STEM Careers Awareness Timelines

Attitudes and ambitions towards science, technology, engineering and maths (STEM at Key Stage 3)

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STEM REPORT

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iCeGS in partnership with the Centre for Education and Industry (CEI) at Warwick University is delighted to present key findings from the first stage of the fieldwork carried out as part of the 'STEM careers awareness timelines' project. The careers awareness timelines project has been designed to embed a series of stimulating STEM careers related interventions into Key Stage 3 learning. The project has involved recruiting and mentoring 28 schools nationally who are planning and delivering their own activities to promote STEM Careers. This occasional paper reports on the findings from year seven and year nine pupils from 26 schools surveyed during the autumn / winter term of 2008. Each of the participating schools have recieved the feedback from their own school alongside the national findings to inform their planning for further activities as part of their timeline projects.

Acknowledgements

The research staff and mentors at the International Centre for Guidance Studies and the Centre for Education and Industry wish to thank our school contacts and all the pupils who participated both in the survey and in the wider project in ensuring the smooth progress of the careers awareness timelines project.

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1. Introduction

1.1 Background

The importance of science, technology, engineering and maths (STEM) expertise to the UK economy is generally accepted as key to maintaining our international competitiveness. This importance was noted in the 2002 review by Sir Gareth Roberts, 'Set for Success: The supply of people with science, technology, engineering and mathematics skills'. This report stemmed from the, *'Government's concern that the supply of high quality scientists and engineers should not constrain the UK's future research and development (R&D) and innovation performance.'* (Roberts, 2002, p.1)

> *'A shortage of graduates in these disciplines is likely to become increasingly serious since the UK economy – with its large financial services sector, strong science base and increasing focus on high-tech and high value-added manufacturing businesses – is likely to need more mathematics and physical science graduates, not fewer'* (Roberts, 2002, p. 49).

The report highlighted increasing employer difficulties in the recruitment of suitably qualified scientists and engineers, and corresponding implications for future UK competitiveness. Although recruitment data revealed that employers and universities were not doing enough to attract candidates by offering competitive conditions of employment, the report highlighted '*poor experiences of science and engineering education among pupils generally, coupled with a negative image of, and inadequate information about careers arising from the study of science and engineering*.' Addressing these issues would require, '*Action in schools and further and higher education*' (Roberts, 2002, p.3).

Recent years have thus seen much emphasis placed on the quality of learning and teaching of STEM subjects in schools, accompanied by adequate IAG provision. However, STEM subjects are being dropped at school by young people in favour of other choices prior to, and following GCSEs, with worrying implications for higher level STEM study, and subsequently careers such as engineering, construction and scientific research. Consequently, the Department for Children, Schools and Families (DCSF) have developed a suite of 11 Action Programmes within a strategic framework to prioritise STEM issues. Action Programme 8 focussed on careers and seeks to achieve two 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.

The Centre for Education in Industry (CEI) with the International Centre for Guidance Studies (iCeGS) and Isinglass Consultancy are partners in the delivery of a STEM Careers Awareness Timeline Pilot project which is a part of Action Programme 8.

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 at Key Stage 3. Some 28 schools across England have participated in the pilot scheme. 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. 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. This paper presents an overview of findings from the survey of year seven and year nine pupils which explored their attitudes to all subjects, their career awareness and their aspirations.

From a young person's perspective a complex interplay of internal and external factors affect subject choice. Major influences on subject preference are often outside the control of the school classroom and can take effect well before attitudes to lessons are taken into consideration. As Roberts (2002) notes:

> *'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 pupil's 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.'*

However, the role for high quality teaching of STEM, and elucidation of STEM career pathways in lesson time and through effective IAG can be significant. The following sections present factors which have been found to affect pupil choices in education and lesson preference.

Parents and families

Many studies find the influence of parental factors to be extremely pervasive. One such study was *Young People's Job Perceptions and Preferences* by Millward et al (2006). This study of 14-19 year olds found that '*parental advice was the most frequently sought and useful of sources for making job, careers and course decisions than advice obtained by teachers and friends.'* Pollard et al (2003) also found that '*parental influences appear often to be more important than teachers or other influences*.' The Gender Equalities Office report (2004), considering how to close the gender pay and opportunities gap, found that parents were seen as a 'major influence' and there was also '*reliance upon teachers for careers advice'*. Thus immediate guardians have been found to be the most important influences on pupil choice, although significant others exerting an influence clearly exist.

STEM careers and gender

As previously mentioned young people's views of STEM subjects and careers are highly gendered. A Royal Society report (2004) of SET practitioners found that 'some branches of science are seen as male only domains', and, 'the top-of-the-mind view of scientists is a stereotype: they are seen as white, male and eccentric'. Smart (2008) found in interviewing Bangladeshi girls that words associated with science and maths included '*masculine'*, '*difficult'*, '*restricted'* and '*risky'* – reflecting findings within the Morris (2006) and ETB (2005) reports and reiterating the link between present feelings, perceptions of future usefulness and eventual subject drop. Smart (2008) also reports that technology was seen to be an 'especially male' subject among the Bangladeshi girls interviewed. The girls were found to have more positive feelings about biology and chemistry due to the links between those subjects and the medical profession, a profession found in many reports to be the exception to the rule that '*girls stay away from science'*. (Roberts, 2002)

There were certain views of STEM subjects revealing attitudes about STEM careers which emerged from the various reports. The IET literature review (2008) stated '*pupils do not see STEM subjects as being the passport to successful and lucrative employment*' – a finding which was echoed with the ETB (2005) findings in which the 'perceived usefulness' of science lagged behind that of maths and English. Smart et al (2008) found that the girls interviewed saw STEM subjects as 'linked to careers in restricted fields.' However, perceptions of careers in STEM were generally inseparable from perceptions of them as being predominantly 'male' or 'female' careers. Although focusing on the labour market and skills shortages, Millward et al (2006) noted, '*young people hold very strong stereotypes about the types of jobs that are appropriate for men and women*'. Despite this general feeling of 'entrenchment' found in most studies, the Equalities and Human Rights Commission report (2005) found a, '*significant number of young people – girls in particular – keen to break out of the roles traditionally assigned to them*.'

