

A toolkit for setting up credit-bearing placements to improve the employability skills of STEM students

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Introduction

There is strong evidence that skills shortages exist in science, engineering and technology (SET) industries (CBI 2010). Almost half of STEM graduates 'choose to take up employment in what have been traditionally considered non-STEM areas' (House of Lords 2012). We need to encourage more STEM graduates to work in SET industries to ensure that talent is not wasted, to address skills shortages and benefit the wider economy.

STEM employers, especially SMEs, seek graduates with employability skills to hit the ground running and students need to recognise the value of work experience to develop employability skills in a competitive job market (CBI/NUS 2011). The evidence for work placements in developing students' employability skills is well-documented. Work experience can also raise awareness of a range of STEM careers but students on non-vocational courses, for example, mathematics are less likely to seek opportunities because their career destinations are not as clear. Students need to be made aware of the range of STEM options available within SMEs and different sectors. Embedding work experience opportunities within degree course programmes will increase the opportunity for students to develop employability skills.

94% of 2nd year mathematics students surveyed at Reading agreed work placements as part of graduate programme would be beneficial.

This is a toolkit based on the results of a pilot study carried out in a higher education mathematics department to assess the impact of different types of work placement formats on the development of undergraduates' employability skills. It provides practical tips, advice and suggestions for further reading to help STEM departments who are considering setting up credit-bearing placement schemes to improve the employability skills of STEM undergraduates.

What to consider when setting up a placement scheme – a checklist

- Who are the key staff who will need to know about the scheme?
- How will you engage with them and persuade them of the benefits of a placement scheme?
- What impact will implementing a placement scheme have on staff time?
- What types of placement are feasible and what are the pros and cons of different types, eg term time/holiday, 3-month, 1-year?
- What types of placement will fit with existing course programmes?
- What is current practice across the university and within other STEM departments in other universities?
- Are there policies in place in relation to Health and Safety and Intellectual Property when students are on placement? Where would you go for information and advice?
- How will you identify opportunities for placements and approach employers?
- What current employer links exist in the department and centrally and how can you make use of these?
- How will you engage students? Will you find placements for them or will you expect them to find their own? What are the pros and cons of each approach?

TIP: Carry out an audit of STEM academic departments across HEIs to find out what schemes are in place and share good practice. Your Careers & Placement Service may help with collecting this data.

Further reading:

A Student, Tutor and Employer Guide to Successful Work Placement, The Keynote Project (2002), Nottingham Trent University, www.keynote-project.co.uk

Effective Practice in Industrial Work Placement – A Physical Sciences Practice Guide (2009), Wallace, Murray and Overton

Investigating student perceptions of work and study placement opportunities, Part One Staff Perspectives (2011) University of Reading

Work Experience - an Employers guide. The AGR Briefing Paper Series (2008), H Smith

What do we mean by employability skills?

'Employability skills are a set of attributes, skills and knowledge that all labour market participants should possess to ensure they have the capability of being effective in the workplace.' CBI (2011)

In addition to the CBI definition indicating which skills are desired by employers, research shows that project management and leadership are also highly valued (Toland 2011). However, employers surveyed find graduates lack some of these transferable skills:

'Even when employers find STEM applicants with the right qualifications, many lack the workplace experience and employability skills necessary to succeed in a role. These skills – which include teamworking, customer awareness and communication – are rarely included in formal qualifications, yet are critical to an employees' ability to adapt to the changing demands of the workplace' CBI (2011)

'My experience is that undergraduates have a good level of functional knowledge, eg maths techniques, IT skills etc. It is in the areas of application and broader business skills that they lack knowledge.' SME STEM Employer

A defined set of employability skills:

1. **Self management** - readiness to accept responsibility, flexibility, time management, readiness to improve own performance.
2. **Team working** - respecting others, co-operating, negotiating/persuading, contributing to discussions.
3. **Business and customer awareness** - basic understanding of the key drivers for business success and the need to provide customer satisfaction.
4. **Problem solving** - analysing facts and circumstances and applying creative thinking to develop appropriate solutions.
5. **Communication and literacy** - application of literacy, ability to produce clear, structured written work and oral literacy, including listening and questioning.
6. **Application of numeracy** - manipulation of numbers, general mathematical awareness and its applications in practical contexts.
7. **Application of information technology** - basic IT skills, including familiarity with word processing, spreadsheets, file management and use of internet search engines.
8. **Project Management** - planning a programme of work, setting clear goals and objectives, managing resources and delivering the completed output.
9. **Leadership and Management Qualities** The ability to inspire people and the ability to effect change.

