The Higher Education Academy
Physical Sciences Centre

Effective Practice in Industrial Work Placement
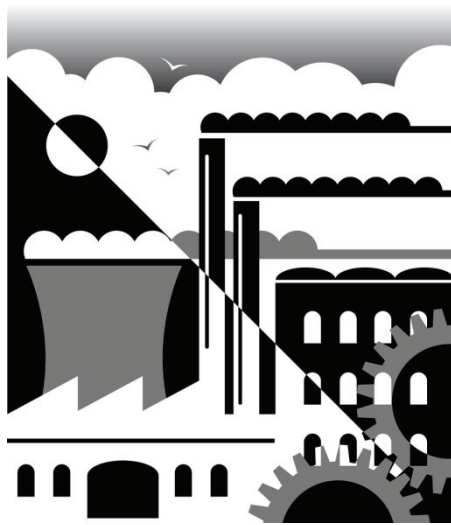
A Physical Sciences Practice Guide

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Effective Practice in Industrial Work Placement

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Contents

The appendices contain specific examples from Universities for operation within the context of their system, and are not necessarily of general applicability without adaptation.

Acknowledgements

Summary

Best Practice in Industrial Work Placements

The one-year industrial placement, integrated as closely as possible with the overall student programme, incorporating all the day-to-day and medium term pressures of the work culture, represents the best practice in work experience that can be offered to students. The assessment of the work experience should incorporate the expertise of the collaborating company.

Significantly shorter periods, or those devoted solely to project work, will not allow students to develop the full range of skills appropriate to the industrial context. However, novel approaches to collaboration with industry and efforts to simulate some aspects of the world of work should be encouraged.

Finding the Placement
A departmental system in which an industrial training tutor makes initial contact with industry, and maintains a co-ordinating role, will provide the best service to students and companies, and will encourage a partnership approach to the placement. A timetable should be given to all the students concerned.

The Partnership - Company, University, Student
A successful partnership will develop if there is a clear basis in terms of statements of responsibilities, set out in a handbook, sectionalised for student, visiting tutor and industrial supervisor. Prompt attention to approaches from industry by the industrial training tutor and a continuance of this liaison by the visiting tutor will encourage the partnership to thrive.

Preparing the Student
Students need to be informed of the benefits of work placements, the time-scale and methods of application. Courses on writing CVs, application forms and interview techniques are important. An informative handbook should be prepared to guide students through the process. Presentations about industry, by industrialists or students returning from industry, should be encouraged.

Maintaining Contact with the Student - Pastoral care
Students should be provided with adequate information, and encouraged, to contact the University to discuss problems and successes. A climate of open discussion between industry, student and University will allow a profitable placement to be established. At least two visits for face-to-face discussions should occur. Students should be provided with contact details of their group, and be encouraged to use a VLE or social networking site to share support with their peers and to share experiences.

Skills Development and Assessment
Students will gain most benefit from the placement if formal assessment, or appraisal procedures are in place, and these emphasise the continuous development of skills. Students need to be conscious of their development and to be encouraged to assess their own progress. Personal development planning (PDP) that students may have engaged in during their academic study becomes much more meaningful when students are in industry.

Project Work in Industry
Some part, but not all, of the time of students who are on M level (MChem, MPhys, MSci) courses should be devoted to project work; i.e. an independent study in which the individual student has scope for planning and executing research.

Academic Studies in Industry
Students on MChem, MPhys and MSci should demonstrate their ability to study new academic material in their own time in addition to their commitment to their placement position. Universities should provide distance-learning material for this purpose which would usually be assessed and contribute to the 120 credits earned for the year in industry.

The Industrial Training Reports
Every work placement should be completed by a detailed report which gives the reader background information about the company, the position of the trainee in the organisation and some idea of the day-to-day work of the student. Students may also be asked to complete PDP or a reflective log. Any project work should also be written up in a professional way.

De-briefing and Reflection
A formal debriefing session, of which a written record is kept, should be held. The student should also complete a questionnaire before the debriefing. A session at the University bringing together students to share experiences, is to be welcomed.

Peer Teaching - passing on the experience
A formal presentation by students returning from industry to those who are about to make the decision whether or not to apply for a placement position, is the best means of informing students of the benefits of work experience.

International Placements
International placements add an extra dimension to that of other work placements, even beyond the language proficiency gained. The additional effort involved in setting up and organising such placements is worthwhile for the benefits to students and the contacts made.

Introduction

The benefits to students of undertaking a work placement have been well documented. Bowes and Harvey[1] found higher employment rates amongst chemistry and physics graduates from programmes with a work placement compared to those from programmes without such opportunities. Wallace[2] found that students who had undertaken a placement programme also were more likely to achieve a first or upper second class degree than their non-placement counterparts.

In their in depth study *Graduates' Work: Organisational Change and Student Attributes*[3], Harvey, Moon, Geall and Bower state:

Respondents overwhelmingly endorsed work-based placements as a means of helping students develop attributes that would help them to be successful at work. A work-based placement not only helps to develop specific 'work-related' skills but also provides a foretaste of workplace culture and thus helps graduates to be effective more quickly. To be a worthwhile experience for both student and employing organisation, the placement should ideally be for an academic year during the course of the programme. 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 and employers to be less reluctant to provide placement opportunities.

University science departments, and Chemistry departments in particular, are well placed in that many have strong relationships with industry for research and/or placement opportunities. The practice of work placement is widespread and provides an incentive to potential students, since such courses provide an experience that will benefit them in their future careers. The sharing of effective practice is therefore essential and should enable departments to achieve the more difficult aspects of a placement that are highlighted by Harvey et al:

Personal and interactive skills should be explicitly developed as an integral part of the programme of study and they should be included as part of the assessment of student achievement. It may be appropriate to use the expertise of employers to develop ways of assessing these skills.

