Lengthening Ladders, Shortening Snakes
Embedding STEM Careers Awareness in Secondary Schools

From the STEM Careers Awareness Timeline Pilot

Report arising from:
Five stakeholder conferences
March – May 2009
Experiences of working with schools at Key Stage 3
October 2009
In recent years the UK has seen an unprecedented rise in interest from Government, industry and others in the uptake of science, technology, engineering and mathematics (STEM) subjects in schools and colleges. This is driven by the need to improve understanding of STEM-related topics amongst the general public and to raise the skills and aspirations of learners. Many organisations are working to engage young people with STEM. The scope of initiatives is broad, including hundreds of opportunities for enrichment and enhancement by schools and colleges, professional development experiences for teachers and the development of curriculum resources.

A STEM framework of 11 Action Programmes has been established to provide a strategic approach to drive these policy priorities. Each Action Programme is taken forward by a lead organisation to act as a point of contact for other STEM partners and to help coordinate the promotion of the Programme with schools, colleges and others. Action Programme 8 focuses on careers and is overseen by the National STEM Careers Coordinator, Kate Bellingham. AP8 is intended to “improve the quality of advice and guidance for students (and their teachers and parents), and to inform subject choice”.

The Action Programme is designed to achieve two key objectives:

- For all young people to be made aware of the fulfilling and attractive careers open to them through the continued study of science and mathematics
- To provide the knowledge and skills to enable young people to make informed subject choices to achieve qualifications to keep their options open for further study and careers in STEM.
EXECUTIVE SUMMARY

Science, technology, engineering and mathematics (STEM) are critical to the UK’s future prosperity. The skills and knowledge they imbue open doors to the modern world of work and lifelong learning. The STEM Careers Awareness Timeline Pilot forms part of a wider Government-backed programme aimed at promoting STEM subjects and careers to secondary school pupils. The ‘Timeline’ pilot seeks to establish how schools can embed a more systematic programme of careers awareness into the existing subject curriculum – initially in the first three years of secondary education.

Some 28 schools across England have participated in the pilot scheme, led by the Centre for Education and Industry at the University of Warwick. An audit of pilot schools has been carried out to establish how much of what they currently offer meets the programme’s objective, and to identify what changes could be undertaken to ensure better integration of STEM careers within the curriculum and wider school ethos. In addition, a pupil survey at the start and end of Key Stage 3 is providing important information about perceptions of STEM subjects and their relevance to future subject options and career choices.

In the spring of 2009 a series of stakeholder conferences took place in Regional Science Learning Centres in England. Participants were drawn from industry, education, pilot schools and from the wider STEM community. The key purpose of these stakeholder events was to interrogate the emerging findings from the audit and survey, to inform the next stage of work.

Key stakeholder perspectives

Whole school
• Cross-curricular working is essential for an effective STEM careers programme
• Better use of the physical environment and a more creative approach to curriculum planning will both lead to better coordination of STEM
• Gender issues still play a prominent role in determining subject choice
• STEM could be highlighted in Personal Learning and Thinking Skills work

“Regrettably, and incorrectly, pupils often view the study of science, mathematics and engineering as narrowing their options, rather than broadening them.”
Sir Gareth Roberts

Subject specialism
• Continuing professional development is central to improving teachers’ and careers guidance professionals’ knowledge about STEM careers – this should include more industrial placements
• Connexions services are not specified in a way that meets the needs of the STEM community
• The relationship between the quality of subject teaching, enjoyment of learning and subject choice should not be underestimated
• Profile of STEM careers should be raised in initial teacher training
• Negative perceptions about mathematics education may influence young people’s subject choice and limit careers options

Management
• Senior management support is essential if schools are to introduce an effective STEM timeline
• The visibility of engineering in most schools needs to be raised
• Establishing a STEM coordinator in every school will enhance the status of careers work

External factors
• Parents play a significant role in influencing young people’s choices about careers – schools and employers should engage them more
• Schools should make better use of external organisations in their STEM careers activity

Discussion surrounding the audit findings and survey data set out to consider practical ways of overcoming obstacles and informing the next stage of the Timeline work. Conference participants also looked at how STEM skills could be applied to young people’s future lives, independent of career aspiration.
INTRODUCTION

The STEM Careers Awareness initiative has been established as a distinct Action Programme, within the Department for Children, Schools and Families’ £140 million initiative to increase STEM (science, technology, engineering and maths) subject uptake at A-level and into higher education. The initiative brings together industry, schools and careers experts, promoting the excitement and value of careers linked with STEM.