Further reading:

A Survey of STEM Workforce Development Needs and Opportunities in the London and South East Region, National HE STEM Programme - London & South East Regional Spoke (2011), L. Lyons

Building for Growth – Education and Skills Survey (2011), CBI

Developing Graduate Skills in HE Mathematics Programmes – Case studies of successful practice, National HE STEM Programme (2011), J Waldock

Higher Education in Science, Technology, Engineering and Mathematics (STEM) Subjects – Select Committee on Science and Technology (2012), House of Lords

Set for Growth: Business priorities for science engineering and technology (2010), CBI

The Graduate Market in 2012 (2012), High Fliers Research Ltd

The HE STEM Employability Skills Review, National HE STEM Programme, (2011), A Toland

Working towards your future: Making the most of your time in higher education (2011) CBI/NUSI

Identifying work placement formats

'Work experience' describes all types of work-based activity. A work placement provides hands-on experience, can be of any length and may or may not form part of a degree course. The terms placement and internship are often used interchangeably and can be paid or unpaid. An internship is more often used to describe an employer scheme (Prospects).

The table below sets out a range of work experience formats and the advantages and disadvantages of each type. Work shadowing and structured site visits have been included to broaden the range of work experience opportunities that employers offer.

Placement Type	Advantage	Disadvantage
1-year sandwich	<ul style="list-style-type: none"> • Offers opportunity for in-depth acquisition of skills and experience • Student is of real benefit to employer and employer may invest in training • Always paid • Evidence of increased student motivation and improved course work 	<ul style="list-style-type: none"> • Competitive entry to good internships • Lengthens degree course by 1 year • Difficult to re-adjust to student life • Students reluctant to leave peer group
Summer vacation work placement/internships (1-3 months)	<ul style="list-style-type: none"> • Offers a good opportunity to learn about an organisation and develop skills • Not necessary to extend degree course by 1 year • Often paid 	<ul style="list-style-type: none"> • Competitive entry to good internships so may not be possible to find one • SMEs may not offer paid placements • Difficult for placement officers to organise as students usually return to home towns • Placement quality can be variable • Travel costs may be prohibitive
Workplacement in Schools/ Term time (1-4 weeks)	<ul style="list-style-type: none"> • Can offer a good opportunity to learn about an organisation and develop some skills if well-structured • School placement as part of a scheme may be easier to embed in a course programme • School placement develops teaching and other skills • Not necessary to use vacation time 	<ul style="list-style-type: none"> • A large amount of time to free up in a crowded student timetable • Difficult to organise as employer may be reluctant to commit considerable resources with little benefit to them. • Need to find alternatives for students who can't find placements • Additional costs/resources needed to manage scheme
Work shadowing 1-2 days	<ul style="list-style-type: none"> • A well planned programme can offer insight into a role • Relatively easy to organise as not too onerous for employer • Can be fitted into student timetable easily 	<ul style="list-style-type: none"> • Limited opportunity to develop skills • Some types of organisation will not offer this option citing security issues etc
Structured site visit (group visit of 1 day)	<ul style="list-style-type: none"> • A well-planned programme offers insight into an organisation • Relatively easy to organise • Can be fitted into student timetable easily 	<ul style="list-style-type: none"> • Not suitable for some types of business • Limited opportunity to develop skills

Minimum requirements for a meaningful work placement

Identifying minimum requirements ensures that placement options used are developed within a professional framework. Part-time working and volunteering, while not placements, can offer a valuable opportunity to develop employability skills and should be promoted alongside any embedded work experience scheme. The following table recommends the responsibilities of the different stakeholders and provides a useful checklist.

