Employability: integral to the curriculum or an add-on?

Professor Sir Bill Wakeham FREng
Chair, South East Physics Network
Chair, Exeter Science Park
Chair, Wakeham Review of Employability in STEM

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Our plan for growth: science and innovation – December 2014

• Government’s Science and Innovation Strategy built on work that looked across the STEM skills ‘pipeline’ to examine issues spanning GCSE at grade A-C level all the way up to masters and specialised degrees.

• A key finding: some STEM graduates require better employment ready skills and some areas suffer from poorer outcomes relative to others.

• S&I Strategy recommends independent reviews of STEM degree accreditation arrangements to improve quality and graduate employability:

  1. Targeted review of computer science degree accreditation and graduate employability – led by Professor Sir Nigel Shadbolt

  2. Wider review of STEM to explore whether other STEM disciplines would warrant similar, specific investigation – led by Professor Sir William Wakeham

• Why me?
Objectives of the Wakeham Review

• Review of STEM graduate employability and degree course accreditation.

• Explore STEM graduate employment outcomes using a range of evidence and determine if there are STEM disciplines of concern which warrant further investigation through future work.

• Wanted to ask questions about the extent of the problem and the reasons behind the relatively poor employment outcomes in disciplines of concern.

• Also wanted to understand to what extent does the accreditation regime(s) for these STEM subjects play a part in graduate outcomes.

• Review will not make explicit recommendations on solutions or specific accreditation regimes. It will identify options for future, more in-depth, exploration of specific STEM disciplines and their associated graduate outcomes.
Methodology

The review was broadly split into 3 overlapping phases:

A) Define scope and interrogate existing data available through Higher Education Statistics Agency (HESA) to develop a more granular picture of STEM graduate employment outcomes across the range of institutional (tariff) types:
   i.  Unemployment rate
   ii. Proportion of graduates in ‘non-graduate roles’
   iii. Proportion of graduates earning low salaries (below £20,000)

B) Conduct an evidence-gathering survey with stakeholders (PSRBs, industry and the HE sector) to develop the evidence base and thus identify the STEM disciplines which appear to have grounds for concern.

C) Target stakeholder focus groups/workshops to explore specific issues in more depth where there was agreement on the concerns.

• Advice provided during course of review by Review Advisory Group – industry, PSRBs and HE sector
Unemployment rates of full-time first degree leavers from UK HEIs, 2006-07 to 2012-13
Unemployment rates of full-time first degree leavers, by degree classification awarded

HEFCE analysis of the HESA standard qualifiers population and Destination of Leavers from Higher Education survey, both 2012-13. UK-domiciled qualifiers from full-time first degree qualifications registered at publicly-funded English HEIs only. Qualifiers who fell within the DLHE target population and provided a valid response to that survey.
Unemployment rates of full-time first degree leavers, by entry qualifications

HEFCE analysis of the HESA standard qualifiers population and Destination of Leavers from Higher Education survey, both 2012-13. UK-domiciled qualifiers from full-time first degree qualifications registered at publicly-funded English HEIs only. Qualifiers who fell within the DLHE target population and provided a valid response to that survey.
Distribution of computer science unemployment rates by institution, 2012-13

HEFCE analysis of the HESA standard qualifiers population and Destination of Leavers from Higher Education survey, both 2012-13. UK-domiciled computer science qualifiers from full-time first degree qualifications registered at publicly-funded English HEIs only. Qualifiers who fell within the DLHE target population and provided a valid response to that survey. All percentages based on fewer than 22.5 qualifiers are not considered to be statistically robust and are suppressed and included under a grouping labelled "Too small".
Distribution of STEM unemployment rates by institution and subject area, 2012-13

HEFCE analysis of the HESA standard qualifiers population and Destination of Leavers from Higher Education survey, both 2012-13. UK-domiciled qualifiers from full-time first degree qualifications registered at publicly-funded English HEIs only. Qualifiers who fell within the DLHE target population and provided a valid response to that survey. All percentages based on fewer than 22.5 qualifiers are not considered to be statistically robust and are suppressed and included under a grouping labelled "Too small".
Disciplines that warrant further investigation
## Headline STEM disciplines of concern based on HESA data

