



Science in the workplace – An introduction

Careers work with young people can consist of many different parts. The traditional one-to-one interview for advice and guidance is only a very small part of how pupils will make choices about their future career path. Science teachers should take opportunities to relate their subject to potential future learning pathways and show pupils where the subject sits in the world of work.

There is great potential in being able to integrate practical work with a careers element within science lessons, and this set of resources exemplifies some of the ways in which this can be done.

How this introduction is organised

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Section 1: Why integrate careers information into lessons?

Recent research on science, technology, engineering and maths (STEM) education regularly suggests a need to tackle the poor reported experience of science among pupils generally, together with a negative image of and inadequate information about careers arising from science. For example, research in physics found that the lack of context and knowledge about careers has actively turned girls away from studying the subject post-16. Physics is still 19th on the list of most popular A levels for girls, while it is 6th on the boys list (www.iop.org/education/teacher/support/girls_physics/page_41593.html).

In response, the Institute of Physics (IOP) has been actively developing more physics teaching resources placed in context, and with links to careers, as part of their campaign to increase the uptake of physics for girls.

Several initiatives were put in place as part of the UK government funded STEM Cohesion Programme. Information about careers from science, maths or other STEM subjects was made available through websites for young people (see FutureMorph www.futuremorph.org and Maths Careers www.mathscareers.org.uk). The STEM Subject Choice and Careers project formed one strand of the STEM Cohesion Programme and provided support for schools in teaching about careers, and in careers advice and guidance. This project developed a range of teaching resources that included a careers element - some through Upd8 *Wikid* and some as stand-alone (all available from the National STEM Centre: <http://stem.org.uk/cxao>).

The response from teachers and from young people to these resources has been very positive.

"More needs to be done to make science a 'conceivable' career option for a broader range of pupils, such as incorporating explicit teaching about STEM-related career opportunities into Key Stage 3 lessons"
(Archer et al, 2012)

The resources in this pack build on this initial work and show how practical science lessons can be combined with a careers element to enhance understanding and raise the careers awareness of pupils.

Find out more...

For more on widening participation of under-represented groups see:
www.stem-e-and-d-toolkit.co.uk

and Lessons Learned Part 2 on the National STEM Centre website:
<http://stem.org.uk/cxao>

or the IOP Girls in Physics project:

www.iop.org/education/teacher/support/girls_physics/page_41593.html

Useful links to careers-related resources ...

www.futuremorph.org

www.mathscareers.org.uk

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www.tomorrowengineers.co.uk

STEM Choices and Sector supplements available in the STEM careers Collection at <http://stem.org.uk/rxxa>

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Section 2: The role of teachers as sources of careers information

The role of teachers in influencing young people's choice of science beyond 16 has been shown by several studies to be important. Yet science teachers have also been found not to see themselves as a primary source of information.

When asked, science teachers have often felt unable or uncomfortable in providing careers information, but on reflection they admit that their pupils have always seen them as important when considering subject choice and hence career choice.

With good quality and engaging science careers information now in place, science teachers are in the position to show their pupils how their subject is used in the world of work.

More than just 'making science fun'

Drawing on a survey of over 9,000 pupils aged 10/11, the King's College London 'ASPIRES' research project found that increasing interest in science or making it more fun is just not enough to persuade young people to make science part of their future (Archer et al., 2011). Careers embedding could be that element needed.

Some areas of science teaching already relate well to a wider context and pupils will be aware of the visible careers available. But there are many areas of the science curriculum which are often delivered through theory or in isolation. There are also many more careers available that link to science than pupils are generally aware of.

Learning about how science is used can actually be a motivator because students can see a purpose that links with their own potential future study or career options. This motivation for learning by context and meaning has now been found frequently in research studies.

Find out more...

Work through the freely available STEM Careers online module - there are three levels and you can do it in your own time working through each level or focusing on areas of interest.

<http://www2.warwick.ac.uk/fac/soc/ier/ngrf/stem/>

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Section 3: Features of the resources

The resources within this pack draw on a range of different methods to embed careers within practical science:

1 Involve role models or case studies in lessons: Starter and / or plenary with a film clip of someone working in research / industry; inviting a STEM Ambassador to answer questions / support the practical activity; utilise case studies of people working in industry / research drawn for various places and ask students to read and feedback key details / guess my job activities.

2 Role play as part of practical: Set the task with pupils in role (brief them beforehand) and ask them to present findings or debate opposing views relating to practical - even better invite real people to see presentations.