The media was shown to be a pervasive influence on the take up of STEM subjects; particularly in relation to the entrenchment of gendered views. Millward et al (2006) noted that, '*job adverts and college prospectuses may perpetuate gender segregation in the implicit gender messages they convey*.' Furthermore, the IET report (2007) of SET practitioners looked retrospectively at factors which had influenced their career paths and found the media highly influential on their choices.

School and teachers

Teachers, the organisation of the curriculum and other organisational factors were shown across many reports to affect the take up of STEM subjects. The Roberts review noted that; '*teachers' subject knowledge and teaching style are vital factors, but it is often their enthusiasm that captures pupil's interest and motivates them to study a subject.*' Lord and Jones (2006) also found that teacher input was highly important to pupil enjoyment of the national curriculum. It has been noted however, that continuing professional development has been missing among STEM teachers. Roberts (2002) found that CPD generally among teachers was found to be lacking; *'it is worrying that few teachers develop their subject knowledge through CPD.*'

Curriculum content is also important. '*Pupils enjoy subjects and activities where teaching and learning is active, participatory and has practical application*.' Thus as well as the approach of the individual teacher, the content of the curriculum was rated as significant. Studies have shown that, '*science teachers only rarely collaborate with other teachers of STEM subjects'* and, '*the organisation of the curriculum and timetabling, all inhibit such links'*, (CEI, 2006). However Austin et al (2001) highlighted the relative difficulty of teaching certain aspects of engineering within 'technology' options subjects, exacerbated by a lack of communication between science and technology departments on aspects of the curriculum.

The report, 'Choosing Science at 16: The influences of science teachers and careers advisers on pupils decisions' (Munro and Elsom, 2000) showed that pupils' experience of science in the classroom was the main factor affecting their decisions to take science further or not. However within timetable constraints, lesson time and teacher input was often found to be insufficient to deliver all the necessary information and guidance on careers that STEM options facilitate. Also however, Munro and Elsom (2000) found that, 'science teachers did not see themselves as a source of information or advice about careers in science and technology'.

Careers Education, Information, Advice and Guidance (CEIAG)

Given the findings of Munro and Elsom (2000) on STEM teachers and their perceived roles, delivery of high quality information, advice and guidance outside the classroom would appear to be extremely important, especially in ensuring that it is grounded in commercial and industrial realities. However, certain reports have presented a mixed picture of prevailing quality and impartiality of careers advice for young people. The Women and Work Commission (2004) found a minimal influence of Careers Education, Information Advice and Guidance (CEIAG) provision for pupils. '*The girls told us that, in their view, the quality of careers advice from Connexions is very poor*.' Within their study Millward et al (2006) found only four per cent of the 120 pupils mentioned interviews with Connexions advisers as a useful source of careers guidance/ advice. These negative (possibly first) experiences for young people of CEIAG in schools are worrying given the research which has shown the positive impact an early careers interview can have on people's perceptions of IAG (Wilson and Jackson, 2000).

Pollard et al (2003) in their 'Ready SET Go' report reiterate the point that, '*the attitudes of family and friends operate at all ages and can be very influential*.' This, in turn meant that '*formal careers advice can have very little impact*.' There are variations to this pattern of IAG commentary however. Blenskinsop et al (2006) noted; '*when pupils felt supported in decision making by the school they were more influenced by school factors such as individual talks with teachers and CEG provision and less reliant on external factors such as friends and family*.' Their research based on a large sample tested over time, found that where schools implement CEIAG programmes across the curriculum, pupils feel better able to make decisions and those decisions are more likely to prove sustainable.

Work experience

Several studies found the importance of work experience to be particularly influential. Smart (2006) found that several of the girls surveyed cited the importance of work experience in their decision to take (or not to take) science subjects. In the IET report (2007) when asked to describe three factors responsible for leading to their working in STEM careers, the respondents listed work experience as the second most important factor, along with the TV and media. Lord et al (2006) found '*vocational relevance*' to be a highly important trait of education to young people, again indicating the importance of perceived '*usefulness*' for the future. These findings would suggest that effective methods do exist for ensuring greater clarity about career pathways in STEM education.

Attitudes towards STEM subjects

Feelings about STEM subjects at school have consistently been shown to influence take up of these subjects following GCSE, and these attitudes, '*harden at a very early age*' (Pollard, 2003). Frequently student attitudes towards subjects are rooted in perceptions of gender '*fit*', and together with perceptions of relevance for future career, ease or difficulty and enjoyment are consistently found to be major factors in decision making.

An IET literature review (2008) looked at the various causes of the decline in take up of post-16 STEM subjects. This review found that a major cause was '*pupils do not believe they will achieve the same grades in STEM as in other subjects*.' Also revealingly, '*there is the perception that anyone who achieves in STEM is a 'geek' or a 'nerd'*.' This study also noted the importance of the media, peers and parents as being the major influencers on whether to opt for a STEM career or not. The perception of STEM subjects as being '*difficult*' or, '*geeky*' is widely reported. However, Morris (2006) also identified perceptions as important in influencing young people's views of subjects. Factors affecting take up were classified into '*intrinsic*' and '*extrinsic*' factors, intrinsic

factors included enjoyment of those subjects, and extrinsic factors referred to perceptions of the subjects' potential role in a future career. Findings within this report included; maths being seen as 'masculine' and correspondingly often found to be more popular with boys; as was the case with science (ETB, 2005). Maths and science were both likely to be seen as '*challenging*' – also the case in the IET report (2008) and Roberts review (2002) – and whereas maths is often seen as useful for future careers; science was less likely to be considered necessary.

Despite negative assessments of the usefulness of science, a general enjoyment of science relative to maths was found to be the norm across several studies (ETB, 2005 and Munro & Elsom, 2000). The ETB report of year nine pupils (2005) found that whereas 50% agreed that they enjoyed science, a lower proportion, 41%, reported that they enjoyed maths. Interestingly, science was seen to be nearly as enjoyable as English (52%).

Positive responses on the enjoyable and interesting nature of science frequently conflict with its perceived difficulty and 'usefulness' for future work. Within the ETB (2005) report only 29% of the pupils agreed or strongly agreed that science was an easy subject, compared with 39% who reported that mathematics was easy and 42% said the same of English. When asked whether they thought that the subjects were necessary for a good job, 55% agreed that science was necessary, compared with 83% for maths. Although more likely to be seen as boring, maths was also far more likely to be seen as necessary.