STEM expertise is generally accepted as key to the UK’s future international competitiveness. This current area of work has its origins in Sir Gareth Roberts’ report ‘Set for Success: The supply of people with science, technology, engineering and mathematics skills’, published in 2002. Set for Success described the difficulties faced by employers in recruiting suitably qualified scientists and engineers, and corresponding implications for future UK competitiveness. It highlighted ‘poor experiences of science and engineering education among students generally, coupled with a negative image of, and inadequate information about, careers arising from the study of science and engineering.’ Addressing these issues, it stated would require, ‘Action in schools and further and higher education’.

The Roberts Report noted the complexity of factors that too often lead to a narrowing of young people’s subject preference in schools, particularly the culture of careers guidance within secondary schools:

“The views of parents, teachers, careers advisers and society in general towards study and careers and science in engineering can play a significant role in shaping pupils’ choices as to whether to study these subjects at higher levels. Regrettably, and incorrectly, pupils often view the study of science, mathematics and engineering as narrowing their options, rather than broadening them. A contributing factor is that careers advisers often have little or no background in the sciences, and that science teachers are often unwilling to advise pupils on future options.”

Studies have also shown how these and other factors influence young people’s desire to study STEM subjects and to aim toward STEM-related careers. These factors include parental advice, quality of formal education, teaching styles, curriculum content and work experience, along with the young person’s interest and enjoyment of STEM subjects, capability and prevailing views about options, careers and gender.

1 Set for success, The supply of people with science, technology, engineering and mathematics skills, Sir Gareth Roberts, published by HM Treasury (2002).
STEM CAREERS AWARENESS
‘Science and maths – see where they can take you.’

STEM Careers Awareness aims to encourage more young people to continue studying mathematics and science subjects post-16. The underlying messages it conveys are: (i) you can pursue a career in STEM, (ii) you may embark on a path towards a career using STEM, or (iii) you may wish to work in a non-STEM career, but STEM will provide you with useful and appropriate skills. In summary, whatever your ultimate career aspiration, keeping science and mathematics options open at 16 is a sensible choice.

Appointed to the role of National STEM Careers Coordinator, Kate Bellingham has the task of overseeing the implementation of Action Programme 8. This programme sets out to improve the quality of advice and guidance for students, their teachers and parents about STEM careers so as to inform subject choice. Kate is also responsible for engaging with a diverse range of stakeholders and oversees four distinct strands of work:

- A three-year communications campaign, designed to engage young people, their parents, the workforce and stakeholders to improve the take up of science and mathematics subjects, post-16
- Future Morph – a website resource, led by the Science Council, designed for young people aged 11-19, to encourage them to study science and mathematics by demonstrating the huge range of careers available to those pursuing the subjects post-16. www.futuremorph.org
- STEM Careers Action Programme – new resources to support effective teaching and learning in STEM careers and the creation of new continuing professional development (CPD) opportunities for teachers and careers professionals. This work is led by the Centre for Science Education, Sheffield Hallam University and VT Enterprise
- Careers Awareness Timeline Pilot – devised to establish a more coherent structure for young people to learn about careers relating to science and mathematics during Key Stage 3. The project is led by the Centre for Education and Industry (CEI) at the University of Warwick, in partnership with the International Centre for Guidance Studies, University of Derby, and Isinglass Consultancy Ltd. The stakeholder conferences were developed as part of this strand of work.

2 Slogan from DCSF advertising campaign.
THE STEM CAREERS AWARENESS TIMELINE PILOT

The Careers Awareness Timeline Pilot is an innovative project designed to establish more coherent programmes of learning for young people about careers relating to STEM during Key Stage 3 (11-14 years). The pilot has placed mentors in 28 pilot schools across nine English regions to carry out an audit of current in-school provision and to help support planning and encourage collaboration between the schools’ key STEM departments and careers services. Schools then develop activities within and outside the mainstream curriculum for this age range. The Timeline Pilot also identifies how schools make use of and adapt their organisational structure, policy and practice to embed STEM careers education into the curriculum. It will assess the effectiveness of the programme in influencing young people’s attitudes toward science and mathematics.

The key elements of the project comprise:

• A pilot development programme in 28 schools, across nine regions of England, with mentor support available to each school

• Initial activity includes an audit of current in-school provision to help support planning and encourage collaboration between the schools’ key STEM departments and careers services

• Survey of attitudes to STEM subjects and careers amongst Key Stage 3 pupils at the start and end of the pilot

• Provision of support materials designed to help schools develop their own plans for effective integration of careers awareness within Key Stage 3 science, mathematics and design and technology, and, where applicable, engineering

• Two series of regional stakeholder conferences and workshops, to involve the pilot schools and the wider education and STEM community

• Production of case studies to help in sharing best practice more widely

A survey of Year 7 and 9 students has been carried out to establish knowledge and attitudes about STEM careers, both to inform future development and to act as a benchmark for assessing progress.