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Unemployment level</th>
<th>Graduates in non-grad roles</th>
<th>Graduates on low salaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological sciences</td>
<td>Above average unemployment for high tariff institutions. Below average for low tariff institutions.</td>
<td>High proportion in non-graduate roles for all institution types.</td>
<td>High proportion in low-pay roles.</td>
</tr>
<tr>
<td>Chemistry and materials science</td>
<td>Above average unemployment rates in 2013-14 (below average for low tariff institutions in 2011-12 and 2012-13)</td>
<td>Above average proportion in non-graduate roles across all institution types.</td>
<td>Above average proportion in low-pay roles from all institution types.</td>
</tr>
<tr>
<td>Computer sciences</td>
<td>Above average or high unemployment Sharp difference between low and high tariff institutions</td>
<td>Generally low proportion in non-graduate roles Sharp difference between low and high tariff institutions</td>
<td>Above average proportion in low-pay roles except for high tariff institutions.</td>
</tr>
<tr>
<td>Earth, marine and environmental sciences</td>
<td>Above average unemployment at high and medium tariff institutions, lower unemployment for low tariff institutions.</td>
<td>High proportion in non-graduate roles.</td>
<td>High proportion in low-pay roles.</td>
</tr>
<tr>
<td>Chemical, process and energy engineering</td>
<td>High unemployment especially for high tariff institutions.</td>
<td>Low proportion in non-graduate roles.</td>
<td>Low proportion in low-pay roles.</td>
</tr>
<tr>
<td>Others in engineering and technology</td>
<td>Variability in unemployment rates: below average in 2012-13, above average in 2011-12 and 2013-14.</td>
<td>High proportions at low tariff institutions and low proportions at high tariff institutions.</td>
<td>High proportions at low tariff institutions and low proportions at high tariff institutions.</td>
</tr>
<tr>
<td>Mathematical sciences</td>
<td>Below average unemployment.</td>
<td>Above average proportion in non-graduate roles for high tariff institutions.</td>
<td>Above average in low-pay roles for high tariff institutions.</td>
</tr>
<tr>
<td>Pharmacology, toxicology and pharmacy</td>
<td>Low unemployment rates/</td>
<td>Low proportions in non-graduate roles for all institution types.</td>
<td>High proportion in low-pay roles.</td>
</tr>
<tr>
<td>Physics and astronomy</td>
<td>Above average unemployment, especially for medium tariff institutions.</td>
<td>Below average proportion in non-graduate roles overall.</td>
<td>Below average proportions in low-pay roles.</td>
</tr>
</tbody>
</table>
### STEM sub-disciplines of concern based on HESA data

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Unemployment level</th>
<th>Graduates in non-graduate roles</th>
<th>Graduates on low salaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>H150 - Engineering design</td>
<td>Variability over time but high unemployment rates for medium tariff institutions.</td>
<td>Low proportions in non-graduate roles.</td>
<td>Low proportions earning low salaries overall in 2011-12 and 2013-14 (and below average in 2012-13).</td>
</tr>
<tr>
<td>H160 - Bioengineering, biomedical engineering and clinical engineering</td>
<td>High unemployment rates for medium tariff institutions in 2012-13.</td>
<td>No data.</td>
<td>No data.</td>
</tr>
<tr>
<td>H400 - Aerospace engineering</td>
<td>Above average unemployment rates, high unemployment for medium tariff institutions.</td>
<td>High proportion in non-graduate roles from medium tariff institutions.</td>
<td>Low proportions earning low salaries for all institution types.</td>
</tr>
<tr>
<td>H640 - Communications engineering</td>
<td>Above average unemployment rates.</td>
<td>Generally below average proportion in non-graduate roles, but high for low tariff institutions.</td>
<td>High proportion earning low salaries from medium and low tariff institutions.</td>
</tr>
</tbody>
</table>
Additional evidence gathering – online survey and focus groups

• Online survey of HE providers, businesses, industry representative bodies and professional bodies – approx 500 responses received. Helped to corroborate findings from HESA data:
  – Biological Sciences; Earth, Marine and Environmental Sciences; Agriculture, Animal Science and Food Science – all disciplines of concern
  – Graduates lacking:
    • ‘Soft / work readiness’ skills
    • Business/commercial awareness
    • Work experience
    • Sufficient levels of engagement in/awareness of career planning and or industry opportunities
    • Mathematical/statistical skills and training

• 3 stakeholder focus groups to explore specific disciplines in more detail:
  • Biological Sciences
  • Earth, Marine and Environmental Sciences
  • Agriculture, Animal Science and Food Science

• Wrote to professional / representative bodies on other disciplines of concern
Example: summary of findings from Biological Sciences focus group

• Agreed that further work/more targeted review would be warranted.

