanation of opportunities, barriers and costs involved. Much of the learning, including case studies cited therein, is transferable and should act as inspiration to other **HE STEM** disciplines.

The report demonstrates that in partnership with employers, a strategy of embedding experience-led teaching across a discipline, with a view to designing and delivering provision in response to identified needs can have wide-ranging benefits for undergraduates.

Student experience of industry can take on a direct or indirect aspect, or indeed some combination of both. In terms of the direct route, the following are common components:

- an industrial placement year
- other work experience
- relevant employment for part-time students
- relevant student-led activity – sometimes supported by relevant societies e.g. The El Salvador Project[21]

[16] www.mathscareers.org
[17] http://www.mathscareers.org.uk/viewItem.cfm?cit_id=383047
[18] www.ima.org.uk/Careers
[19] http://pdp.northampton.ac.uk/engineering/index.html
[20] Engineering Graduates for Industry, Royal Academy of Engineering / HEA Engineering Subject Centre, 2010 www.engsc.ac.uk/graduates-for-industry
[21] www.elsalvadorproject.org.uk/

All of these activities significantly improve the employability skills of graduates as well as in many cases helping to focus a student on the pursuit of a STEM specific career. Whilst the components outlined above specifically relate to engineering their success as evidenced, see Appendix D , may inspire their wider adoption across other STEM disciplines.

With the availability of industrial placements coming under increasing pressure, developing alternative modes for students to gain indirect experience of industry has the potential to mitigate the negative impact of such scarcity. The following are examples of indirect experience-led components taken from the Engineering Graduates for Industry report and again these are mainly generic in nature:

- Industrial simulation
- Project based learning and other forms of active learning
- Industrial group projects, design projects, multi-disciplinary projects
- Case studies from industry
- Influence of part-time and mature students on full-time students
- Site visits and field trips
- Entry to national and international competitions
- Student involvement with professional institutions

Cogent has compiled an overview for employers of the various types of work placement, including benefits and limitations thereof. The information may be equally valuable to HEIs in steering discussions with employers as part of their own portfolio for employer engagement, see Appendix E. In addition, the RSC as part of its role in the **HE STEM** Programme is developing projects to increase and enhance engagement opportunities between HEIs and employers. The RSC has developed an online portal[22] aimed at,

- Supporting placement provision and uptake
- Increasing availability and improving access to Industrial Placements for students and Industrial Placement coordinators
- Enhancing the Industrial Placement experience for students, employers and IP coordinators

Curriculum development

Since 2006, the QAA has adopted learning outcomes for engineering as defined by Engineering Council UK Standard for Professional Engineering Competence (UK SPEC). UK SPEC defines series of general learning outcomes that includes practical skills and general transferable skills. The transferable skills in particular refer to functional skills that are 'commonly needed for success', in work such as evidence of problem solving, communication, and working with others. Further information on these Key Skills is available at the Qualifications and Curriculum Development Authority[23]. It is not the intention to infer here that the Engineering statement is in some way superior in this respect, rather to highlight an aspect of one benchmark statement which ring fences general learning outcomes that underpin employability and attempts to define what these are. This approach has the potential to form the basis for a suitable global approach to embedding employability across all subjects.

[22] www.rsc.org/Education/HESTEM/EmployerEngagement/Placements.asp
[23] www.qcda.gov.uk

Accreditation is a valuable lever to encourage adoption of employability components. Any approach to enhancing existing provision or indeed the development of future provision, will have to balance concerns amongst course and curriculum developers, and some employers, over the available room for manoeuvre in already busy curricula to ensure that degrees do not become, overloaded at the expense of technical content. Embedding employability across the curriculum may be the most effective way of addressing this concern by dampening any pressure on individual elements and at the same time delivering a comprehensive response to gaps in the provision of employability skills. In addition, HEIs may wish to investigate how much scope exists within departments to involve employers in the development of employability elements within provision.