Opportunities for work experience should be developed so that students can become acquainted with work place culture and develop higher-level academic abilities in a work setting. Overall, employers benefit from providing work-place learning opportunities and should continue to be encouraged to become more involved.

Indeed the greater the opportunities that individual Departments can provide takes us closer to the objective spelt out by CIHE[4]:

Most British people, most educators and most students now believe that it is one of higher education's purposes to prepare students well for working-life.

The Royal Society of Chemistry has endorsed the practice of work placements as an integral part of enhanced courses, and in its document *Enhanced First Degree Courses in Chemistry (MChem/MSci)*[5] states:

The value of industrial placements is widely recognised and such provision should be provided in some enhanced courses.

Where an extended period(s) of industrial placement is an integral part of an MChem course replacing a period of academic study:

The placement should provide an educational experience of a standard appropriate to an enhanced course. It should provide an appropriate level of challenge which should be reflected in it contributing significantly to the classification of the award. Some of the theoretical studies which students on full-time MChem courses would complete in the University should be completed by students on the sandwich variant by means of distance learning augmented by short residential courses. The University should maintain substantial contact with the student during the placement.

The substantial project required for MChem courses might often be completed during the placement.

The placement should further develop students' experience in the applications of chemistry and help to develop their professional skills.

The challenges of such placements in the context of MChem courses are likely to be such that both the number of suitable placements and of students capable of filling them will be limited.

The purpose of this report is to highlight the variety of work experiences undertaken and to share effective practice.

The Traditional Work Placement

The traditional approach is the one referred to as ideal by Harvey et al; the one-year placement integrated into the academic programme.

Many Universities have been running such programmes for 30 years or more. In the regulations governing the year in Industry, it is important that the actual time scale be defined. Frequently this is 48 weeks, although the student will have earned holiday as part of this time, but can be much shorter, say 36 weeks but still occupy the 'academic' year. Occasionally the successful student will have the time extended, working from early summer one year to late summer the next, and so be able to introduce the next trainee to the job.

From simple beginnings, this has been developed by many Universities into a carefully monitored experience in which students are assessed, their assessment contributing 120 credits to an M level programme. In other Universities and in many BSc programmes the experience, although valued by all parties, is not assessed.

The year out is almost universally the third and so penultimate year of the course, i.e. a genuine 'sandwich' experience. However, the final year of a four year course has been used and this is discussed in the next section.

Fields of Work available to Physical Sciences Students

Students are placed in a wide range of industries but invariably associated with science or the application of science. It would be rare for a student to be placed in, for example, the marketing section of a company. The science community has been able to maintain a very rigid view on what is considered acceptable experience. Having said this, there is a wide range of opportunities for the applicants for work experience. These include

- Quality Control work
- Analytical development work
- Operation of state-of-the-art equipment
- Research in any branch of science
- Pilot plant work
- Design
- Full scale plant work, involving shift work
- Technical sales and customer contacts
- Taking a product from design to production scale
- Information Technology
- Material science
- Nuclear technology
- Computers – software and hardware developments

The quality and quantity of placements available is very dependent on the current industrial climate, and any one of many factors that can affect the chemical and allied industries. Industrial restructuring may give rise to redundancies, when the employment of placement students will be out of the question. Exchange rates can allow multinational companies to concentrate effort in one country rather than another. Board decisions can switch research from one country to another. The industrial training tutor is at the mercy of all of these factors.

Novel ways of achieving Work-like Experience

If a work placement is not used, it is possible to develop courses that give students an insight into the skills required by industry. Particularly effective are Team Development courses which industry or management organisations may provide for selected Universities. These tend to very intensive courses, generally lasting a few days, led by specially trained tutors and involving outdoor activities. They are generally recognised by industry and are welcomed by students, but some academic staff are sceptical and resent the time 'lost' on such courses. Without industrial sponsorship, such courses could be prohibitively expensive.

In addition to direct physical team building, these courses might typically involve lectures on management styles, accountancy, science policy, personal and IT skills. Increasingly Universities are recognising the importance of broadening the education that is offered to include professional skills, i.e. preparation of the student for the workplace.

Another approach that simulates the work environment is to offer modules in which teams of students carry out real tasks in a business-like fashion. An example of such an initiative is one in which students undertake the manufacture of soap and the redistillation of solvents. These efforts were carried out commercially with the soap being sold to the University and the purified solvents re-used in the laboratories. Business plans were written, accounts kept, research, development and marketing achieved.

Collaboration with local industry has been explored to give students a period of several days working on plant to experience the pressures of manufacturing in a very real context.

Best Practice

The one-year industrial placement, integrated as closely as possible with the overall student programme, incorporating all the day-to-day and medium term pressures of the work culture, represents the best practice that can be offered to students.

Significantly shorter periods, or those devoted solely to project work, will not allow students to develop the full range of skills appropriate to the industrial context. However, novel approaches to collaboration with industry and efforts to simulate some aspects of the world of work should be encouraged.

Finding the Placement

Practices vary across the sector, from the carefully controlled with a co-ordinating officer within the Department, to a system requiring students to find their own placements. Whilst the latter will quickly bring home to students the importance of proper application, such students are likely to be seriously disadvantaged as so many Universities have established Departmental links with company personnel officers or other staff designated with responsibility for selecting trainees. Most Departments will insist that if a student accepts a placement then that decision is final; companies rely on this in their planning. If students apply as individuals, they may hold more than one offer, taking their time to choose what they consider the best. Whilst this is a very desirable situation in selecting a career position, it is not likely to be acceptable to companies and consequently not generate the partnership with the Department that is desirable.