• Huge array of sub-disciplines with own nuances; jobs market for Bio Sciences diverse and difficult to understand.

• Need a better understanding of whether there is an unmet demand from industry.

• Identified skills gaps:
  – Practical skills;
  – Transferrable skills including team work; and
  – Mathematics (and applicability to real world), although variations across sub-disciplines.

• Work experience improves outcomes, but very limited supply.

• Very new accreditation regime, with impact as yet uncertain.
Findings 1

• Stakeholder survey and focus group evidence seems to corroborate poor employment statistics from HESA data.

• Disciplines that warrant future, targeted exploration:
  — Biological Sciences
  — Earth, Marine and Environmental Sciences
  — Agri-Food disciplines

• Additional disciplines where graduate outcomes display some cause for concern, and which would benefit from some further investigation: Biomedical Engineering; Aerospace Engineering, Engineering Design
  — Recommend that for each discipline the respective industry bodies, HE providers and professional bodies for those disciplines should work together to clarify the nature of their graduate employment outcomes and decide on future action.

• Data which elucidates the links between the supply and demand for STEM graduate skills needs to be better mapped and strengthened — e.g. different types of work experience; geographical factors; flows of STEM graduates into STEM and non-STEM industries.
Findings 2

- Increased engagement between industry and HE providers is needed:
  - **Graduate soft / work readiness skills need to be improved and adjusted as demands change.** Consideration should be given to how these could be embedded to a greater extent in existing degree course provision/curricula.
  - **Careers advice / training for graduates could be improved** – large degree of variation across providers and disciplines.
  - **Work experience** needs to assume greater prominence in degree courses and the benefits must be clearly communicated to students, however we also need to explore how else such benefits might be derived for the student.

- **Accreditation can have a positive effect on employability.** Where STEM disciplines are subject to new or emerging systems of accreditation they may wish to derive learning and experience from the Engineering disciplines which tend to have more well-established accreditation frameworks and can provide examples of good practice for other disciplines going forward.
Findings 3

- Significant overlap of cross-cutting themes with Shadbolt Review of Computer Science graduate employability:
  - Value of **work experience**
  - **Soft skills/work readiness**
  - Graduates needing the ability to **learn and adapt** through their careers and importance, therefore, of **foundational knowledge** and **personal resilience**
  - **Difficulty of articulating employer demand** – employers want different things
  - Importance of **systematic and robust careers advice**
  - **Graduates need to take responsibility** for career planning and engagement
  - Significance of **horizon-scanning for future skills requirements** – Agri-tech as an example, but there may be others!
Implications for Staff, Universities and Education of new focus

• Issues of Principle
  – Is employment the same as employability?
  – Is employment a good measure of teaching quality?
  – Is employment outcome the only purpose of Universities?
  – Are Universities about education or training?
  – Is accreditation by a professional body valuable?

• Issues of Practice
  – What are the possible implications for institutions?
  – What are the implications for students?
  – What are the implications for staff?
  – How should employability be fitted into the STEM curriculum?
Principles

- **Is employment the same as employability?**
  - It is not of course but employment is more easily measured

- **Is employment a good measure of teaching quality?**
  - It is not of course but employment is more easily measured

- **Is employment outcome the only purpose of Universities?**
  - It is not the only purpose but it is a legitimate desire of government to expect that graduates produced by a system it supports in many ways are fit for employment in the economic activity of the country.

- **Are Universities about education or training?**
  - Universities must be about both. Certainly in the case of STEM there must be a balance between the training necessary to fit a graduate into the present demands of the workforce and an education in the fundamentals of Science that will enable the graduate to adapt to changing demands over a fifty-year working life time. A graduate will need to reinvent themselves many times.