Minimum Requirements	Work Based Learning Experience Format						
	One Year Sandwich Placement	Work Placement/ Internship	Part Time Jobs	Volunteering	Work Placement in School	Work Shadowing	Structured Site Visit
EMPLOYER responsibility							
Student mentor	•	•			•		
Work-based learning contact/line manager	•	•			•	•	•
Introduction to company, procedures and conditions	•	•	•	•	•	•	
Health and safety matters	•	•	•	•	•	•	•
Introduction to role, clearly defined work programme	•	•	•	•	•	•	
Specific technical training	•	•					
On-the-job training	•	•	•	•	•		
Employer review/appraisal/debrief with student	•	•			•		
STUDENT responsibility							
Research company	•	•	•	•	•	•	•
Reflect on employability skills pre/post experience	•	•	•	•	•	•	•
Attend and conduct themselves professionally	•	•	•	•	•	•	•
Keep in appropriate contact with tutor/contact	•	•			•	•	
Attend Health and Safety briefings as appropriate	•	•			•	•	•
HIGHER EDUCATION INSTITUTION responsibility							
Clear learning outcomes communicated to student and employer	•	•			•	•	•
Work-based learning tutor/contact provided	•	•			•	•	•
Student preparation and reflection on employability skills/transferable skills	•	•	•	•	•	•	•
Employer preparation	•	•			•	•	•
Underpin H&S issues	•	•			•	•	•
Procedures for termination of the contract	•	•			•	•	
Grievance/disciplinary procedure	•	•			•	•	•
Procedure for approving employers	•	•			•	•	•
Placement support for student and employer	•	•			•		
Opportunity for student and employer reflection/feedback post experience	•	•	•	•	•	•	•

Further reading:

A Good Practice Guide for Placement and Other Work-Based Learning Opportunities in Higher Education, Good Practice for Placements Guides, Volume 2, (2009), ASET

Code of Practice for the Assurance of Academic Quality and Standards in Higher Education: Section 9 Work Based and Placement Learning, (2007) QAA

Engaging with employers and students

Employers

Almost all of the UK's leading graduate employers offer internship programmes of varying duration, which are usually paid. Entry is often highly competitive but offer a good way into the company. Many major employers offer 'insight days' or one-day site visits.

SME employers may be more willing to arrange placements on an ad hoc basis. However, they are less likely to offer payment. You will need to ensure they have sufficient staff and resources to plan a placement role and take responsibility for supervising a student effectively.

Employers may not be aware of all the benefits that providing placements to undergraduates can offer and it is worth highlighting these. For example, evidence shows that undergraduates can bring energy, enthusiasm and a fresh pair of eyes to tackling workplace issues. Gather examples of where students have made a real contribution and provide evidence and testimonials, for example, as well as strong skills in numeracy and problem-solving, mathematics students can help with research projects, data gathering and inputting, IT, internal communications and general administration.

'Peter was able to give a great deal of assistance to our design engineer because there was some quite complex maths involved and he has a skill set which no one else in the company really has. This was really useful. We will definitely offer work experience again if there is suitable work. This was a bit of a one-off but we would have no hesitation in repeating it.' SME Engineering Company

List the business benefits in language employers understand:

- Publicity and marketing
 - be identified nationally as an organisation contributing to research in higher education
 - raise your profile at the University as a graduate recruiter
 - ongoing opportunities to put forward guest speakers and offer site visits
- Enhancing your workforce
 - cost effective help with delivery of projects and activities
 - access to the brightest students and potential applicants for future roles
 - opportunities to meet your diversity requirements
- Corporate Social Responsibility
 - contribute to your local community
 - help young people increase their chances of finding a job and develop skills including team working, communication and commercial awareness
 - contribute to addressing employability skills gaps and meeting employer needs

TIP: When targeting employers, widen the pool of employers who recruit STEM undergraduates eg utilities and SME engineering companies recruit mathematics graduates. Only 26.6% of graduate vacancies are with blue chip companies (Guardian 2.6.12).