A typical Departmental system would inform students of the nature of placements (see below - Preparing the Student) and collect CVs. This process would begin about a year before the student was likely to enter industry. All information about potential industrial trainees would need to be in the hands of the Departmental industrial training tutor/officer at the start of the students' second year if they were to be spending their third year in industry.

Departments will enforce their own internal selection procedures if they consider that only appropriate and motivated students should be allowed the privilege of a placement. This can itself provide a motivating influence throughout the first year of a course. A Departmental reference based on a student's first year performance will carry much weight. Similarly, the proven 'best' students might be offered to the 'best' companies.

Contact between Company and University happens at the start of (or sometimes well before!) the academic year. Details of the placement are brought to the attention of students who will indicate their willingness to apply. This may be done company by company, as contact is made between partners, or if there is a guaranteed list of participating companies then students can make their preferred selections from the complete list. Information (CV, Application form, covering letter, reference etc.) about the students is sent centrally from the Department to the company, who will make its decision about who to interview. Interviews are competitive, not only within those applying from a given University, but also across the sector. Interviews may take place at either site dependent on whether companies like to visit and perhaps talk to a wider audience about company products, research, prospects and general policy and mission.

Time scales can vary widely but most UK placements are decided before Easter, with the placement starting in the summer. This is ideal for company forward planning and the peace of mind of the student.

A plan for the year (see Appendix 1) can help staff and student keep up-to-date with all the necessary procedures.

Best Practice

A departmental system in which an industrial training tutor makes initial contact with industry, and maintains a co-ordinating role, will provide the best service to students and companies, and will encourage a partnership approach to the placement. A timetable should be given to all the students concerned.

The Partnership - Company, University, Student

Each of the three has a key role to play in a successful placement. In the past, effective practice with a particular industry would have grown over the years, along with a clear understanding of what was expected from each. However, nowadays it is perhaps important and almost a legal requirement, to commit certain obligations to paper, usually as part of a handbook informing all parties. This is particularly important with respect to safety and the responsibility towards the students' safe working practice. If the student (or their LEA) is paying fees to the University then the University retains obligations with respect to the student's safety, and this needs to be clarified with the company.

The student will become an employee of the company and as such will be required to sign a contract. This will give many in-house benefits (induction, training, access to library, computers etc. access to sports facilities etc.) but also the responsibilities and demands of industrial life. This includes the non-disclosure of any information the company decides is secret, as well as dismissal for violation of company rules, particularly those regarding safety, which may be very stringent in certain industries. The University authorities, and particularly visiting staff, may be required to sign such secrecy agreements as required by the company. Such legal requirements must be clearly understood and it is from this basis that a co-operative partnership can develop.

The student must understand their first duty is to the firm and to whoever is their line manager. At the beginning of the placement the student needs to know exactly what is expected of him/her and should take some time over a number of points which will allow the work experience to get off to the proper start. These are best stated as a series of directives to the student:

- ensure you understand your specific objectives and work programme
- understand your line manager's role
- know who your day-to-day supervisor is, and to whom to go for advice if your supervisor is not available
- ask to have information reconfirmed if you are not sure
- define your boundaries and responsibilities with your supervisor
- make sure you understand how your performance will be assessed
- clarify if you are expected to work overtime
- familiarise yourself with GLP, GMP, COSHH and Standard Operating Procedures; failure to adhere to these strict guidelines will probably invalidate anything that you do
- be frank about the errors in your work; think about the accuracy, reliability and significance of your results

Certain responsibilities fall on the industrial supervisor. In a good working partnership these will be acceptable.

- helping the student to be aware of the goals, expectations and job description for the work placement
- liaising with the Department and reporting immediately on any major problem (poor timekeeping, unsatisfactory work, sickness etc.)
- aiding the student in forming a learning plan which will help the formative and summative assessments
- meeting regularly with the student
- participating in visits by the academic tutor
- completing forms to aid in the assessment of the student

The partnership for a given placement will then be maintained by the personalities, attitudes and commitment of the three individuals; the student, the academic (visiting) tutor and the industrial supervisor. Contacts between these are discussed below.

In the longer term, the Departmental industrial tutor/officer will have overall responsibility for maintaining a good relationship with the company. This will allow forward planning to occur and the reviewing of the partnership, which may well develop in many ways, such as prizes for students, sponsorship, ideas and support for projects in the University and research collaboration.

Students need to be clear that a relationship of value to students, which has taken several years to build, can be destroyed by the actions of just one thoughtless student.

Best Practice

A successful partnership will develop if there is a clear basis in terms of statements of responsibilities, set out in a handbook, sectionalised for student, visiting tutor and industrial supervisor. Prompt attention to approaches from industry by the industrial training tutor and a continuance of this liaison by the visiting tutor will encourage the partnership to thrive.

Preparing the Student

The student should be made to realise that being an industrial chemist is more than just having a strong knowledge base of the subject matter. Invariably there will be the opportunities to communicate knowledge in a variety of different ways; to use that knowledge to solve problems; to manipulate and manage knowledge in new circumstances to generate ideas.

What this means is that the students need to develop or refine a number of skills so that they are prepared for the industrial context.

There will be specific aspects of particular courses that will prepare students for particular industries. In addition, the more practical work that a student has completed, the more beneficial this will be, particularly if this has involved group work and/or detailed planning by the student(s) of their work. Case studies, open-ended practicals or project work will allow a more smooth transition into industrial laboratories.