In spring 2009 five seminar-style stakeholder conferences were held at Regional Science Learning Centres.

Some 130 stakeholders participated in the conferences and contributed extensively to the project team’s thinking. A number of bespoke activities were developed to stimulate discussion and capture the thoughts and ideas of those attending. This report sets out their views in the context of the wider STEM Careers Awareness Timeline Pilot.
Between September 2008 and January 2009, 4073 pupils from schools participating in the STEM Careers Timeline Pilot completed a questionnaire about STEM careers and subjects. The work, led by Jo Hutchinson from the International Centre for Guidance Studies at the University of Derby, sought to present an overview of attitudes and perceptions amongst year 7 and year 9 pupils, and also generated the baseline data against which any impact could be measured.

Key findings from the survey:

**Subject popularity and importance**

- Design and technology and science were rated by young people as the third and fourth most popular subjects.  
- Mathematics was the second least popular subject after foreign languages.  
- Mathematics and science were considered to be important subjects since they are needed to secure a good job.  
- The percentage of young people who would consider a career related to a STEM subject is comparatively high (with 59% contemplating future work linked with technology, 52% in science and 50% in mathematics; 38% would consider a career related to engineering).  
- There was a corresponding level of curiosity in finding out more about careers in each of these subjects, with 84% expressing an interest in wanting further information about careers related to at least one of the STEM subjects.

**Sources of information**

Young people (at Key Stage 3) favour family as a source of information about jobs and careers (78%), followed by careers teachers (50%), subject teachers (48%), friends (36%), year or form teachers (23%) and, finally, Connexions advisers (20%).

**Age and gender difference**

There were few significant differences in the views held by Year 9 students and their younger colleagues, with the exception that Year 9 were less likely to name science and design and technology as most enjoyed subjects, but more frequently reported science and mathematics as important. The fact that similarities exist between the two year groups may suggest that the Key Stage 3 school experience has little impact on pupils’ perceptions of STEM careers.

Gender differences were most pronounced when pupils were asked to select from a given list of future possible careers. Boys were more likely to select jobs in security and construction whereas girls appeared to favour design, arts & crafts and the performing arts. Girls also tended to view STEM less favourably than boys, who rated subjects as easier and more enjoyable, though the subjects were not perceived as being intrinsically ‘for boys’ or ‘for girls’. There is some evidence that gender preference for STEM subjects does becomes more pronounced between Years 7 and 9.

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3 Most popular: PE (57%), art (41%), design and technology (36%), science (30%).

4 Least popular: Foreign languages (41%), Mathematics (38%), Geography (35%), History (35%).

5 Key Stage 3 pupils would not be expected to be aware of Connexions.
Survey implications

Stakeholder perspectives

Stakeholders considered the implications of the survey findings. Their views are set out below:

1. The quality of teaching is paramount for pupils to engage with STEM subjects.
2. More cross-curricular working within schools will enhance student engagement, foster real-life contexts and provide young people with generic STEM skills.
3. Gender issues are still a prominent reason why many young people fail to keep their options open when it comes to making subject choices.
4. Teachers need professional development to improve their knowledge of the breadth of available careers.
5. Schools must make use of competent external organisations to inspire school careers programmes.
6. Parents need to know more about what STEM is, since their influence over pupils’ choice is great.
7. Pupils need to have a clear idea of the benefits of studying STEM, including salaries, lifestyle and career choices.
8. The value of careers should be an intrinsic component of STEM teaching.
9. There is no substitute for real-life STEM experience in attracting young people to possible careers.
10. Careers education information and guidance should start early in secondary education and include elements on STEM learning and careers.
11. The relationship between enjoyment and subject option choice should not be underestimated.
12. STEM education should aspire to be both enjoyable and rigorous.
13. High-quality, accessible information on STEM careers should be available for students, teaching staff and careers guidance professionals.
14. Perceptions about mathematics education may influence young people’s choice of subject and consequently limit future career options.

More detailed discussion explored how the survey findings relate to specific aspects of STEM within schools:

Secondary school pupils’ experience

Stakeholders considered that existing careers education programmes do not adequately reflect the opportunities available through STEM. This could be partially rectified through the introduction of a more systematic approach to learning about careers during Key Stage 3 and then again at Key Stage 4.

Some held the view that the Connexions service should be involved earlier and with greater frequency, whilst others felt alternative routes to careers education information, advice and guidance are needed – questioning whether the Connexions agenda meets the average pupil’s needs when it came to STEM. Reference was made to the importance of any system accommodating how young people’s ideas about their future careers may change over time.