- **Is accreditation by a professional body valuable?**
  - Empirical correlation shows where there is strong and clear accreditation by a professional body with practitioner participation, employment (arguably employability) is greater. This is not a causal connection but is strongly suggestive of value. It is often the only source of practitioner input to courses; it may be that other practitioner input could be equally valuable.
Implications for Academic Staff

1. Secure funding for research
2. Perform research that is internationally competitive
3. Publish research in the most highly rated journals
4. Secure and measure the impact of this research
   - On other research
   - On the economy
   - On the public
5. Deliver excellent teaching and feedback
6. Make sure your students learn and like you
7. Develop in your students their life and business-based skills
8. Make sure your students are employed or employable
9. Manage your group and Department
Institutional Implications

1. Educate for a lifetime of work
2. Curriculum Change
3. Different teaching and learning methods/modes
4. Careers service
5. Do all staff have to do everything?
6. Does a model work in which the total tasks are shared unequally?
7. How to handle differences of esteem and reward?
8. Real management of performance of all
9. Removal of failing staff must be possible
10. Far from the traditional model of University Staff
11. Will academia remain an attractive career?
Implications for students

• You are being educated and not just trained
• Take responsibility for your education
• Expect from your University some exposure to a real world experience
• Engage with the ‘concept’ of work and a career early on
• Recognise that learning requires your effort; it is not something done to you
• Expect Challenge intellectually, personally and emotionally
• Expect team-working across disciplines and deadlines
• Expect business professionals to be involved in your education
• Contribute to the assessment of your education
Implications for the curriculum/pedagogy
Employability, embedded or explicitly add-on?

• Embedded
  • Integration into the course structure using existing material
  • Acquisition of soft-skills by action learning, e.g.
    – Resilience
    – Timekeeping
    – Communication
    – Professional behaviour (ethics)
    – Teamworking
    – Placements
    – Projects
    – Work experience

• Business/Professional practice
Implications for the curriculum/pedagogy

Employability, embedded or explicitly add-on?

• Add-on
  • Extra material devoted to employability
    – Explicitly dedicated to acquisition of soft skills and badged as such
    – Communication
    – Professional behaviour (ethics)
    – Teamworking
    – CV-building
  • Led by specialists
  • Generic and common across disciplines
Employability, embedded or explicitly add-on?
Pros and Cons

• **Embedded**
  • Academic staff can contribute profoundly
  • Seamless and uses course material already extant
  • Integrate professional business staff into course
  • All employability skills can be integrated
  • Deep learning from practice and assessment possible
  • Students do not recognise their learning has occurred

• **Add-on**
  • Explicit course element provides accountability to students
  • Generic nature means it is efficient
  • Discipline specific Academic staff may not need to be engaged
  • Not all soft skills can be learned this way
  • Little business practice possible
  • Extension of contact time required
An engineering model

- Significant fraction of curriculum devoted to project work (40-50)% (extending and applying taught material) in every year
- Taught curriculum not to cover everything or to suit research specialisations of staff but a vehicle to self-learning later inside or outside of the discipline
- Mastery of course fundamentals built into assessment
- Projects always open ended with different size teams from 2 -12, (Possibly across disciplines) not always well-posed; a variety of communication methods used
- Multiple projects overlapping
- Some course elements have risk of failure and re-evaluation
- Industrial staff involved in design, delivery and assessment of several course aspects
- Large projects run as business activities with professional behaviour, timekeeping behaviour, leadership etc.
- Industrial placement of some kind whenever possible
- Peer assessment by students of their own performance
- Intensive accreditation process by a single body
- Demanding of staff and students but rewarding
Physics work experience: SEPnet exemplar

*Summary of survey of work experience offered on courses of 21 English Higher Education physics departments.*

<table>
<thead>
<tr>
<th>Type of work experience</th>
<th>Number of instances</th>
<th>% Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry placement on degree 6 – 12 months (undergraduate or postgraduate)</td>
<td>14</td>
<td>67%</td>
</tr>
<tr>
<td>Industrial projects (group or individual)</td>
<td>10</td>
<td>48%</td>
</tr>
<tr>
<td>Summer intern/placement scheme (inc. SEPnet)</td>
<td>10</td>
<td>48%</td>
</tr>
<tr>
<td>Research placement on degree 6 – 12 months (postgraduate)</td>
<td>3</td>
<td>14%</td>
</tr>
<tr>
<td>Physics in school module</td>
<td>3</td>
<td>14%</td>
</tr>
<tr>
<td>Physics/teaching degree</td>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td>Module with industry experience</td>
<td>2</td>
<td>10%</td>
</tr>
</tbody>
</table>
My conclusions

• Ensure curriculum contains the fundamentals of the STEM subject and their understanding
• Embedding employability into the curriculum is best
• Many engineering courses offer good models
• Strength of engineering accreditation is good but could be simpler (36 PEI’s?)
• Physical Sciences are making efforts (RSC especially)
• Biological/Environmental/Agri disciplines a long way to go