Many courses stress the importance of skills, such as communication (in the form of presentations, report writing etc.), library skills, and IT skills. All of these will give students the confidence to make real and proper contributions in industry and will consequently reflect well on the training given by the University.

Every author presents their own variation on the list of skills and here is a selective list:

- communication
- numeracy
- use of information technology
- learning to learn
- group working
- time management

We would expect students to require the skills of **time management** more in industry than at University. Here are a few thoughts about time management which may be usefully given to students and which can explored further through the many books and videos on the subject.

- Start by analysing how you spend your time.
- Do you waste time, or do other people waste your time?
- Are there periods when you are not achieving anything? Is this your fault or others?
- Set goals – long-, medium- and short-term.
- Have a daily "to do" list.
- Prioritise this list, but do items from the low priority as well as high, otherwise eventually all jobs become stressful high priority ones.
- Get quick jobs done – some things take as long to make a note of as they do to complete!
- Don't be discouraged that you will have to carry jobs on to the next day's list.
- Plan your time to do the most difficult jobs when you are at your best.
- Delegate if you can (but you can't delegate your studying!).
- Have a place to study where you can get down to work quickly.
- Break large jobs down into manageable amounts.
- Have a balanced life!

It is significant that representatives of industry continue to refer to the lack of these core skills in the graduates that they employ. This, in itself, justifies the need to use some course time to practice some of the relevant skills. We do recommend to students that they develop their own on-going portfolio of evidence to show that they have achieved a certain level in these skills during their work placement. Ideally, this should be part of their on-going Personal Development Plans or e-portfolio.

Such a portfolio is part of professional development and is a way that the student can become empowered in the world of work. The CV will contain a summary of this information but it is very impressive to have the evidence to hand.

The Careers Advisory Services at Universities produce much useful material reflecting the needs of industry, either individually, or as members of **AGCAS, Association of Graduate Careers Advisory Services.** The AGCAS booklets and information sheets are published by the Higher Education Careers Services Unit, whose web site is <www.prospects.csu.ac.uk>.

There are a number of web sites that encourage students to reflect on their own experience and engage with PDP. A summary of these can be found in the following publications: <www.heacademy.ac.uk/assets/ps/documents/toolkits/toolkits/pdp_2009.pdf>

The work that students perform at this formative stage should be regarded as a starting point for developing higher skills. The Association of Graduate Recruiters have produced a report **'Skills for Graduates in the 21st Century'** in which they state:

In the 21st century the most significant challenge for graduates will be to manage their relationship with work and with learning. This requires skills such as negotiation, action planning and networking, added to qualities like self-awareness and confidence. These are the skills required to be self-reliant in career and personal development, skills to manage processes rather than functional skills.

We think the process to achieving this self-reliance begins with a period of industrial training.

More specifically, for getting the job, students will need to be told about the methods of application. For this purpose, many Departments will seek the collaboration of Careers Services within the University. There are current expectations (fashions!) for a CV. A conventional chronological approach may not be what a firm is looking for. An emphasis on skills may make the writer much more worthy of interview. Application letters must be of a high standard, and many application forms seek information that requires careful thought on the part of the student.

There are basic (common sense?) rules for an interview; videos, either commercial or of willing volunteers from the cohort, can be valuable in making those rules clear. Role-playing, in which students are placed in the position of selecting just one from several applications, brings home the importance of a carefully prepared and thought out application. Such an application is a task that will take several days to complete.

Practice at interviews is important; the student needs to know if they will be subject to a rigorous technical interview, or perhaps to psychological tests. Knowledge of the company is essential and this can be gained from web sites, company literature, obtained direct from the company or from the Careers Service files, and, most importantly, by talking to students who have spent placements at the company.

Students must be prepared for obvious questions and have their own questions ready to ask, if invited. They should be advised to act naturally, to think about questions and to ask for clarification if necessary, to talk freely, be positive but honest about experience and knowledge. There will be questions they cannot answer and they should try not to be flustered by this, nor indeed attempt to bluff their way through an interview. Dress sense is important - the interviewer will like to think that the interviewee has taken some trouble to prepare themselves physically as well as mentally for the interview. It is not an opportunity to display extreme fashions - anticipate prejudices in the interviewer!

It is likely that a student will have several interviews in order to obtain a position. Hence, the support of the student's tutors, an analysis of what can be improved and some feedback from the company can help to maintain student motivation for what could otherwise be a demoralising process.

The greater the exposure to industry's way of thinking, the more prepared a student will be. Thus, visits and lectures by industrialists, as part of a defined module or as general presentations, will inform students and begin the process of familiarity with the nature of jobs available and how the individual might begin to see their career start.

The Higher Education Academy has published an Employability Resource pack which consists of a collection of activities for undergraduates which will help them prepare for obtaining employment – or a suitable work placement: <www.heacademy.ac.uk/physsci/home/pedagogicthemes/employability>

The Handbook

A handbook should spell out the benefits of industrial placements. In this form, students can take their time to absorb the information and make their decision. Some of the benefits may seem obvious, but need to be listed for students in the following way:

- you will learn how an organisation operates
- you will use state-of-the-art technology
- you will acquire the interpersonal skills to be effective as part of a team
- you will gain experience of a real working environment
- you will apply theory to practice
- you will see the relevance of your own work in an industrial or commercial context
- a part of your degree will be taught and assessed by industrial scientists
- the process of securing a placement position will provide good experience for career job applications
- you will be assisted in making career choices by your placement experience
- the placement will provide a real environment to enhance your transferable skills
- you may be offered a permanent job by the placement company
- your maturity and motivation will be increased and this may reflect on your effort in the final year and hence your degree classification
- you will be helping in forging links between the company and your University.