“We should be telling pupils that it’s OK to change your mind. The system needs to accommodate this and be sufficiently flexible.”
Some expressed concerns that pupils might not know what is meant by each of the four STEM subjects. Prominent within discussion was pupils’ understanding of ‘engineering’ and whether the low survey scores for the subject were based on ignorance of the subject rather than lack of interest. Either way, raising awareness about engineering both as subject and career path was considered to be particularly important.

Lack of accurate and up-to-date information was seen by some as leaving pupils without any foundation for effective decision-making. Since families appear to be the primary source of careers information, one option was for schools to develop a programme to provide parents with the knowledge and skills to direct their children to reliable and good quality sources of information.

Teachers’ knowledge about STEM careers, the number of specialist teachers in STEM subjects and the quality of STEM lessons were all identified as major factors to be considered for a healthy STEM future. In drawing on the survey data, one group highlighted the link between teacher professional development, positive learning experiences and young people’s career choices. According to this group: ‘Pupils choose what they enjoy and what is taught well’, a point echoed by others who stated: “Good quality teaching staff are essential”.

STEM teaching should draw on real life contexts, with young people made more aware that STEM is everywhere, with a specific request to:

“...reinforce the new curriculum with more applications to relevant contemporary science for pupils to have access to in lessons”

A plea to go beyond simply including emerging science and developments in curricular content, highlighted a need for STEM careers work to reflect an up-to-date picture of the current labour market.

Since pupils appear to appreciate the value of STEM, it was suggested that the main thrust of careers-related activity should focus more on enjoyment and less on promoting STEM’s currency.

Greater emphasis should be placed on pupils’ understanding of the transferability of STEM skills, echoing one of the main underpinning ideas of the STEM Careers Programme.

**Schools and their communities**

STEM careers activity and school careers guidance should engage parents more in careers education programmes. Suggestions include giving parents clear guidelines on how to access high-quality information, involvement of parents in careers sessions with pupils and through the development of parents’ own skills in guiding their children. Schools could then address a concern that families with no history of STEM employment or education may be less inclined to encourage their children to embark on a path towards a STEM career.

Parents and other relatives are a potential rich seam of careers experience, in particular when it comes to more unusual career paths. Lack of parental involvement is a concern strongly emerging from the audit. Delegates drew on the survey data to conclude that parents and other members of the local community would be especially valuable in promoting STEM, especially in talking about the more oblique careers and circuitous routes to employment. Selected employees from local companies could present the work and career path in real-life context. Schools and their communities could also be more systematic in drawing on this community-based STEM expertise and show how most working environments are populated by a range of types of people with diverse sets of skills. However, the inclusion of local employers should not skew perspectives, especially when there are large local STEM companies, who may simply have interests in a narrow set of skills or a niche sector. Equally using the ‘wrong ambassadors’ can be more detrimental than no intervention. Where possible, it was felt that schools should actively encourage gender and ethnic diversity and to counter stereotypes that may otherwise discourage young people from certain career paths. Progressive opportunities for industry and business to contribute to curriculum delivery would require planning and a source of funding, as would wider community links.
Science education

Stakeholders commented on questions about science education raised in the research. Specifically:

- **Gender** – how schools were to address the gender difference linked to interest in science present by the end of Key Stage 3
- **Curriculum development** – the opportunity presented by alternative science curriculum models now available for Key Stage 3 to bring together processes and skills from all STEM subject areas
- **Science teachers** – How to ensure that teachers see the link between curriculum content and careers; to make explicit the skills and knowledge from the subject that can be applied in technology and mathematics education; and emphasise links with everyday problem solving
- **Authenticity** – Science is currently isolated from its real-life applications and pupils should, on occasion actually “make something”, which would forge a natural connection with technology and engineering
- **Challenging academic elitism** – How might science education be pitched to meet the needs of students who are unlikely to achieve high academic success but still wish to follow a STEM career path?

Engineering as encountered in schools

One of the real challenges for the entire STEM programme is how to promote engineering, when few young people know what ‘engineering’ means, and while it remains outside of mainstream study for most. Though the study of engineering is growing in some schools, through new courses in the subject and the conferring of specialist status, most have no strategy for teaching and learning about the discipline. Stakeholders drew on the survey data to express their concerns and indicate the scale of the challenge, expressing the view that knowledge about engineering is rudimentary.