Summary of factors influencing young people's choices

The Roberts Review has highlighted the need to ensure that the UK economy has people skilled in science, technology, engineering and maths to ensure sustainable international competitiveness. However, employers and universities report increasing difficulties in recruiting young people with these skills. Government strategy to address this issue is to encourage high quality teaching that engages and enthuses young people, alongside improved careers education, information, advice and guidance, to encourage them to take these options further to open doors to a wide range of interesting and varied careers.

The likely impact of this strategy on young people's actual subject choices has to be assessed in the light of their decision making skills. While they are not a homogenous group, certain factors influence the decisions that all young people make about their learning and future careers. These include:

- Gender as stereotypical views of option and career choices prevail
- Family and the direct and indirect influences of parents and the extended family
- Formal education, teaching style, curriculum content and work experience
- Interest in and enjoyment of subjects, alongside whether young people consider themselves to be good at it; and
- Careers education, information, advice and guidance can be influential when implemented effectively.

1.2 Questionnaire survey of Key Stage 3 pupils

As part of the 'Careers Awareness Timelines' project, in partnership with CEI, iCeGS have managed a survey among young people to explore attitudes to STEM and careers. Most studies of decision making have tended to focus on young people's decision making in general (Foskett, 1997, Kidd and Watts, 1996) or year 10 and 11 in the context of destination choices (Morris, 2006, Hodkinson, 2004), however the survey that informs this paper relates solely to Key Stage 3, and links subject choice with career choice. As the survey is part of the 'timeline' programme, it will be repeated in September 2010 to provide a longitudinal perspective of work in the

participating schools. All schools have been provided with feedback of how their own pupils responded alongside the average from across all schools. The survey results have been used by many schools to plan appropriate activities for inclusion in the project, highlighting areas where pupils might lack understanding, knowledge or interest, and where further careers focussed work might help better inform and motivate pupils.

Questionnaire development

A questionnaire was designed using SNAP software and piloted with year seven pupils, amended and then distributed to contacts within participating schools in September 2008. The survey was anonymous for young people, they were asked to identify only their gender, their year of study and the school they attended. Question areas then explored:

- Enjoyment of all subjects currently being studied
- Attitudes towards STEM subject study
- Attitudes towards future subject choice and its importance
- Career goals and aspirations related to STEM careers and industry sector
- Sources of information, advice and guidance.

Schools were instructed to select proportions of year seven and year nine pupils to take part in the study, and they were able to respond to either an online or paper version of the questionnaire within lesson time. The timeline mentors liaised with school contacts to ensure paper copies of the questionnaire were received and word documents enclosing a link to the online version of the questionnaire made available. Schools were provided with resources to introduce the purpose of the survey and signposts to further sources of information if they required this. Mentors were also on hand to ensure project timelines were adhered to and questionnaires completed. The fieldwork stage lasted from September 2008 until January 2009.

Fieldwork and school reports

Questionnaires completed online were imported using SNAP software and subsequently analysed using SPSS. Paper copies of the questionnaire were received through the postal system and manually inputted, then analysed as part of the full dataset using SPSS. Following receipt of all of the responses from each school, two school specific data reports were produced for year seven and year nine giving answers to each question in a set PDF format. This was distributed by the school mentors to their contacts within each school.

Overall analysis

Following the individual analysis of the school responses and submission of school reports, an overall analysis of the data was carried out. An interim 'Data report' was produced and presented, detailing the main findings. This report concludes the overall analysis stage, presenting all findings and analysis from 26 schools that eventually submitted questionnaires (a full list of the participating schools can be found in the appendices). Further analysis of the dataset will be undertaken and published elsewhere to explore further differences between different types of school and the responses of pupils.

2. Survey Analysis

2.1 Survey responses

A total of 27 out of the 30 pilot schools returned questionnaires, but for technical reasons returns from 26 schools are included in the overall analysis. As Table 2.1 shows, a total of 4073 year seven and year nine responses were analysed. There were a slightly higher number of females responding to the questionnaire than males which may partly be attributed to the fact that there were more girls' schools in the sample, and there were in addition slightly more year seven responses than year nine mostly attributable to higher proportions of returns from Y7 from four schools.

Table 2.1 Summary of questionnaire returns analysed

	Year 7	Year 9	Total
Males	1029	920	1949
Females	1142	982	2124
Total	2171	1902	4073

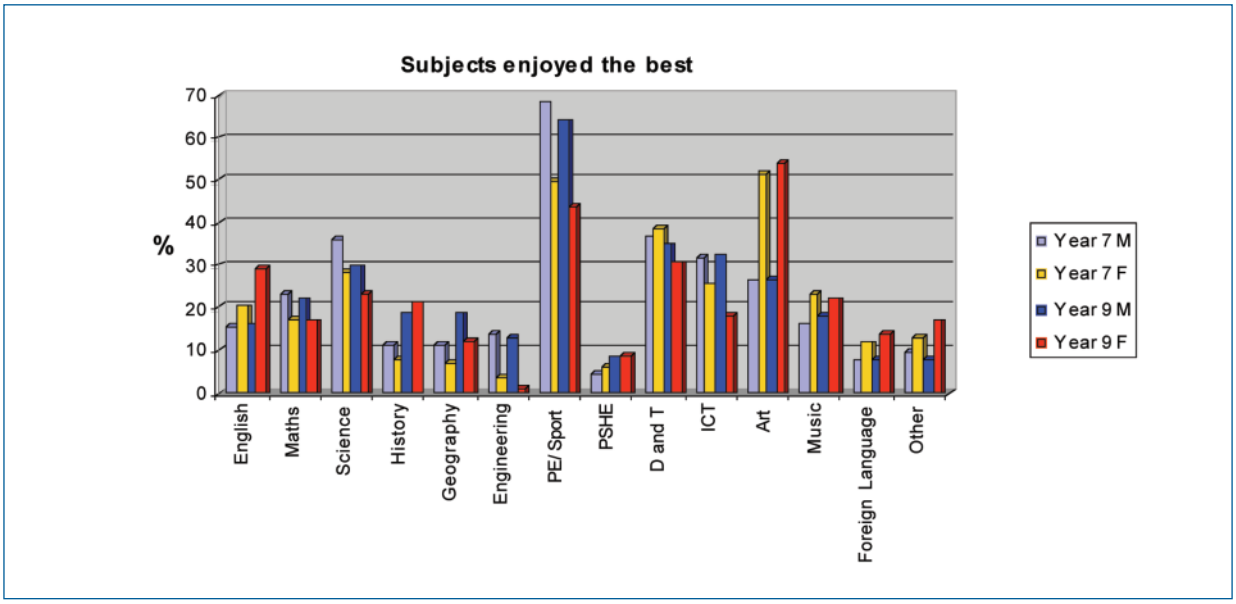
The following section of this paper summarises key findings against each of the question areas, with year group and gender differences highlighted throughout.