Such bullet point summaries will highlight the real advantages of the industrial year to the student.

A checklist for students (see Appendix 2) will enable them to complete the necessary stages on time. It is important, having said all this, that student and position are matched. It is not only the type of work (research, quality control etc.) and the type of industry, but also the geographical location (and associated expense) and salary (although hopefully this would be secondary to obtaining the right experience!) that have to be considered. Some jobs involve shift work with tightly controlled working hours, whereas others will be on flexi-time. Some may provide excellent experience of industrial plant or technical support for sales staff but be quite unsuitable as part of an M level degree, since no aspect could be interpreted as equivalent to a project in the academic sense.

A simple form requiring students to express their wishes is useful at an early stage, both for the industrial tutor/officer's forward planning, and to focus the student's mind on what they really want from the placement.

Having secured a placement there is advice to be given to students to assist the transition to industry

- find out about any pre-placement requirements (health checks, which may involve checks for the use of drugs, reading lists etc.)
- check payment details (provide bank details if required)
- check accommodation arrangements
- check travel arrangements
- check whether a CRB check is required
- check any language arrangements if you are going abroad
- be clear on how you will be assessed
- identify your own objectives for what you want to achieve in the year.

Best Practice

Students need to be informed of the benefits of work placements, the time-scale and methods of application. Courses on writing CVs, application forms and interview techniques are important. An informative handbook should be prepared to guide students through the process. Presentations about industry, by industrialists or students returning from industry, should be encouraged.

Maintaining Contact with the Student - Pastoral care

Multitudes of practices can be put in place to support the student. It is imperative that students are not simply left to fend for themselves. Should anything go wrong, there must be an immediate point of contact with the University in order for the problem to be solved. Many issues that arise only become problems when left to develop unattended. A swift resolution of minor matters will perhaps not even be recalled when the analysis of the year is undertaken.

Some recommended practices are:

- a list of telephone numbers, e-mail addresses of key University staff (Industrial Tutor, Visiting Tutor, Personal tutor, Year Tutor, Departmental Secretary)
- a handbook that spells out the purpose of the placement year and the responsibilities of the partners involved
- approximate dates for the Visiting Tutor to carry out on site discussions with all relevant partners
- emails, sent at stages through the year, setting out tasks for the student - such as the planning of the report, selection of modules for the following year etc.
- contact email addresses for the placement group of students or an online forum/social networking site to allow the cohort to keep in touch during the year

A good way of establishing contact between the cohort of students in their various locations is for every student to write a short contribution for a forum/discussion board on an work placement area on the VLE. Topics could be social life, work being undertaken, the geographical area, special non-technical courses etc. Students should always be on the lookout for good ideas that can be used by their own University. The sharing of effcetive practice can be undertaken at all levels.

Students should be clear as to the purpose of the visits by tutors and be given copies of the assessment forms that are used. Whether or not they should see the completed forms is a matter for discussion between visiting tutor and industrial supervisor. Certainly some feedback must be given and if there is reason for criticism or censure, then both tutor and supervisor should be involved. A memo to the student detailing the problem and the way to overcome or correct the situation is necessary. If the student's performance or behaviour does become worse then a proper procedure must have been used and documented, since situations that ultimately end in dismissal will have ramifications for the student's degree programme. The company may not wish to use the system they have for permanent staff but should be encouraged to do so. The system should also be used to gauge whether the student is being presented with a worthwhile learning experience and that they are being treated well This should be a three-way discussion.

Visiting staff should be provided with a checklist to ensure they cover all the relevant points in their visits (See Appendix 3). Every visit should involve time alone with the student and with the supervisor. A prime aim is to check that both parties are benefiting and that the student is in a genuine learning situation. Some fundamental points that a visiting tutor should address are:

- knowing the student and their academic background - being able to answer questions on performance in recent examinations
- helping clarifying goals for the student - discussing the job description
- dealing rapidly with any problems that arise at the visit or other times
- looking at the working accommodation of the student
- showing the student the assessment forms that will be used
- reviewing the student's progress
- discussing a format for the report and deadlines for submission of any work to the University
- reporting on every visit, documenting any action
- completing all assessment forms

Best Practice

Students should be provided with adequate information, and encouraged to contact the University to discuss problems and successes. A climate of open discussion between industry, student and University will allow a profitable placement to be established. At least two visits for face-to-face discussions should occur. Students should be provided with contact details of their group and be encouraged to keep in touch via an area on the VLE or via social networking sites.

Skills Development and Assessment in Industry

The student's progress needs to be monitored regularly throughout the placement. A minimum arrangement might involve an initial visit in which the training arrangements for the student are discussed and an initial assessment of how well the student has settled in is made, and a final visit to make an overall assessment of performance and to consider the report written by the student. If a mark is recorded this may be largely based on the quality of the report.

However, those minimum arrangements have been superseded in many Universities by a much more sophisticated approach. This will involve

- a listing of the skills that the student should be conscious of developing through the placement period
- forms which will allow for the assessment of the skills (see Appendix 4)
- an involvement with the company's appraisal scheme
- frequent contact using e-mail and telephone to emphasise the continuous nature of the development process
- oral presentations at the company and on returning to University
- encouraging self-evaluation by students, alone and alongside their peers
- encouraging students to maintain a skills log/e-portfolio/PDP
- encouraging students to collect evidence of their achievements
- allowing students to add to the list of skills, thus allowing for the individuality of the placement

Best Practice

Students will gain most benefit from the placement if formal assessment, or appraisal procedures are in place, and these emphasise the continuous development of skills. Students need to be conscious of their development and to be encouraged to assess their own progress. A series of forms (see Appendix 4) for such assessment can be used to focus attention on these issues.