Engaging employers and building up a database of placement-ready employers takes time. Placements are more likely to be successfully arranged if employers are clear what is expected of them and if their expectations match what the student is able to offer. Some employers have unrealistic expectations of students' skills. Request a task description and person specification for a placement role to ensure the requirement is clear from the outset.

Responsibilities and obligations need to be clearly stated, either in a contract of employment (which may be the employer's standard one) or a letter of agreement. This should include:

- Length of placement (agreed start and end dates) and hours
- Remuneration/expenses
- Supervision arrangements and tutor visits
- Induction/training
- Health and safety
- Intellectual property (**student and tutor can sign a non-disclosure agreement**).

Students

Provide students with a reality check and evidence so they are aware that a good degree is not enough to secure graduate employment. For example:

- Employability skills are first on the wish list when potential employers look for graduates to fill vacancies (Prospects)
- A recent survey of employers offering placements shows 69% of students on placements were offered graduate jobs (ASET)
- 'Students need to be career-savvy at university, college or even school if they are to compete for the top jobs', Gaenor Bagley, Head of HR, Price Waterhouse Cooper

Remind them that placements can offer a great opportunity to:

- gain insight and experience of relevant job sectors
- have something extra to put on your CV
- make industry contacts
- develop employability skills such as applied problem-solving, applied numeracy and IT
- increase your chances of getting a permanent job

They also enable you to:

- apply your academic knowledge to a real world situation
- try out a career or organisation or employment sector
- learn and practise new skills

Reasons why students are unsuccessful in finding placements:

- Lack of forward planning: students may adopt a 'one thing at a time' approach, concentrating on their academic studies and not thinking about their career until it becomes unavoidable.
- Lack of preparation: students who have not devoted time to compiling a good CV and practising skills in completing application forms and interview techniques are unlikely to be successful with placement applications
- Geographical: students seeking summer placements may find that the type of placement they would like is not available in their home area
- Financial: students may not be in a position to take unpaid placements
- Lack of contacts: students with contacts through family and friends are more likely to have access to placements
- Lack of confidence: some students may not apply for placements because they do not feel they have much chance of success.

'Start looking early. A lot more people in my year would have taken up placements if they'd been encouraged to do it earlier. Lots of people in my year are now wishing they had done placements.' Sandwich student

'I didn't apply for any work placements because they are so competitive and I didn't think I would get one so I was put off from applying.' 2nd year mathematics undergraduate

TIP: engage more students by:

- **organising structured site visits to local employers**
- **arranging for students returning from placements to give presentations about their experiences**
- **identifying a dedicated staff member as a point of contact and ensuring students are aware of the CV, interview preparation and placement advice they can get from their careers service**
- **combining placement support with preparation, self-reflection and skills awareness exercises to enhance value**
- **encouraging students to improve employability skills through other opportunities such as volunteering and paid jobs.**

'I would say to students that you'll regret it if you don't get some placement experience. In interviews I can give examples of situations I've dealt with. Otherwise I'd have to make things up which wouldn't be very convincing' Summer placement student

Which placement formats develop students' employability skills?

A survey of 17th year mathematics undergraduates who experienced a range of work experience formats, including part-time work and volunteering, were asked to rate their perception of the opportunity that each experience had to develop their employability skills. Results showed:

Students on sandwich placements perceived most benefit in the development of employability skills overall:

'I gained a lot of skills – team working, working independently, presentation and report writing. I learnt that experience counts as much as academic success, but I'm also more aware now of how my academic work can be applied to the real world - Sandwich student

'My skills have developed enormously. There is no comparison with where I was before. Also I learnt a lot about working within an organisation and not just for myself' - Sandwich student

In addition, one-year placements can motivate students with their studies in their final year:

'I was shocked to think how much of my course is actually relevant to the real world I hadn't thought of that before. Now I can see how it applies so I'm much more focused on my future'. Sandwich student

'I believe, and evidence from recently placed students on year-long placements backs this up, that undergraduates who have tasted the world of work can see the value of their studies – they can see it's for something. These students are highly motivated' - Mathematics tutor