Mathematics as a school subject

How to counter the low popularity of mathematics by making it more interesting and relevant was an emerging theme of the conferences. The National Centre for Excellence in the Teaching of Maths (NCETM) is leading the wider STEM initiative to address this through a dedicated action programme. Some suggestions made echoed the philosophy and practical approaches adopted by the Bowland Maths Initiative\(^5\), which aims to change pupils’ views of maths by increasing motivation and enjoyment. The survey data stimulated delegates to highlight some fundamental questions:

1. Whether mathematics is intrinsically difficult, whether it is made difficult by the way it is taught or whether young people simply perceive it to be so?
2. At a deeper level why does mathematics appear to be unpopular with many young people?

Technology education

The value of an authentic experience was highlighted here too, as was the potential for technology education to draw out the applications of scientific and mathematical ideas:

- **Real-life contexts**: Is the technology that students are using in their day-to-day lives more advanced than that encountered in school? How does this affect perceptions of the subject?
- **The real value of technology**: Should we be encouraging pupils to appreciate that, as well as being an enjoyable subject, technology is important too? Technology education should produce better links between skills, abilities and types of career and be the bridge between academic study and real life activity
- **More than just ICT**: How to challenge the widely held view in schools that technology is effectively ‘computing’

Careers guidance and staff

It was clear from the discussion that while over half the young people in the survey would go to their subject teacher for careers advice, these subject teachers are ill-equipped to respond to requests for careers-related information. Similarly, careers coordinators and teachers are not thought to be well connected with STEM subject teachers. The situation is made worse by the limited engagement of the Connexions service in careers education at Key Stage 3 as it tends to focus on destination choices in Year 10 and 11. And since careers professionals strongly support the view that careers guidance should be impartial, there is unease about ‘promoting’ any particular career path.
There was also a strong sense that school careers guidance staff have limited knowledge of STEM careers and that as a consequence young people are making judgements about careers from a very low level of understanding – especially when it comes to engineering. Delegates expressed the view that both teachers and careers professionals require significant professional development, including industry placements. They felt that it should be responsibility of careers education staff and subject teachers to increase awareness of what STEM careers information is available and where to go to find more. The statutory requirement to deliver careers education from Year 7 should continue throughout pupils’ school experience. Careers guidance staff should be keeping up to date with trends in STEM careers.

Careers experts were seen as being able to provide a level of impartiality – which subject teachers cannot, though they should work more closely with subject teachers.

Careers and teaching staff should be more aware of, and make better use of, national and local initiatives such as the STEM Ambassadors’ scheme.

Employers

As part of the wider STEM initiative, the STEM Cohesion Programme considers how to secure partnerships and promote future sustainability in STEM education. At its core lies a commitment for the educators and employers to work together to ensure that STEM provision meets curricular and extra-curricular needs of schools and colleges.

Despite this there is still a view shared by some that employers were not doing enough and should take greater responsibility, since they are also beneficiaries of STEM careers activity. There was a sense that employers' needs are not aligned with those of the school system. At present, too few are contributing to initiatives such as Engineering into Education and the STEM Ambassadors scheme. Employers could also help in making school access to their staff, ‘easy and painless’. They should also provide ‘decent work experience opportunities’ for teachers and careers guidance professionals as well as being more proactive in the provision of work experience for young people. Schools and colleges, on the other hand, can help employers maximise the impact of time they spend working in schools by collapsing school timetables so that they can access an entire year group at a time.

Picking up on the importance of parents and siblings in influencing career choices, there was a suggestion that employers should also work through families – and this may extend to include schools in some sort of three-way relationship. Employers too should be involved as early as possible in secondary education. Delegates also felt that industry should be more active in attempting to restore the gender imbalance still prevalent in STEM, through sensitive promotion and continued use of non-stereotypical role models.

Higher Education Institutions

Higher education institutions (HEIs) could do more to find out what is taking place in schools in relation to careers and to know where to direct students for further support. When it comes to promoting higher education courses, how much consideration is given to employment opportunities after graduation? Concerns were raised that neglect of these issues places STEM subjects at a disadvantage in comparison to ‘easier’ or more popular subjects that have no obvious job prospects at the end. Other thoughts about how the survey data could impact on HEIs included making the Aim Higher scheme more universal. 7

“it's not just about cars!”
Comment by delegate at conference, in reference to perceptions of engineering in schools

6 www.bowlandmaths.org.uk
7 Aim Higher seeks to promote HE amongst those that are traditionally seen as ‘disengaged’ from it.
Peter Stagg, Project Leader, highlighted emerging findings from the audit and development work, taking place in the Timeline pilot schools. Most schools provide pupils with opportunities to participate in a range of STEM activities that offer some insight into future STEM careers. In the majority of cases the activity has tended to be planned and delivered at individual department level, but uncoordinated with any other department. The STEM Careers Awareness Timeline pilot has been designed to build on schools’ strengths in this area. It sets out to help coordinate and communicate what is happening and to produce a planned programme that can be followed by a school and replicated elsewhere. Central to this work is an audit undertaken at each pilot school, led by the school-appointed coordinator supported by an external project mentor. Through this work each pilot school has produced a detailed outline of all of the activity taking place and a review of the current status and future potential for more effective STEM careers work.