Project Work in Industry

The nature of project work carried out in industry can vary widely as illustrated by the following examples:

1. The student may undertake a traditional independent project on an area of research relevant to the company. Technical targets will be set at regular review meetings based on progress made.

2. The student joins a team working on the day-to-day technical problems of internal or external customers. The student would be expected to have their own targets and deadlines but will contribute to the output of the group. Skills such as team working, communication, initiative and time management will be very important. If the project is contributing to a M level degree, the University must ensure that there is a rigorous enough academic content and range of practical experience.

3. A combination of the above two examples may provide the student with team objectives as well as an assigned independent project. This may be a preferred arrangement in that it allows the student to be assessed over a wide range of competencies and to develop a balanced skills portfolio.

Best Practice

Some part, but not all, of the time of students who are on enhanced courses should be devoted to project work - i.e. an independent study in which the individual student has scope for planning and executing research.

Academic Studies in Industry

In a placement that forms part of a BSc degree it would be expected that a student becomes familiar with the background theory of any techniques or specific apparatus being used. This would be achieved by reading, requested by the student, and directed by the industrial supervisor. In addition, it is common practice to provide students with a reading list to prepare them for their return to study at University. This will usually be of a review nature, rather than anticipating the final year topics. Students benefit more from a revision of fundamentals at this stage.

However, if the placement is one of the four years contributing to an MChem/MPhys/MSci degree, then some additional academic work is required by most Universities. Students will earn 120 credits from their year in industry. If this is to make its proper pro-rata contribution to the class of the degree then some academic work should be included and assessed and so become part of the student's portfolio of achievements for the year. This can best be accomplished by converting existing modules to distance-learning format. Assessment can be novel or conventional and ideally, the student should have the support of a period of face-to-face tutorials.

Best Practice

Students on BSc degrees should be expected to support their placement work and prepare for their return to University with academic study.

Students on M level courses should demonstrate their ability to study new academic material in their own time in addition to their commitment to their placement position. Universities should provide distance-learning material for this purpose.

The Industrial Training Reports

Clear instructions need to be provided to the student as to the format, length and purpose of any reports required. In most instances, there is no conflict between what is required by the company and the University. Since the student is an employee of that company, and if the results are of significance and are to be circulated around the company, then they must comply with company policy. University requirements can be added to such a report; these are likely to be

- a short history of the company
- a breakdown of company structure, including management and/or commercial organisation, to show the position of the trainee and the group in which he/she is working
- detailed description of the chemical processes or reactions in the laboratory or plant, and the apparatus used
- detailed description of the methods used in the laboratory - analytical methods, GLP, quality control, safety, general management control
- the physical location of the work and the extent of the company's operations in the UK, Europe and the world
- an analysis by the student of tasks and skills necessary for the satisfactory performance of the work
- personal development reflective log
- description of any project work, which will in turn involve:
    1. critical appraisal of the literature
    2. planning and execution of work
    3. logical interpretation of results
    4. discussion of conclusions

These elements may be incorporated into one document or separated out, for example, into company report, reflective log and project report. The assessment of a report is best achieved by double marking - perhaps the visiting and industrial tutor, or two academic tutors who can give a view of that report without a detailed knowledge of the other attributes shown by the student in the industrial context. Some contribution to the mark may be sought from the industrial supervisor. These marks are often much higher than academic marks and a scaling process may have to be used. Occasionally confidentiality will require that a report may not be read by anybody other than the visiting tutor who will have signed an agreement with the firm and the report may have to marked on their premises.

Best Practice

Every work placement should be completed by a detailed report which gives the reader background information about the company, the position of the trainee in the organisation, some idea of the day-to-day work, a reflective log, and a thorough report on any project work carried out. The report should be word processed, suitably structured and referenced.

De-briefing and Reflection

A formal de-briefing session is necessary if students are fully to appreciate what has been gained from the placement. Frequently a student can make a judgement about a period in industry that implies little has been learned. This is generally because the process has involved a slow development, and it is only when confronted with questions in a formal de-briefing, and a questionnaire, that the full benefits are realised. Those who teach a group that has returned from industry are well aware of the gains in confidence and transferable skills, as well as some specific scientific skill or technique, compared to those that have stayed at University.

A note should be kept of the de-briefing and the most important outcomes.

If the facilities exist, the group could be brought back for a week during the year. This would allow for an exchange of views and experiences. Students would learn from each other and become more aware of what is to be gained from the year, and return determined to get the most from their placement.

Bringing the group back just before the start of term can have a great impact on morale. A week of activities can be set up related to their experiences, possible careers and preparation for the forthcoming final year. This can set the scene for the different modules that will be presented and so help with decisions about choices and can give information about projects and any special features of that final year. Some laboratory work in the main branches of chemistry can prepare students for the year ahead after what might have been a specialised experience.

In-depth discussion can follow student presentations about the different industries that have been experienced.

Best Practice

A formal debriefing session, of which a written record is kept, should be held. The student should also complete a questionnaire before the debriefing.

A period at the University, before the start of the academic session, bringing together students to share experiences, is to be welcomed.