However, all types of work experience were considered to offer opportunities to develop employability skills:

'All these experiences have given me different skills. I think you need to do as much as possible' - Student who has done several placements

'I'm more business savvy than I was. For example, I've got used to thinking about things in terms of how you can promote things to make a profit' – Student with part-time job

Students on structured site visits rated their development of entrepreneurship skills as high (possibly due to tasks set during the day which were designed to encourage creative thinking). Structured site visits and work shadowing opportunities were shown to be valued and to have a significant impact on career decision-making:

'It made me realise that I wouldn't really want to do that kind of work because it's more about problem solving than maths' – Student after site visit

'The work shadowing changed my plans in that, although I had it in mind before, I am now definitely thinking about a career in IT' – Student after work shadowing

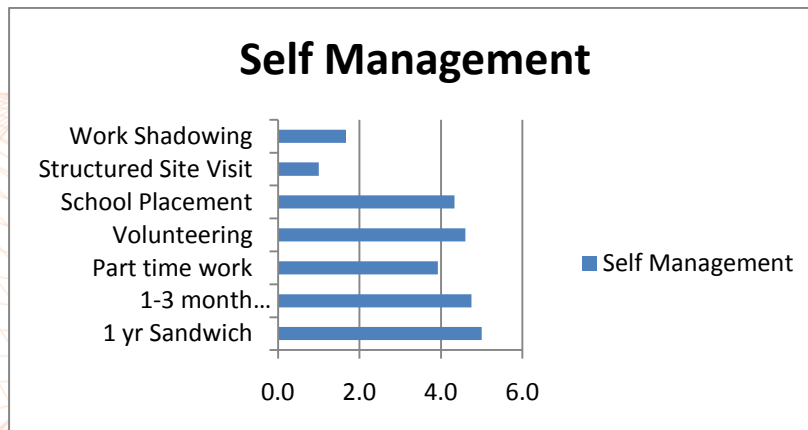
'The talk on career opportunities was most useful. Gave options on both summer internships and graduate schemes for future employment' – Student after site visit (considering applying for the graduate programme).

'I think more work shadowing opportunities would be good because you can find out a lot of information in a short time. We got a really good introduction to the company and a good idea of what a graduate job would be like' – Student after work shadowing

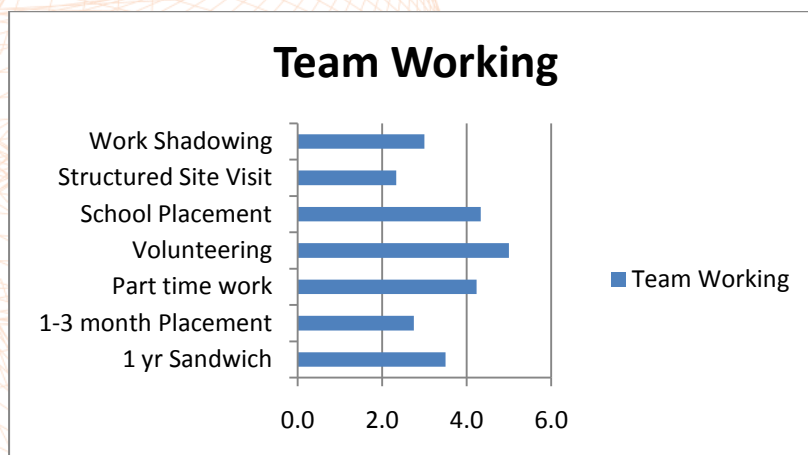
TIP: Consider the value of embedding structured site visits in degree course programmes for raising students' awareness of a range of career options. Visits should be tailored to students' STEM discipline and include a site tour, talks from diverse role models and group exercises. Target local employers to keep travel costs down and encourage students to take responsibility for making their own travel arrangements.

Which placement formats develop students' employability skills?