**Initial findings**

Peter Stagg presented the following common features emerging from the audit to the conferences. Among the positive findings were the following:

- The widespread existence of commitment in principle to STEM careers
- Most schools participate in more STEM career activity than they had recognised
- Some schools have set up STEM groups including careers guidance staff
- The increasing numbers of schools who are appointing a STEM coordinator
- The widespread use of enhancement and enrichment activities
- Schools’ willingness to develop better relations with external partners
However, the findings also indicated some significant challenges:

- STEM departments do not work together
- STEM departments have very little contact with careers staff and careers professionals
- Enhancement and enrichment activities are not evaluated for career learning potential
- Many schools do not have a strategy for supporting learning about engineering
- The opportunities for STEM careers-related CPD for staff are very limited, with teacher placements being rare
- Parents are neither approached nor involved

Conference delegates were asked to consider these findings from the pilot and highlight how to build on these and other strengths they perceive to exist in schools. They were also asked to think about how to remove obstacles. The elements of ‘school’ that they were asked to consider (though not exclusively) were:

- buildings
- curriculum
- experience of staff
- parents
- government and other political priorities
- finances.

A selection of responses is depicted in the snakes and ladders board and accompanying table.

The experience of teaching staff was seen both as strength and weakness when it came to informing about STEM careers, though all teachers were thought to benefit from professional development opportunities, including work experience placements. Schools should promote creativity and enthusiasm amongst teachers and encourage greater risk-taking with the curriculum.

Most mentioned the importance of the physical environment, including how the school buildings reinforce ‘subject silos’. STEM departments should take advantage of opportunities as they arise, through, for example, being active in discussions of the design of new buildings.

Every school should appoint a STEM coordinator to bridge the cross-curricular gap. To be effective the coordinator role should be of sufficient status for the holder to have access to the senior leadership team. Overall there appears to be a high degree of optimism that STEM careers work could benefit from the current thinking on curriculum development and assessment.
Each group was provided with three different lengths of snake and ladder stickers. The longest snake represented the greatest challenge; the longest ladder, the best opportunity. Then they were asked to complete two snakes and ladders boards, one depicting the existing opportunities and obstacles, the other showing how to shorten snakes and lengthen ladders.
TURNING SNAKES INTO LADDERS

- Embed and raise the profile of careers and enrichment in teacher training
- Use restructuring opportunities for new curriculum time
- More variety in pathways to progression such as apprenticeships and foundation degrees
- STEM teachers prepared to challenge these conventions
- Appoint a STEM leader in every school at middle/senior management level
- Focus on the collaborative STEM work across departments when planning new buildings
- Professional development including industrial placements
- Bear limits on space in mind when developing new buildings and better sharing of space
- Develop a school based activity in which parents have to come into school

KEY

Large opportunity

Large obstacle

Medium opportunity

Medium obstacle

Small opportunity

Small obstacle
Table setting out how opportunities and obstacles within schools could be turned into greater STEM careers opportunities.