In terms of how best to embed employability skills there are no established rules and no 'one size fits all' approach. HEIs will each have their own position and pursue their own agenda driven by some combination of institutional strategy and available resource to support delivery. In a climate where resource limitations are increasingly influencing strategic plans, and the extent to which underpinning activities are resourced, it seems reasonable to look to established models that can provide frameworks for delivering a quality service.

The Graduate Develop Centre[24] at Liverpool John Moores University (LJMU)offers an opportunity for students to develop their graduate skills. These skills are embedded in all LJMU courses and are identified in home, work, hobbies, etc. Students get the opportunity for practice, assessment, and receive feedback for their personal development. On graduation, having successfully met the graduate skills criteria, students receive a formal certificate as evidence of attainment.

The Centre for Career Management Skills at the University of Reading has produced an online resource which aims to support 'career learning' for undergraduates and taught postgraduate students called Destinations®[25]. The site contains a number of topics that cover themes such as 'careers and employers', 'interviews', and 'personality'. Reading has this embedded in all undergraduate degree courses as a credit-bearing unit delivered by a member of the Careers Service alongside a member of academic staff. The product is not free and is available to HEIs in the UK and overseas.

An approach taken by the Centre for Learning and Teaching or CeLT located at Manchester Metropolitan University has been to develop processes, projects and resources to aid staff in finding ways to achieve improved employability for its students. A 2007 project entitled 'Embedding Employability' has resulted in a number of new initiatives. An outcome from the project has been the development of the Employability Curriculum Framework (ECF). The framework is a process for embedding employability into a developing curriculum. The core aim of this framework is to support programme teams in developing a teaching programme that achieves 'MMU Employability Curriculum' status through meeting a set of predefined requirements. The ECF and report on the initial pilot phase of the project is included in Appendix F.

In the chemical sciences, the RSC is currently working towards developing and disseminating resources aimed at addressing employability. As part of this work, they are developing and publishing resources for use in undergraduate curricula in the form of context- and problem-based learning. Each resource, available online, contains all of the information required for delivery, practical guidelines and suggested modes of assessment[26]. These resources are design to help students develop problem solving and higher-level skills through applied learning. An overview of context- and problem-based learning, including guidance for those interested in using C/PBL in their teaching is also available on RSC's Education web page and is available as an appendix to this review, see Appendix G.

[24] www.ljmu.ac.uk/WoW/students
[25] http://www.reading.ac.uk/ccms/destinations/ccms-destinationsbenefits.aspx
[26] www.rsc.org/Education/HESTEM/CPBL/index.asp

The HEA Maths Statistics and Operational Research Network are currently working on methods for embedding employability skills within Mathematical Sciences Programmes as part of the National **HE STEM** Programme Mathematical Sciences Curriculum Innovation Project. This work will address the challenges involved in overcoming the wish to retain the pure theoretical nature of programme content whilst incorporating a wider range of employability skills within a finite undergraduate curriculum.

Finally, the Higher Education Academy (HEA) Subject Centres are responsible for developing and disseminating discipline specific practice aimed at enhancing the student learning experience, which includes preparation for employment. The HEA Employability and Employee Learning (EEL) team[27] aims to influence and enhance the student learning experience by facilitating and brokering networks of projects, institutions, individual academics and subject centres in the areas of employability, employer engagement and employee learning.

The HEA Physical Sciences Subject Centre has published a practice guide on developing employability skills that focuses on department-based activities as a response to the widespread lack of work placements and variability in experience gained. The activities outlined are transferrable across disciplines and the specific skills developed outlined against each activity. This guide is available in Appendix H.

[27] www.heacademy.ac.uk/ourwork/teachingandlearning/employability
[28] http://www.heacademy.ac.uk/ourwork/teachingandlearning/employability

The HEA is also a source of much advice and guidance including tools, resources and specific disciplinary approaches to employability that HEIs may find useful[28].

Staff capacity and capability

To overcome many of the challenges outlined in this review, HEI staff will need to develop their own capacity and capability to deliver an appropriate level of response. There is much guidance and supporting material available, and under development, outside of the HE sector. Staff will need to be encouraged to develop relevant skills, such as employer engagement skills, to ensure that this information has maximum affect at departmental and faculty level. However, this level of commitment requires resourcing which some institutions will be more able to deliver than others.