2.2 What subjects do young people enjoy?

The questionnaire firstly asked pupils to choose the three subjects they enjoyed the most and the least. As graph 2.3 – broken down by year and gender – shows, pupils were most likely to choose PE, art and design and technology as their three most enjoyed subjects, the overall average number choosing these subjects ranging from 35.8% for design and technology, up to 56.5% for PE. This reflected a general pattern throughout the findings for design and technology being the most favoured of the STEM subjects, and is reflected in student responses to later questions rating this subject as 'easy' and 'enjoyable' more so than the other STEM subjects, science, maths and engineering. It is worth noting that the number of schools offering engineering as a subject was relatively small therefore measures of 'ease' and 'enjoyment' of the subject have to be treated with caution. Pupils were also far more likely to rate design and technology – than other STEM subjects – as a subject they were good at, perhaps also indicating a reason for a high level of preference for this subject.

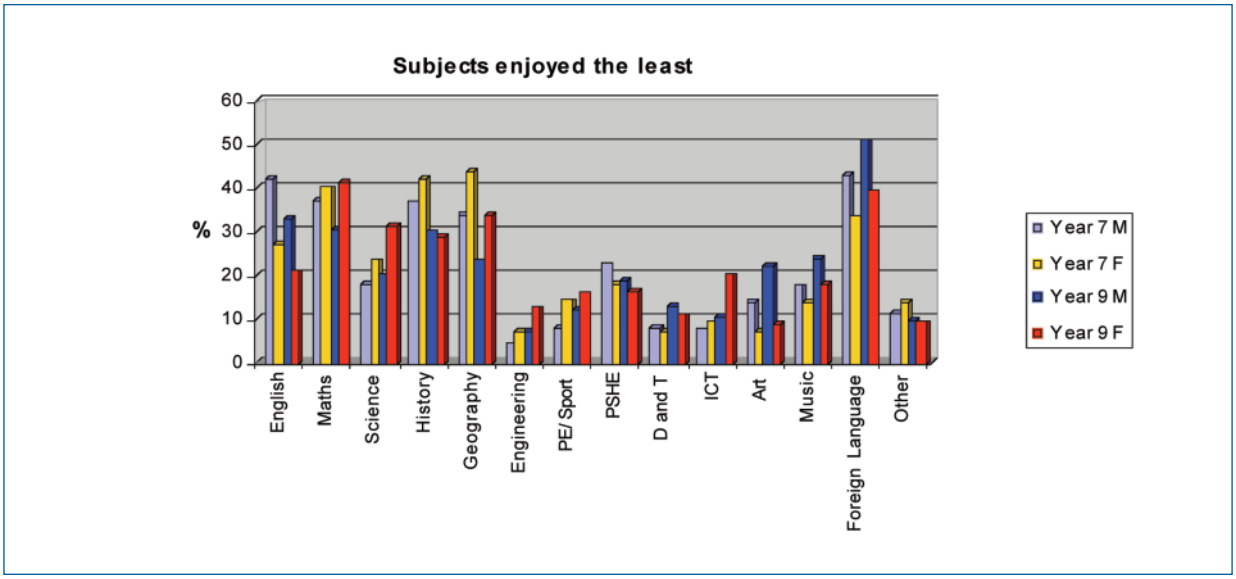
The other STEM subjects; science, maths and engineering were less likely to be chosen as a popular subject. While science was the fourth most popular overall – almost 30% of pupils choosing it for 'one of three subjects enjoyed the best' – just over 20% chose maths, and engineering was the least likely of the STEM subjects to be chosen, around eight per cent choosing this subject as among their top three. Again, these results reflected later findings on 'ease', 'enjoyment', and whether pupils perceived themselves to be good at a certain subject or not. For example, science was rated as more enjoyable than maths by over 20 percentage points. These findings thus reflect those of Munro and Elsom (2000) that science was generally enjoyable, and the ETB findings (2005) which also showed science to be more enjoyable than maths.

Graph 2.3



The three 'least enjoyed' subjects were some of the subjects scoring poorly in graph 2.3 above namely, foreign languages, maths and history. Design and technology and science were less likely than maths to be chosen as a least enjoyed subject, but this does show a trend that pupils show little ambivalence towards studying maths, either they enjoy it or they don't.

Graph 2.3a



Differences between the opinions of year seven and nine pupils on subject enjoyment existed, and hinted at a tendency towards increasing disillusion with STEM with age. Pupils were less likely to choose science or design and technology as among their most enjoyable in year nine than they were in year seven, a statistically significant difference. And, although the preference for maths remains quite constant at about 20%, the increase in preference for humanities subjects; history (by around 10 percentage points), geography; (around six percentage points) and

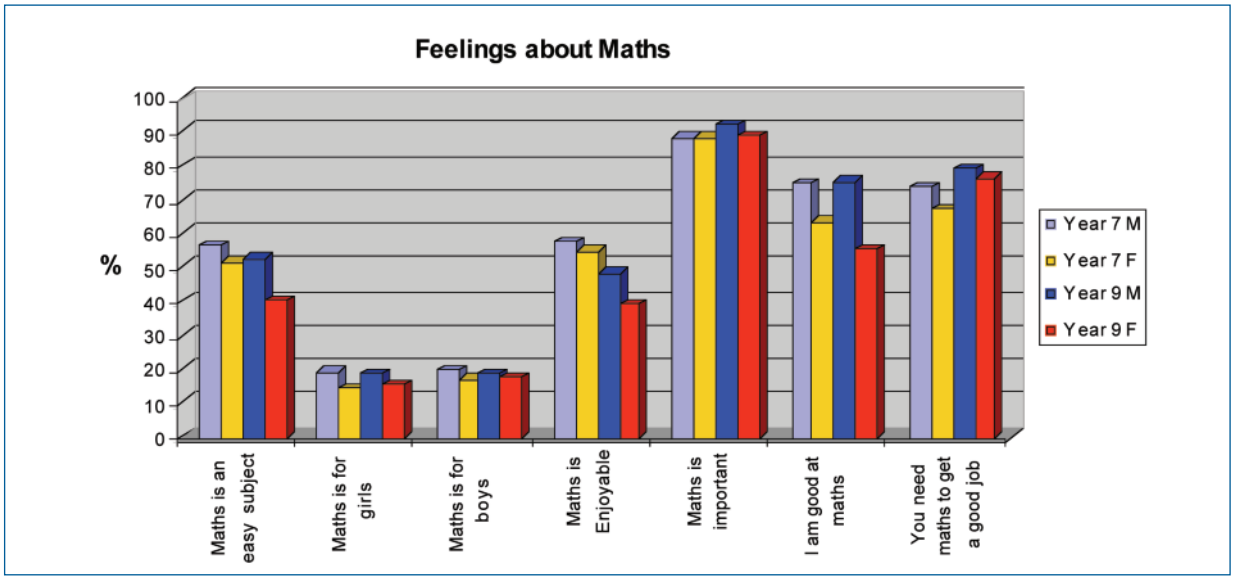
English (4.8 percentage points) would seem to show pupils at key stage four beginning to move away from STEM subjects. This was the case for both boys and girls and might reflect the 'hardening of attitudes' that Pollard (2003) refers to.