<table>
<thead>
<tr>
<th>CURRENT SITUATION</th>
<th>POSSIBLE FUTURE SOLUTION</th>
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<tbody>
<tr>
<td><strong>STAFFING</strong></td>
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<tr>
<td>A positive attitude to STEM already exists amongst teachers</td>
<td>Recognise where STEM fits with existing initiatives</td>
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<td>Enthusiasm of staff makes a genuine difference</td>
<td>Reward and recognition for teachers carrying out enrichment activity</td>
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<tr>
<td>Teacher experience</td>
<td>Professional development including industrial placements</td>
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<tr>
<td>Some teachers identify creative ways of using existing resources</td>
<td>Increase teacher risk-taking with STEM curriculum</td>
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<tr>
<td>Difficulty in gaining permission to go on CPD courses for new STEM careers approach</td>
<td>Extra financial resources made available within STEM departments for supply cover</td>
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<tr>
<td><strong>BUILDINGS AND RESOURCES</strong></td>
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<tr>
<td>Limited appropriate space in schools suitable for enrichment activities (e.g. science labs are not ideal)</td>
<td>Bear this in mind when developing new buildings and better sharing of space</td>
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<tr>
<td>Absence of dedicated funding for STEM careers impedes new approach</td>
<td>Provide ring-fenced funding for STEM careers</td>
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<td>STEM subjects physically and perceptually apart</td>
<td>Classroom and teaching swaps along with team teaching</td>
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<td>Building Schools for the Future</td>
<td>Focus on the collaborative STEM work across departments when planning new buildings</td>
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<td>Lack of curriculum time and money</td>
<td>Use restructuring opportunities for new curriculum time</td>
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<td><strong>EXTERNAL RELATIONS</strong></td>
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<tr>
<td>Parents’ poor perception of STEM (many see it as hard and discourage their children)</td>
<td>Government to fund school-based STEM awareness scheme for parents</td>
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<td>Work-related learning</td>
<td>Better involvement of community partners</td>
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<td>Parental influence is based on outdated information</td>
<td>Develop a school-based activity in which parents have to come into school</td>
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<td>CURRENT SITUATION</td>
<td>POSSIBLE FUTURE SOLUTION</td>
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<tr>
<td>GOVERNMENT</td>
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<td>Focus of Ofsted</td>
<td>Ofsted to consider schools’ commitment to professional development</td>
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<tr>
<td>Science is still less important in terms of school targets compared to maths and English (technology – even more so)</td>
<td>Government raises STEM status</td>
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<td>Specialist status (science/maths/technology/engineering)</td>
<td>Establishing ‘STEM’ status</td>
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<td>Too much information and no coordination between outside agencies</td>
<td>Create a single point of contact for STEM careers</td>
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<td>Government recognition of STEM and the need for joined-up thinking</td>
<td>Raised awareness in schools of STEMNET, STEM Ambassadors and business links</td>
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<tr>
<td>SCHOOL ORGANISATION AND LEADERSHIP</td>
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<tr>
<td>Lack of communication between science and maths depts</td>
<td>Collaboration on projects after exams</td>
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<td>Senior leadership team do not necessarily see the importance of STEM and links to careers</td>
<td>Senior team include STEM careers in overall vision and make a commitment to it</td>
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<td>Structure and background of leadership team</td>
<td>Roles and responsibilities of senior team to reflect STEM agenda</td>
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<td>Senior management teams fail to see the importance of STEM in relation to careers</td>
<td>Mechanism in place for seconding a STEM middle manager to senior leadership team</td>
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<td>STEM is perceived by senior managers as being ‘yet another initiative’</td>
<td>Get departments together to show senior managers their shared commitment to STEM</td>
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<td>In most schools there is no clear accountability or ownership of STEM</td>
<td>Appoint a STEM leader in every school at middle/senior management level</td>
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<td>Lack of clear vision on alternative ways to deliver the curriculum</td>
<td>Professional development seen by STEM staff as a process to achieve this</td>
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<tr>
<td>Ineffective or inappropriate use of external partners</td>
<td>External partners made better use of to contribute to extended curriculum</td>
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<tr>
<td>CURRENT SITUATION</td>
<td>POSSIBLE FUTURE SOLUTION</td>
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<tr>
<td><strong>CURRICULUM-RELATED ISSUES</strong></td>
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<tr>
<td>Changes at Key Stage 3, removal of SATs and introduction of Diplomas all offer</td>
<td>More variety in pathways to progression such as apprenticeships and foundation degrees</td>
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<tr>
<td>opportunities for STEM careers</td>
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<tr>
<td>Lots of STEM enhancement and enrichment support</td>
<td>Coordinated support</td>
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<tr>
<td>Exam pressures on time</td>
<td>Build STEM time into curriculum</td>
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<tr>
<td>Qualifications and curriculum development agency lack of coordination of STEM</td>
<td>Using the STEM careers initiative to feed back to QCDA and to the Department for</td>
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<td>subjects</td>
<td>Children, Schools and Families</td>
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<td>Conventions of teaching in each of the STEM subjects</td>
<td>STEM teachers prepared to challenge these conventions</td>
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<tr>
<td>Science and technology have very separate identities</td>
<td>Further Government commitment for ‘real joining up’</td>
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<tr>
<td>Being prescriptive with approach to STEM careers inhibits creativity</td>
<td>Embed and raise the profile of careers and enrichment in teacher training</td>
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</table>
Underlying the STEM Careers campaign motto ‘Science and maths, see where they can take you’ is a firmly held belief that continued study of the subjects will be of benefit for most young people, regardless of career aspiration. They might progress to study STEM subjects at undergraduate level, but what if some choose to pursue the STEM route, then to find other career paths more attractive? Part of the value of a rounded education that includes STEM is to provide more generic skills, for example, to be discerning in selection of information sources in all areas of their lives. This section of the conferences explored how schools might set STEM careers work in a broader context.