3 Build in career skills development and reflection into practical task so that pupils can review and reflect on their own skills base or interests / values and relate it to careers in science.

4 Identify a local company / organisation with expertise in a related STEM area: Involve them and illustrate what they do - arrange a visit or work shadow - develop a new teaching resource on the basis of this.

5 Include individual career research activities for students as part of the task either within class or as homework: set tasks for information searches on a range of jobs or routes to jobs - or key aspects of careers like salary, qualifications, key roles.

6 Involve your own pupils and do some research with them about their own awareness and interest in science careers. Follow this up by working with colleagues and the school careers lead to develop a joint activity (which could be based on the suggestions above). Let the results feed in to open evenings and option choices events with parents.

The resources in this pack also include key signposts to support pupils and teachers in building knowledge of careers *from* science and *in* science. The information sources ensure that the careers included can be accessed at different levels of qualification and include a diverse range of case studies / role models. Information signposts are recognised as providing up to date and well structured and accurate information coming from quality assured sources.

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Section 4: Transferring the model and designing your own resources

The resources provided here exemplify different approaches which you might like to take when developing your own lessons.

Several teachers adapted the STEM Careers resources (from the STEM Subject Choice and Careers project) and developed their own - see Lessons Learned Part 1 and 2 - particularly case studies one, seven and ten.

When planning to integrate practical work with careers information, initially you need to consider whether the practical you intend to use is 'authentic'. So, does it relate well to a current careers context?

Some practical activities commonly used in science teaching are about recreating historical methods not used today, while others have a clear link to contemporary science. Whatever the status of the practical work, the methods used in carrying out the practical can be utilised in other ways to highlight general employability skills which could be useful in many careers. Practical work is therefore useful to help pupils reflect on their own broader careers education.

To include the elements of broader careers education find out more about skills and careers by looking at National STEM Centre - STEM Careers and Personal Capabilities (<http://stem.org.uk/rx3ao>), or download the STEMNET employability framework from www.stemnet.org.uk.

Remember that practical work can illustrate both careers in science and other careers more loosely connected with science (e.g. plumber, fire fighter, pilot). FutureMorph and other similar websites show how wide ranging these career areas are.

Planning to integrate practical work and careers information

There are some key aspects to consider when including careers information in practical lessons. Which you use will depend on your starting point:

a) Include images of STEM careers within teaching and signpost students to recognised and up to date resources.

On the face of it drawing on images can seem simple and many teachers will claim to do this as a matter of course. But we know that pupils can hold very stereotyped perspectives of science careers and fixed views of what sort of people do science, so it is important that images used in teaching can challenge these gender / ethnicity / social background stereotypes. FutureMorph and MathsCareers websites are good starting points and for more ideas on this see www.stem-e-and-d-toolkit.co.uk (search for the Inclusive Role Models in the case studies section). You can find a host of careers video clips at www.icould.com and do not forget your Subject Association.

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b) Make direct references to careers in your teaching and begin to work in partnership with other teachers and with allied subjects.

Direct references to careers should be widely based and acknowledge different levels and types of qualification needed. Both vocational and academic routes need to be shown to pupils. We know teachers often find it hard to build partnerships with other subject groups but if the difficulties can be tackled it is worthwhile. The STEM Careers Timeline project explored ways that STEM subjects can work together (see Lengthening Ladders, Shortening Snakes report <http://stem.org.uk/rx3o7>). A first step might be in Science and Engineering week. We know that once science teachers have shared ideas about enhancing careers awareness in their own subject group, the logical next step is to continue the good practice with other science subjects and other STEM subjects.

c) Make links to other curriculum support for careers education - via industry visits, work experience, and working with a careers delivery team.

The easiest way of including people from industry is via your STEMNET local broker. See www.stemnet.org.uk to find out about who to contact and how to get an Ambassador to visit. They also provide information about competitions, clubs and different award schemes like CREST run by the British Science Association (www.britishtscienceassociation.org/web/ccaf). The network of regional Science Learning Centres runs a series of study visits for science teachers which not only help subject teaching but also enhance careers awareness. If your school has a STEM or Enterprise Coordinator you may have access to other local employer contacts. If your school offers work experience or takes part in placement schemes it can offer a very personal careers insight to individual pupils if managed well (see www.futuremorph.org; teacher section on placements)

d) Develop a whole department strategy.