Somewhat in line with the findings of Smart (2008), gender differences in responses existed, with girls generally displaying less of a preference than boys for STEM, and more of a preference for other subjects. For example, although 33.5% of boys chose science as a top three subject for enjoyment, the figure was 26.5% for girls. Boys were also more likely to choose maths in their top three subjects, 23% of boys choosing maths compared with 17.4% of girls. Boys were more likely than girls to strongly agree that maths and science were easy and enjoyable. Perhaps in explanation of this, girls were more likely to choose English as a top three subject than boys, while art, music and foreign languages were also more likely to be chosen by girls than their male counterparts.

2.3 What STEM subjects do young people think are important?

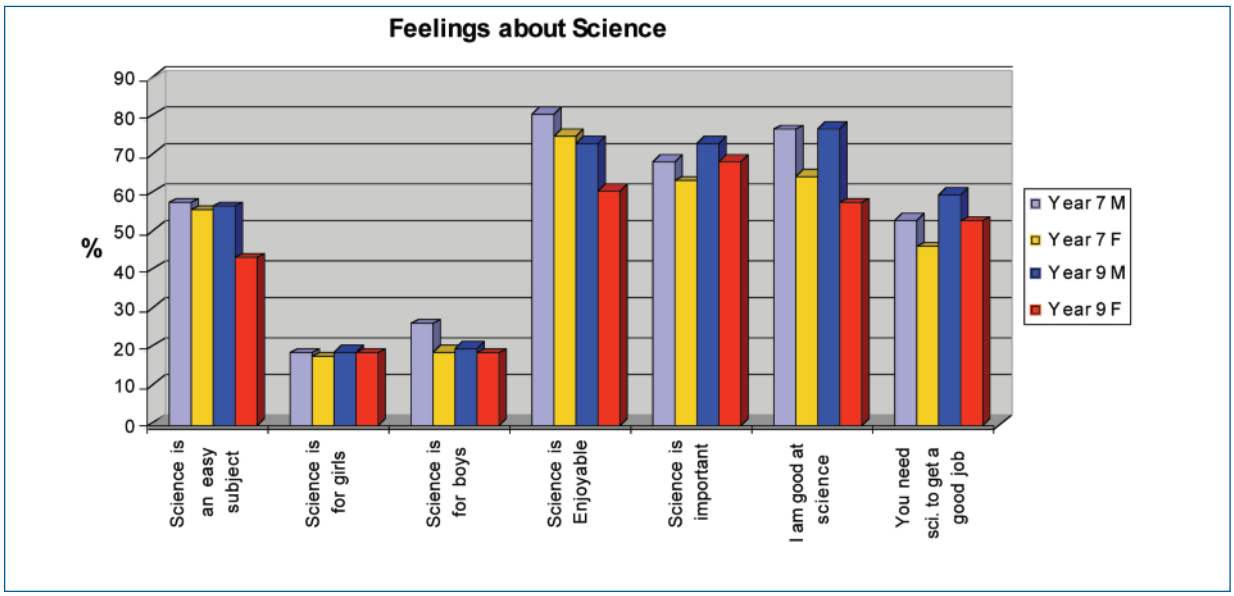
Pupils were asked about their feelings on each STEM subject in particular, with questions including perceptions of individual STEM subject; ease, enjoyment, importance and need, while gender 'fit' questions were added to gather perceptions on whether STEM subjects were suited to one gender over another.

Graph 2.4



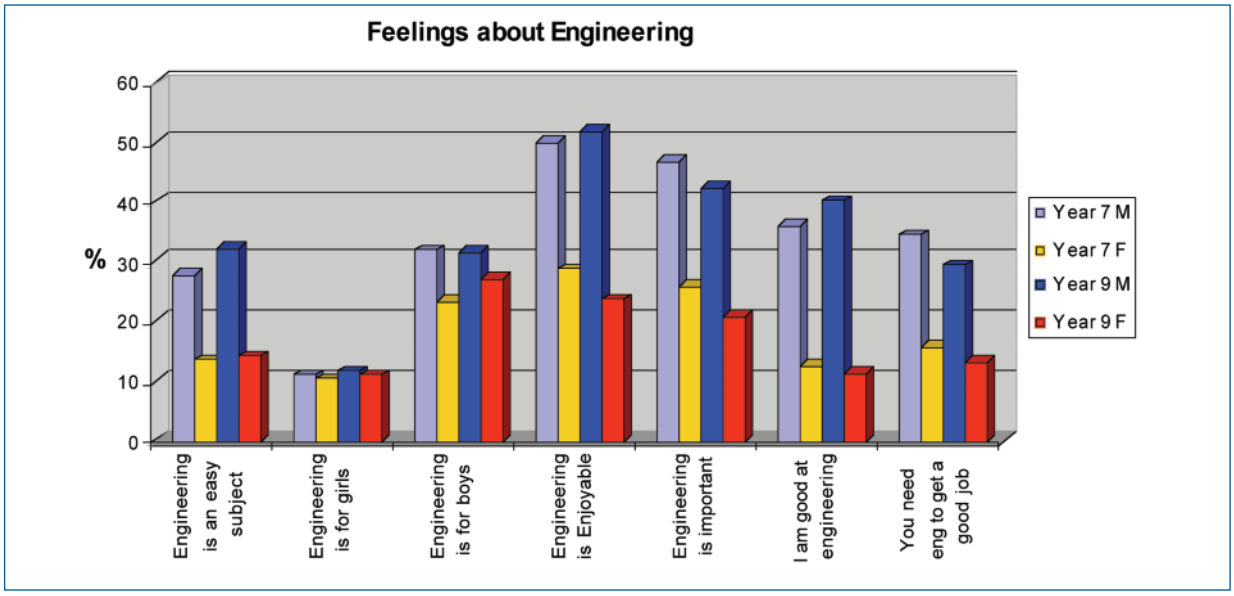
As can be seen in graph 2.4, maths was seen to be important and needed for a good job. Almost 90% rated it as important, and nearly three quarters overall thought that it was needed for a good job. Graph 2.4a shows that although nearly 70% rated science as important, just over 50% thought science was needed for a good job. Thus, although high proportions of pupils see an importance and need in studying these STEM subjects, these findings corroborate the findings of the 2005 ETB report, in which science was seen as less important than maths for a good job by quite a margin.