Peer Teaching - passing on the experience

It is necessary to bring home to students the benefits of the industrial placement. It is not the easy option for them, as it will involve a disruption from 'student life', a new city, different accommodation, new friends to be made, a more disciplined time, and all the hassle of application and interviews etc. The most persuasive voice will be that of their peers, not the industrial tutor quoting from years of experience, nor the Careers Service with current information from several industries, not even the visiting industrialist who wants to employ students with placement experience. Hence, the oral presentation to students who are about to make that crucial decision serves two purposes:

1. It supplies information from a source that the students relate to
2. It offers an opportunity for the placement student to demonstrate, and be assessed on, their communication skills

Generally, the presentation will work best if it lasts about 20 minutes, is well-illustrated by overheads and provides information about:

- the nature (size, influence, product range, etc.) of the company
- the management structure and the trainees position
- a typical day's activities
- the benefits (financial, social and career prospects) of working for the company, and is assessed

Best Practice

A formal presentation by students returning from industry to those who are about to make the decision whether or not to apply for a placement position is the best means of informing students.

International Placements

A year spent in the industry of another country has all the benefits discussed in this report. In addition, it also supplies the student with:

- a degree of fluency in another language
- a knowledge of another culture
- the opportunity to show their flexibility
- a widening of horizons for career jobs and an extension of their networking, through new contacts and new friends
- the opportunity to travel

The majority of students who go abroad for their placement will go to other EU countries. This is because there will not be work permit problems, and these countries will be part of the job market that the student will eventually be entering. It is not necessary to have knowledge of the language but it is necessary to be willing to learn. Students should not be deterred by the fear of the foreign language. Most companies use English as their working language, especially as so many are affiliates of multinationals, and will employ British and Americans amongst their permanent staff. However, the language is important for day-to-day living and a social life and so some time spent learning it during the year prior to the placement is advisable, and a short 'crash' course just prior to going is ideal if the finances are available. Many Universities have language classes that offered to all Faculties and language labs for all to use.

Students must be informed of the different position held by trainees in other countries. In the UK, they are regarded as employees with a salary and responsibilities commensurate with their experience and knowledge. In some other countries, not familiar with a year long position, it is considered a privilege to be allowed to observe the workings of the company. Consequently a low wage is paid. This cultural difference can be overcome by discussion with the overseas partner but inevitably, the amount paid could be less than a comparable UK placement. There are grants available and it is necessary for the responsible person within the University to keep up-to-date with the ever-changing details of grant applications. Often a link with a University in another EU country will be useful in finding a placement and in visiting the student and liaising with the firm. This link may be part of the funded arrangement and so allow the UK academic the opportunity to visit student, company and partner University. Visits to other European countries do not always involve greater distances, but University administrators may regard them differently. Since they may have ultimate sanction on travel expenses, this can turn into a battle. However, some battles are worth fighting!

Best Practice

International placements add an extra dimension to that of other work placements, even beyond the language proficiency gained. The additional effort involved in setting up and organising such placements is worthwhile for the benefits to students and the contacts made.

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APPENDICES

Appendix 1: Year plan of activities

Appendix 2: Student Checklist

Appendix 3: Checklist for visiting tutor

Appendix 4: Forms for the assessment of students

Appendix 1: Year plan of activities

EVENT		
1st Visit (July/August)	Discuss with Tutor. *Choice of academic modules? Plan for R&D Methodology report? Professional Skills? Progress?*	
Mid-December	Written outline plan for R & D Methodology completed	
14th December	DEADLINE for choice of academic modules	
4th January	Professional Skills @Cognitive Skills user pack sent out	
Early January	R & D Methodology report 'context' section written	
11th January	Mailing of first part of distance learning material	
Mid-January	Start thinking about/ make a start on writing Professional Skills 'case study' report	
Late January	R & D Methodology report 'experimental design' section written	
Early February	R & D Methodology report 'risk assessment' section written	
Mid February	R & D Methodology report 'project literature review' section written	
2nd Visit	Discuss with Tutor. *Detailed planning of Project? Progress? Give Professional Skills Oral Presentation?* Hand in to Tutor. *R & D Methodology report?*	
1st March	DEADLINE for return of first distant learning formative assessments (2)	
15th March	Mailing of second part of distance learning material	
1st April	DEADLINE for submission of Professional Skills 'case study' report	
26th April	DEADLINE for return of second distance learning formative assessments (2)	
10th May	Mailing of third part of distance learning material	
May/June	Writing up of Project and preparation of Project Poster	
Full TWO WEEKS Before 3rd Visit	DEADLINE for submission of Project	
1st July	DEADLINE for return of major distant learning assignments (2)	
30th July	DEADLINE for submission of Professional Skills 'cognitive skills work'	
3rd Visit	Discuss with Tutor. *Overall experience of industry? Give Project Presentation (combined with viva voce examination)?*	
2/3 September	Revision tutorials at 'home' institution for distance learning modules and microscope work, Liquid Crystals Module	
8/9/10th September (provisional)	Liquid Crystals, Organometallic Chemistry and Advanced Analytical Chemistry Examinations	

Appendix 2: Student Checklist

Student Checklist before leaving University for placement position

[ ]   Attend meeting at end of second year to obtain booklet and complete placement form

[ ]   Await receipt of information from Industrial Training Tutor concerning Academic Supervisor

[ ]   Inform Industrial training Tutor in writing of any changes in circumstances

[ ]   Prepare forms *(with provisional list of skills)* within first few weeks of placement

[ ]   Contact Academic supervisor about visits (if he/she fails to contact you)

[ ]   Keep forms up-to-date (confer with Industrial Supervisor)

[ ]   Have ready any evidence for learning, e.g. computer printouts, reports, graphs, results for discussion, or even a demonstration, especially for visits by Academic Supervisor

[ ]   Begin placement report/presentation/poster in good time

[ ]   Ensure that report and all forms are submitted, presentation and poster completed by ....