Once you have got together with other teachers and built up some momentum and support then you can start to build a programme into schemes of work. See STEM Subject Choice and Careers: Lessons Learned part 1 (case study one) and part 2 (case study seven) showing how different schools have managed the process. There is a 'STEM Manager', which is an online tool available from the National STEM Centre (you will need to join for access to this) to support schools in overall planning for STEM Careers.

Each of these elements has a thread of equality and diversity running through them. Without tackling the barriers that face under-represented groups in STEM careers we will fail in the aim to increase participation in STEM subjects and careers. Further information can be found in the Equality and Diversity Section of STEM Careers at the National STEM Centre (<http://stem.org.uk/cxar>).

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Section 5: Involving others and developing longer term strategies

Here are some ways in which you could involve others with careers initiatives:

- 1** Present what you are doing to others in a team meeting - show them other resources available and invite them to get involved.
- 2** Work in a cross-curricula way with the maths department to show the links between science and maths, and combine with a career activity (see Teachers' TV in STEM Careers Collection).
- 3** Work on an enrichment activity for science week involving other departments - using a topic such as 'food' and include practical science.
- 4** Develop a strategy with the careers delivery team in school.
- 5** Involve your senior leadership team in developing a STEM strategy (draw on the STEM Strategic Planner at the National STEM Centre).
- 6** Look for further CPD possibilities via your regional Science Learning Centre.

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Section 6: Route map

The following diagram provides a route map for development of STEM careers awareness for Teaching and Learning. This is based on the diagram on page 8 in STEM Subject Choice and Careers: Lessons Learned Part 1, and illustrates how change can be put in place from any starting point to improve practice in STEM careers awareness. It is suggested that a simple audit is utilised to identify where you currently are on the levels.

A. Teaching and learning to create greater pupil engagement and to promote STEM careers awareness, including cross-departmental work

Level 1 No explicit or planned reference to STEM contexts and careers in curriculum planning. Individual teachers might make occasional reference to STEM careers if opportunities arise.	Level 2 Some STEM teachers make use of work related contexts to achieve greater pupil engagement in STEM subjects.
The change explained: Teachers begin to use ‘images’ of specific STEM careers in their teaching, e.g. through the use of the project’s STEM Careers Curriculum resources (e.g. the KS3 science resources developed as part of the <i>wikid science</i> project). Greater understanding of the need to motivate pupils in STEM subjects, as this has an impact on attitudes and subject choice (e.g. at 14, Triple/Double/Single science, single/double mathematics: at 16+, towards STEM related post 16 courses).	
Mechanisms to achieve change: Publication and promotion of resources (e.g. via upd8, futuremorph, mathscareers sites, and others). CPD programme includes session on how to use resources effectively. Likely to complement DfE policies on pupil engagement.	
Resources available: STEM careers curriculum resources. Add examples from those we have mapped. On-line support.	

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Level 2 Some STEM teachers make use of work related contexts to achieve greater pupil engagement in STEM subjects.	Level 3 Widespread use of work related contexts to support curriculum planning and delivery by teachers across the STEM subjects.
The change explained: Whilst individual teachers may be making more explicit reference to STEM careers, and work-related contexts, the shift up to the next level involves a more co-ordinated approach, with teachers across subjects (e.g. science, maths, D&T) using this approach, which is also planned into schemes of work.	
Mechanisms to achieve change: Promotion of cross-curricular co-operation with CPD sessions to show how the materials including the TV programmes can help develop this co-operation. Practical examples of areas where cross-curricular work can enhance the promotion of STEM careers. Explicit examples of how to incorporate careers into teaching. Sessions for teachers from all STEM subjects with careers professionals.	
Resources available: LEA and consultants. Role models (SEAs) and the use of work experience. Specifically designed CPD sessions with the emphasis on cross-curricular co-operation and working with careers professionals. On-line support.	

Level 3 Widespread use of work related contexts to support curriculum planning and delivery by teachers across the STEM subjects.	Level 4 Whole school approach to use of work related contexts to support curriculum planning and delivery across all the STEM subjects.
The change explained: Subject teachers working and planning together as part of a whole school effort to focus on STEM careers. Integration with other areas of careers education and IAG, e.g. work placements used as a source of curriculum activity	
Mechanisms to achieve change: Use of ASTs to promote whole school activity. CPD sessions for, e.g. HoDs to help them develop in-school training for staff. Whole school recognition of the importance of STEM careers promotion. Recognition of school commitment, e.g. STEM School status (?).	
Resources available: LEA and consultants. Role models (SEAs) and the use of work experience. Specifically designed CPD sessions for HoDs run at SLCs. On-line support.	

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