Graph 2.4a

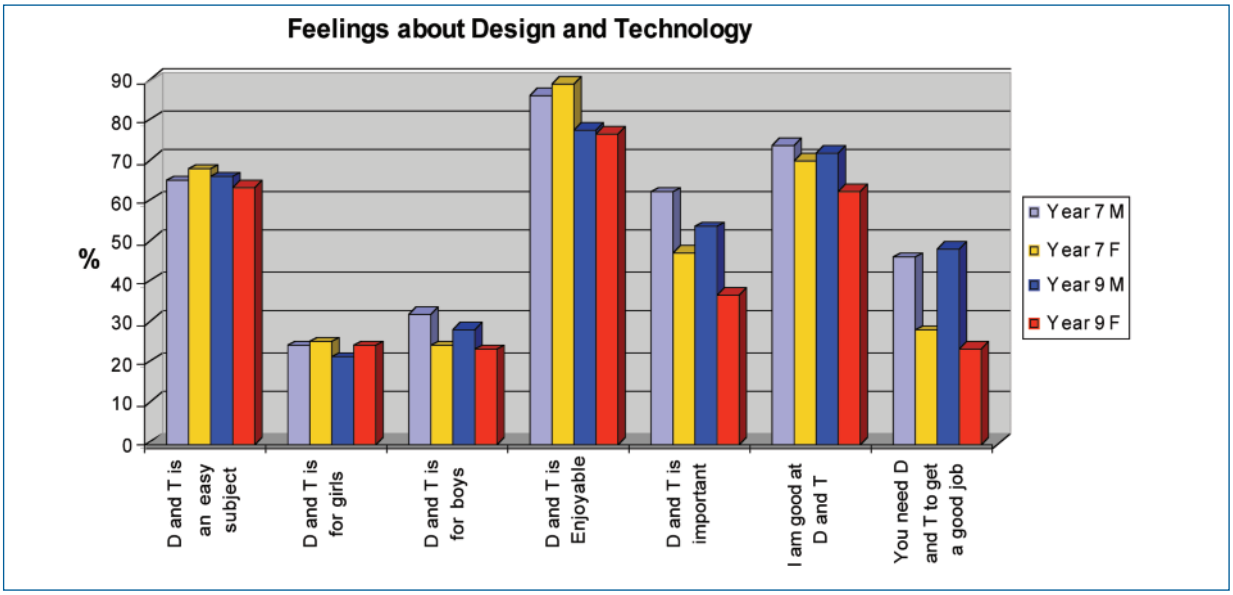


Graphs 2.4 (b) and (c) show that while design and technology and engineering respectively were rated as less important or needed for a good job than science or maths, around 50% still rated design and technology as important and over a third that it was 'needed for a good job'. Overall figures for the importance of engineering were 33.9% and 'needed for a job' was 23.2%. It is worth noting that although the number of schools offering engineering as a subject was small, all student responses on the 'importance' and 'need for a job' of engineering can be thought of as valid perceptions of the subject.

Graph 2.4b



Graph 2.4c



There were slight differences in year group responses to the questions of STEM importance and need for a good job. While year nine pupils were slightly more likely to rate science and maths as important and needed for a good job, this was not the case for engineering and design and technology; the percentages of pupils rating these subjects as important and needed for a good job falling slightly following year seven. This could be due to these subjects' lack of 'core status' in the curriculum, and their corresponding non-statutory nature in most schools at key stage 4.

When asked about the attributes of the individual STEM subjects pupils were asked about the gender 'fit' of those subjects. As the graphs above show, generally pupils didn't believe that any of the STEM subjects were greatly suited to one gender over another. Under 20% of pupils answered that maths or science were either 'for boys' or 'for girls', and there was little variation by gender response. Slight deviations from this were found with design and technology and engineering however. Namely design and technology was more likely to be seen as *both* a 'male' and 'female' subject, while engineering was more likely to be seen as a subject for boys rather than girls, with a greater proportion of boys (over 10%) holding this view.