Appendix 3: Checklist for visiting tutor

Paperwork required: Information on report format (for student and supervisor)
Visiting lecturer's report form (to be sent to Industrial Training
Tutor after the visit)
Assessment Form (for information only at this stage)

Discussion with Student:
Check working environment
Obtain verbal description of work being carried out
Is student learning from this work?
Is the training being given suitable for the course?
Is the placement an enjoyable one?
Are colleagues in the laboratory helpful?
Is salary sufficient?
Is accommodation satisfactory?
Is there a good social life?
Give information on the report format
Inspect laboratory book
Has 2nd year of course been useful by the way of preparation
for the industrial year?

Discussion with the Supervisor
Informal verbal intermediate assessment (i.e. has the student
settled down satisfactorily?)
Will a project involving practical work be undertaken?
Give information on the report format
Give information (including the actual form) on what is being
looked for by the way of assessment
Review training plans for the remainder of the year (including
looking for any specific areas in which it would be beneficial for
the student to get involved)
Did the student have the right background when he/she started
his/her placement?
Ensure student has access to typing facilities for report

Other general areas to explore:
Student requirements for next year
Likely graduate vacancies for following year
Any other areas of mutual interest e.g. research, courses, surplus equipment

Appendix 4: Forms for the assessment of students

FIRST VISIT - MSci

<u>INDUSTRIAL TRAINING ASSESSMENT</u>

Name of Student ....

Training Organisation ....

Department in which employed ....

Academic Supervisor ....

Industrial Supervisor .... (e-mail)..........

ASSESSMENT

1.   <u>Settling-in period</u>

Mark reflecting how well the student has settled into his/her job and has fitted into the working of the organisation.

    <u>Comments</u>

1
2
3
4
5

1   Very Poor

5   Very Well

2.   <u>Attitude to work</u>

Mark reflecting how well the student has applied himself/herself to his/her job.

    <u>Comments</u>

1
2
3
4
5

1   Very Poor

5   Very Well

Signed ....

Date of Visit ....

WORK PROGRAMME - MSci

Proposed Student Programme

Name of Student   ....

Training Organisation   ....

Department in which employed   ....

Academic Supervisor   ....

Telephone No. and extension   ....

Email   ....

Nature/Type of work to be carried out

Provisional Project Details

Summary of training programme, skills which will be acquired, duties, etc

Signed   ....

Date of Visit   ....

SECOND VISIT - MSci

INDUSTRIAL TRAINING ASSESSMENT

Name of Student ....

Training Organisation ....

Department in which employed ....

Academic Supervisor ....

Industrial Supervisor .... (email)..........

ASSESSMENT

1. Progress achieved since first visit

Mark reflecting how the student's work has progressed during the time that he/she has been with the organisation.

    Comments

1	Very Poor
2	
3	
4	
5	Very Well

2. General ability

Mark reflecting general aptitude including student's continuing attitude to work, his/her ability to co-operate with other members of staff, report writing etc.

    Comments

1	Very Poor
2	
3	
4	
5	Very Well

PLEASE TURN OVER

R&D Methodology Module (Progress Report)

Project (Detailed Planning)

Signed   ....

Date of Visit   ....

R&D Methodology Module (Progress Report)

INDUSTRIAL TRAINING ASSESSMENT

Employer's Report

Name of Student

Training Period from

                    to

GUIDANCE FOR SUPERVISORS

It would be most helpful for our records if you could spend a few minutes completing this assessment of the student. The aim of the assessment form is to obtain an indication of the student's performance during his/her training and his/her potential on completion of the period spent with you.

Please place a tick in the box which you consider to be most appropriate to each criterion (1-5). In columns headed "weighting", please place a tick in the appropriate box to indicate whether that criterion has high, medium or low importance in the assessment, bearing in mind the opportunities available to the student to satisfy such a criterion. If a given criterion has not been assessed, please indicate this in the form.

PLEASE TURN OVER

INDUSTRIAL TRAINING ASSESSMENT **Marking Sheet**

	Very Poor	Poor	Acceptable	Good	Very Good
Ability to comprehend					
Practical skills and reliability of work					
Ability to communicate verbally					
Supervision required (tick very good if little is required, very poor if an inordinate amount is always necessary)					
Speed of work					
Development of student's technical knowledge					
Report-writing ability/ day to day record keeping					
Initiative and organising ability					
Originality (i.e. generation of his/her own new ideas)					
Attitude and General Conduct (industriousness, conscientiousness, interest and enthusiasm etc)					
Timekeeping and absenteeism					
Relationship with others					

Name of student   ....

Training Organisation   ....

Department in which employed...

Academic Supervisor/ First Examiner

Second marker

Industrial Report with reflective log (30%)

Project report (30%)

Independent study (30%)

Oral Presentation (10%)

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Physical Sciences Practice Guides are designed to provide practical advice and guidance on issues and topics related to teaching and learning in the physical sciences. Each guide focuses on a particular aspect of higher education and is written by an academic experienced in that field.

The benefits to students of undertaking a work placement have been well documented. For example such students:
- have higher employment rates
- are more likely to achieve a first or upper second class degree

The purpose of this report is to highlight the variety of work experiences undertaken and to share effective practice.

This guide was originally compiled by Ray Wallace and Bob Murray of Nottingham Trent University.

In October 2009 the guide was revised by Tina Overton of the Higher Education Academy Physical Sciences Centre, University of Hull.