To embed experience-led components into HEI provision will require a consolidated effort ranging from senior managers through to curriculum developers and teaching staff. In addition, the numbers of HEI staff with prior experience of industry is decreasing especially in research-led institutions; see Engineering Graduates for Industry report.
To address these issues HEIs could consider the following:

- The recognition and rewarding of staff who pursue employer engagement activities with broader adoption throughout the HE system as a method to lever the cultural changes in behaviour that are required
- Existing HE staff with no previous experience of industry should be encouraged to undertake industrial research collaborations or secondments into industry and embed this into the teaching, learning and assessment agendas. Knowledge Transfer Partnerships are an example of a well defined and structured way of achieving this
- Create employer forums that allow industry to contribute directly to the development of curricula and bring industrialists into HEIs to support teaching

- Establish so called 'Communities of Practice' (CoPs) – The CeLT at MMU has established a number of CoPs in themed areas including PDP and employability[29]. The aims of the communities of practice are to provide to practitioners at MMU:
  - Opportunities for learning through networking, discussion, dissemination
  - Advice and encouragement
  - Opportunities for development and evaluation of Learning and Teaching activities across MMU
- The National **HE STEM** Programme is providing a series of workshops, which will aim to develop HE staff's employer engagement skills[30]. These master classes will address the following topics:
  - Understanding your market – planning for employer engagement
  - Producing effective business engagement plans
  - How to make successful contact with employers
  - Using real world for assessment – a role for employers in the assessment process
  - Quality assurance for work-based learning

Conclusion

This review has highlighted a number of key themes in graduate skills provision that when pursued can have a positive impact on employability. These themes are not new and are accompanied by examples of good practice that STEM providers may consider adopting when developing a strategy for embedding employability. Whilst there are many sources of information and external support does exist, this is not always available in a format, which is readily accessible or usable. A policy of effective employer engagement through HEIs and external organisations such as Sector Skills Councils and professional bodies collaborating has the potential to improve HEIs understanding of the skills needs of the sectors that employ their graduates. However, for this information to have an impact HEI staff will need to be empowered with the capacity and capability to deliver the changes required.

[29] http://www.celt.mmu.ac.uk/cops/
[30] http://www.hestem.ac.uk/Masterclassesinemployerengagement/tabid/180/Default.aspx

Key recommendations for National **HE STEM** Programme

- Increase HEI recognition of the value of providing for the acquisition of graduate employability skill sets. A greater emphasis within subject benchmark statements on the employability language and terminology as used by employers to make more explicit the links between both generic and practical employability, and wider graduate skills attributes would help to facilitate this. The incorporation of recognised accreditation standards has the potential to act as an additional lever

- Further work needs to be carried out to understand common practical challenges and solutions required to embed employability skills within the STEM curriculum. Establish effective practice for wider dissemination across HE

- Encourage HEIs to explore ways of engaging with employers to develop employability support plans that will help ensure their graduates have the relevant practical skills that are required for the workplace

- STEM undergraduates should be encouraged to utilise and develop personal progress files in order to recognise and capture development of employability skills, and thus contribute to improved self-awareness and ability to articulate these skills to employers

- Increase HEI awareness of the developing methods of providing both direct and indirect experience of employers, and support their wider adoption across STEM

- Deliver an enhanced capacity for employer engagement supported by training and a commitment by employers to financially support programmes which provide clear benefit

- Encourage HEIs to utilise 'in-house' careers advice and guidance support resources. These services are particularly relevant to strategies that aim to address graduate employability skills through providing appropriate levels of information on, for example, career destinations and other industry relevant labour market information, so that undergraduates can make informed choices about why, how and what they study

- The information, advice and guidance landscape is complicated. Whist there is much valuable material and significant efforts made to make this widely available to HEIs; this material is not always easily accessible and is often in a format that is not easily translatable to a HE context. A centralised or coordinated common approach by STEM 'partners' would help to overcome this barrier