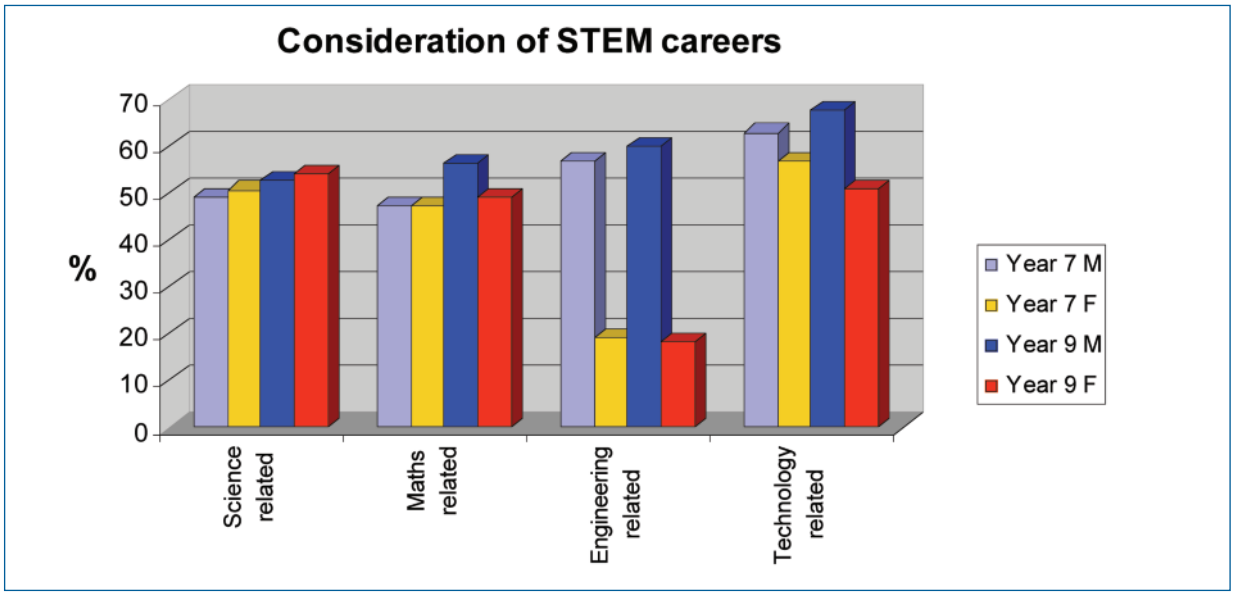
Gender differences in perceptions of usefulness of STEM subjects for a job could be seen in the proportions giving a 'strongly agree' response to the STEM subject statements on 'importance' and 'need', and reflect earlier findings on the perceptions of STEM among girls (Smart, 2008). Although both genders tended to either 'strongly agree' or 'agree' that STEM subjects were useful and important, boys were more likely to 'strongly agree' that STEM subjects were needed for a job and more important than girls. This was especially the case for engineering, where boys were far more likely to both strongly agree and agree with the statements.

Results from question eight of the questionnaire reiterate the findings that boys both enjoy, and see a greater need for science and maths. Boys were slightly more likely than girls to respond that they were keen to study maths and science and that those subjects were important. These gender differences between the years became more marked in year nine, indicating perhaps that gender based subject feelings become more entrenched approaching GCSE, and why girls may tend to steer clear of taking STEM options and then careers at higher levels (Royal Society, 2004).

2.4 Would young people consider a career related to STEM subjects?

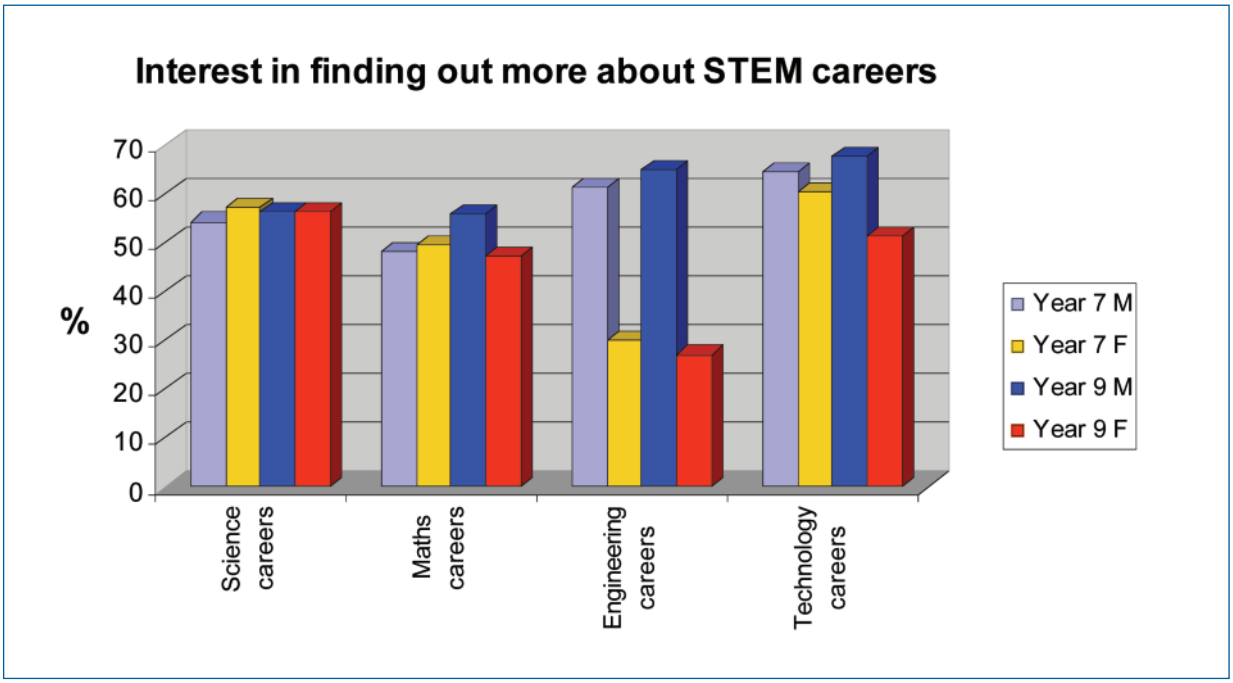
Pupils were asked if they would consider working in STEM related careers using, science, technology, engineering or maths, and if they would like to find out more information about careers in each of those areas. The percentages of pupils saying 'yes' when asked if they would consider a STEM related career ranged from 59.3% for technology to 37.9% in engineering – however large differences in gender responses were also apparent, somewhat concealed in the overall average figure. 51.5% of pupils overall would consider a career in science, while the proportion for maths was 49.7%. The results can be seen below in graph 2.5. Further analysis revealed the link that those pupils who found maths, science, engineering and technology easy and enjoyable were far more likely to say that they would consider STEM careers later on.

Graph 2.5



Similar results could be seen with responses about a desire for more information about STEM subjects (results displayed below in graph 2.5a). Pupils again expressed the most interest in technology, the highest percentage answering 'yes' when asked if they wanted to find out more information on careers in this area. Around 50% of pupils reported that they wanted to find out more about maths and science. Engineering was the least likely of the STEM subjects to be selected for either more information or in consideration of a future career. Thus it would appear that despite moderate preferences for STEM subjects indicated earlier, many pupils would like more information on, and consider careers in STEM, and indeed, 84% of pupils who participated in the survey said that they would like further information about at least one STEM related career.