Delegates were shown a short specially commissioned film, comprising a series of interviews with five professionals who use STEM skills in their diverse working lives. The interviewees were asked about the importance of STEM skills, both now and in the future. They were also prompted to comment on the value of STEM skills in other areas of their lives, beyond work. In planning a ‘road map’ that could be used for teacher professional development, participants identified milestones in career and non-career contexts, along with challenges to be overcome. They were then asked to consider how STEM skills can help reach some of the milestones and overcome challenges, both in a person’s working life and in a personal context. Groups used these ideas to help answer a number the following questions:

1. Are STEM skills, life skills?
2. What, if anything, is special about STEM skills?
3. What are the important messages for teachers and schools related to the skills that STEM provides?

The views presented suggest that getting through life involved a good deal of problem-solving. Though STEM subjects do not have a monopoly on providing useful spin-off skills, they do offer a powerful set of tools for assessing uncertainty. Many of the STEM skills link in with Personal Learning and Thinking Skills (PLTs), but it was felt that there would be some resistance to the notion that STEM has something special to offer in this area. It would be worth exploring the origins of this perceived resistance in the second phase of the pilot.

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8 These STEM Careers Interviews can be streamed and downloaded from the Teachers’ TV website: www.teachers.tv
The importance of numeracy was highlighted, as was how STEM study encourages people to see patterns in the world around them.

Our culture and education system encourage all young people to express an opinion. STEM can further help pupils by promoting the value of objectivity in helping to differentiate one opinion from another.

There was a feeling in some cases that it is only adults – specifically employers – who are interested in the notion of ‘skills’ and that this should be borne in mind when presenting STEM careers to young people. Concern was raised about over-emphasising STEM as skill sets – better to focus on career case studies that demonstrate enjoyment and success, rather than deconstructing STEM careers to individual competencies.

It was felt that STEM provides young people with some of the tools that they need to assess risk including numerical, quantitative and analytical skills.

“A life is one big experiment...
The principles we learn in science and maths are the core of learning. And whether we learn them in science or elsewhere, they are the things that help us in our lives.”

Carlton Reeve, Executive Producer, Illumina Digital
From the Teachers’ TV Programme produced for the Careers Awareness Timeline

A plea was made to be more explicit in showing how skills are transferable and how they relate to different careers.

Schools need to prepare young people to make the most of what their life brings them. They should encourage students to keep their options open for as long as possible, but the special case for STEM is predominantly an economic one for the country, rather than a re-evaluation of educational entitlement.
The first series of stakeholder conferences took place near the project’s halfway mark. A second series of conferences is scheduled to take place in autumn 2010, with a dissemination event to be held at the completion of the pilot. The participants were asked what they felt needed to be incorporated into the continuing programme of work, to suggest further areas for exploration and to state what they would want to see at the next set of stakeholder conferences. Their responses included:

- Presentation by a head teacher from a timeline pilot school
- Some insight into the decision-making process of students who choose STEM progression
- How can schools encourage young people and their parents to see a career as more than just a job?
- A more detailed breakdown of pupils’ attitudes in relation to STEM – looking at aspirations and ability groups and how the timeline and STEM careers resources are having an impact.
- Is it realistic to be able to see how much progress is made within the timescale of the project?
- Some case studies of what schools are doing that works.
- Who are the experts on STEM careers Information, Advice and Guidance (IAG)?
- Views of business and industry about what is needed in particular sectors.
- Impact on pupils, schools and uptake of CPD.
The rationale for planning the first series of stakeholder conferences was to enable the STEM Careers Timeline Pilot team to consider the preliminary outputs from its work in schools. The presentation of pupils’ and teachers’ perspectives at the mid-point in these stakeholder forums will help the team both to focus on areas of specific concern and to raise lots of concerns.

Successfully embedding STEM careers into the Key Stage 3 curriculum and the wider school experience will remain a challenge for schools, managers, Government and the STEM community. Models of good practice will go some way to achieving success, though the organisational, resource and cultural features associated with changing how schools approach the topic will need to be addressed if the successful aspects of the pilot are to be translated into sustainable mainstream practice.
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ACKNOWLEDGEMENTS

The project team wishes to thank the following for their support:

Jill Collins
Centre for Science Education, Sheffield Hallam University

Haley Cox
National Science Learning Centre

Denise Eaton
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Ken Mannion
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Pat Morton
Centre for Science Education, Sheffield Hallam University

Claire Nix
VT Enterprise

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National Science Learning Centre

Science Learning Centres:
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