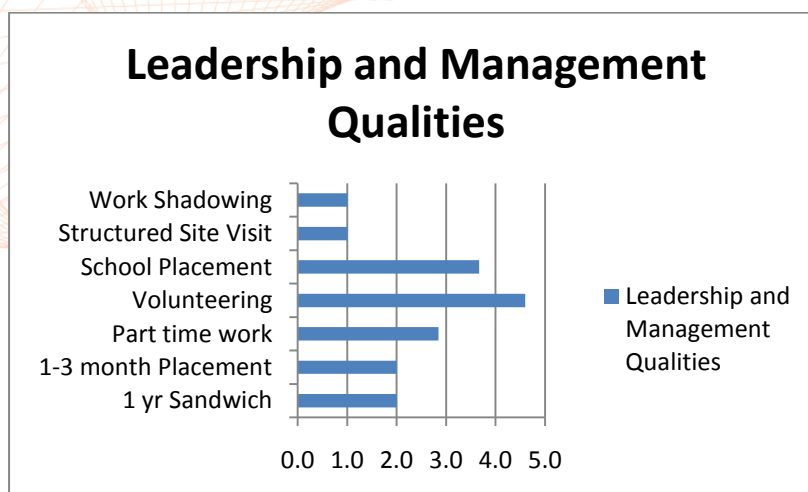
Students in volunteering roles reported high levels of development of self-management skills (some roles were shown to carry a reasonable amount of responsibility).



Students rated volunteering roles high for development of team-working skills (projects described were structured to emphasise team-working). Lower ratings for placement roles may be due to students being allocated specific projects to work on individually and therefore having less perception of being part of a team.



Leadership skills development was rated much higher by those in part-time jobs than those on placements (possibly because those in part-time jobs were often working at a supervisory level with considerable responsibility whereas those in placements were likely to be working at a junior level).



Assessing and accrediting work placements

What are the difficulties in assessing work placements?

- No two placements are the same. They are variable and inconsistent by their very nature.
- Each student will have a different experience and different learning opportunities
- The type and level of work will vary
- The duration of placements may differ
- The opportunity for application of degree subject will vary
- A placement takes place away from the university and therefore is not subject to the same degree of oversight as university-based activities.

What to consider when setting up an assessed work placement scheme:

- What are your objectives?
- What weighting do you want to give to applying academic knowledge versus improving employability skills?
- How will you agree and define the learning outcomes required?
- What are the advantages and disadvantages of different formats in terms of student and employer engagement and what will be the impact on the curriculum?
- Can you include more than one format as part of the course programme to meet the needs of different students and what would be the implications of offering more than one option?
- Whether students should be assessed formatively or summatively or both
- What staff resources and commitment you have to support an assessed scheme.

What to consider when setting up a credit-bearing placement scheme:

- Can student performance on work placement be assessed and marks awarded as part of a university degree classification? What are the implications if a student does not successfully complete his or her placement?
- Can students be awarded a separate certificate or diploma, against specific criteria, to recognise his or her achievement?
- Can the placement period be registered as a simple pass or fail or should students be apportioned a percentage of an overall mark towards the final degree classification?
- Can assessment of the learning which has occurred during a year-long placement period be embedded in a final year unit?
- Can work experience be offered as a complete or part module during term-time in the final year?

Finally, you will also need to consider:

- How the evidence would be collected and who would assesses it
- How the contribution of work-based/placement learning would fit with the overall aims and learning outcomes of the course
- How much the placement provider should be involved in assessment
- What impact failure or non-completion would have on re-assessment opportunities and on progression
- If the assessment of work-based/placement learning should be subject to the normal departmental procedures in respect of moderation and external examining
- If the work experience should be assessed as an integral part of the student's educational programme and what might be included
- How students would be assessed: reflective diary or log during/after placement, employer assessment report/appraisal, student self-assessment during and after placement, final report by student, presentation by student to peer group?
- What preparation and support students might need to complete a reflective diary or report
- What contingency plans should be put in place should an employer cancel a placement offer at the last minute.

Integrating credit-bearing placements into a degree programme

A range of placement models, accredited and unaccredited operate within STEM faculties. In many cases, and, in particular with vocational degrees, an industrial placement forms an integral part of a degree programme. Alternatively, in many degree programmes placements form an optional element which may or may not be assessed and credit-bearing.

An audit of 28 mathematics department undergraduate programmes, and review of other STEM departments, has identified the following formats as the most popular credit-bearing models:

One year sandwich

Many STEM departments offer a 4-year degree option to include one year in industry. Students may choose this option prior to starting their course or may decide to switch to a 4-year course during their studies.

Assessment of year-long placements ranges from pass/fail recognition to a requirement to produce a report, logbook and presentation which are accredited as part of the degree course. In some cases students who successfully complete a placement receive a diploma or certificate which recognises their year in industry.

Term-time module

A term-time accredited placement in schools in the final year of a degree courses as part of the University Ambassadors Scheme (UAS) is a popular alternative, or addition to, sandwich placements within STEM Departments. Its aims are to provide key transferable skills and teaching experience to undergraduate students. Some departments choose to accredit it as a separate module whilst others run it as an alternative final-year project. Students are assessed through a logbook, presentation and a report.

As well as offering students who participate a more consistent, measurable experience, the scheme provides the framework for a degree course module awarding academic credit to STEM undergraduates. Visit <http://www.uas.ac.uk>

Other placement schemes

An optional year abroad at the end of the 2nd year. The student spends a year studying mathematics at a partner university. Normally as part of the EU's Erasmus scheme. Courses taken while abroad may count towards the students' final transcripts. <http://www.britishcouncil.org/erasmus-about-erasmus.htm>

A placement year entrepreneurship scheme - a credit-bearing module which is assessed by work-based learning and counts towards the final degree mark. See <http://www.shu.ac.uk/employability/pyes.html>

Summer internships through STOR-i - one of the national Doctoral Training Centres. Internships are eight-week long positions. Students produce a report and poster but internships are not credit-bearing. See <http://www.stor-i.lancs.ac.uk/intern/detail>

Summer studentships and placements over periods from 2 to 8 weeks with external employers or helping with research projects, some funded by EPSRC, Wellcome and Nuffield vacation bursary schemes and not credit-bearing. See:

<http://www.epsrc.ac.uk/funding/students/Pages/vacationbursaries.aspx>

http://www.ucl.ac.uk/prospective-students/scholarships/undergraduate/wellcome_vac_schol

<http://www.nuffieldfoundation.org/undergraduate-research-bursaries-0>

Conclusion

With graduate employability high on the agenda, universities are under increasing pressure to produce graduates with the skills and experience that industry needs. There is considerable evidence to suggest that work experience can improve undergraduates' employability as well as their success rate in their studies and early career destinations. Aston University states that over a third of students on placements across all degree courses are offered graduate jobs by their placement employer and students who take a placement year consistently get higher results in their degrees. Kingston University claims 81% of placement students (compared to 34% of non-placement students) got a first or 2.1 in the Faculty of Science, Engineering and Computing in 2008. A recent report written by Brunel University's Placement and Careers Centre found that graduates who have undertaken a professional placement will, on average, find employment more rapidly and earn a higher starting salary than their peers from 3-year courses.

As early as in 1997, Harvey, Moon, Geall & Bower in their report 'Graduates' Work: Organisational Change and Student Attributes' stated:

'If there were to be a single recommendation to come from our research, it would be to encourage all undergraduate programmes to offer students an option of a yearlong work placement...'

More recently, a report commissioned by HEFCE and published in 2011 found that:

'there appears to be evidence, clearest for sandwich placements, that a benefit of structured work experience is improved employment outcomes after graduation'.

While embedding well-structured placement schemes into undergraduate programmes should help to increase the number of students who engage with employers and develop employability skills, it will also lead to pressure to develop more creative work experience opportunities as larger numbers of students compete for placements. Site visits and work-shadowing may offer alternative options as well as work experience opportunities with SMEs and other non-traditional graduate employers.

Credit-bearing placements offer additional challenges in ensuring the work-based learning is appropriate and assessment methods are rigorous enough to fit within academic course programmes. However, a scheme which assesses student performance on work placement and awards marks as part of a university degree classification should enhance the value and quality of the experience and contribute towards its sustainability.