Graph 2.5a



Generally there was very little difference in responses by year group to the questions of 'consideration' or 'more information' and those differences that exist are not statistically significant.

However, gender differences with regard to the question of 'more information' and 'consideration' were marked for design and technology and engineering subjects. Whereas around 60% of boys expressed a desire for more information and that they might consider careers in engineering, this figure was closer to around a quarter of girls. Likewise girls were less likely to express an interest in receiving more information or consider careers in design and technology, although the difference here was less marked and over 50% of both boys and girls answered 'yes' to those questions. There was very little gender difference with regard to interest in more information and likelihood of considering science and maths careers. This probably reflects the findings that girls saw an importance in the STEM subjects despite not being 'keen' to study them.

2.5 Which industries might young people consider working in?

The questionnaire presented young people with a list of industry sectors taken from the Job Families developed for Jobs4U, the Connexions Direct Careers Database (www.connexions-direct.com/Jobs4u). Industry choice was found to reflect enjoyment for the subjects highlighted earlier in the report. Namely, careers most likely to be chosen as possible future routes were; design and technology (42.5%), performing arts (41.2%) and leisure, sport and tourism (40%). Careers least likely to be chosen as possible future routes included retail sales and customer service (12.6%), languages, information and culture (14.1%) and manufacturing and production (16.9%). This reflected preferences for PE and sport, art and design and technology and a general dislike of foreign languages. Graph 2.6 shows these results.

Popularly conceived STEM careers such as science, mathematics and statistics, and engineering were also presented as options in the questionnaire, along with building and construction and

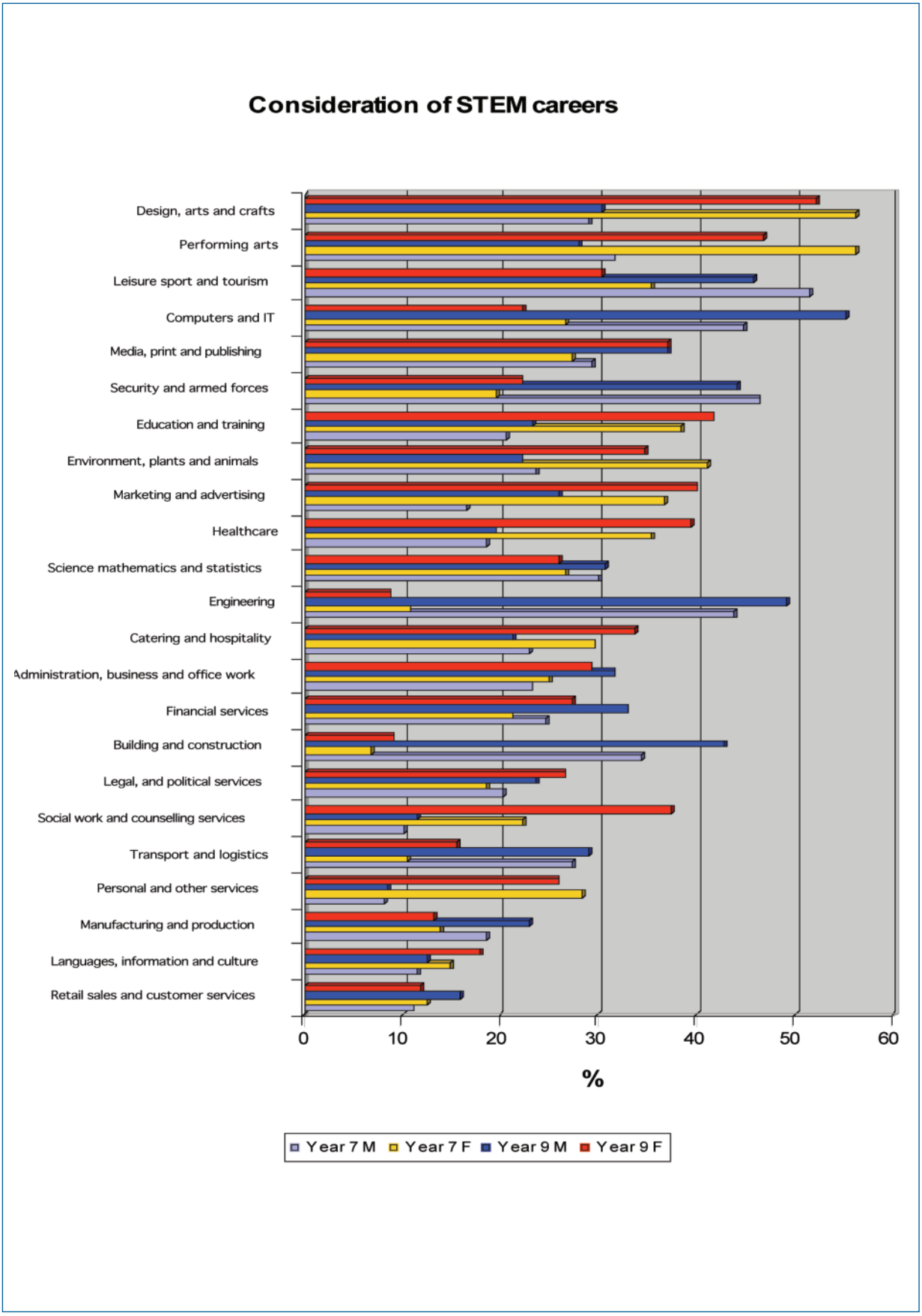
manufacturing and production. However these choices were relatively unpopular, with between 15.0 and 28.2% of pupils selecting them as possibilities. This contrasted somewhat with the above finding of a relative interest in general STEM careers, although could be due to an inherent lack of awareness of careers included within job families such as science, mathematics and statistics.

Year group difference in career preferences varied by sector and career, and these differences are visible in the graph 2.6. While the three most readily chosen careers remained as likely or less likely to be chosen between years seven and nine, other careers such as marketing and advertising and media, print and publishing were more appealing to year nine pupils. This was also the case with financial services and legal and political services. There were few major differences in percentage preferences for STEM subjects between year seven and nine, only a six percentage point greater preference for building and construction among year nine pupils. This may reflect the case that by year nine pupils are beginning to think about their futures based more on realism and informed by careers education and guidance within schools.

Gender differences in future likely industry choices were significant, and reflect existing gender stereotypes. Girls were far more likely to choose design, arts and crafts and performing arts compared with boys – whose likely consideration of these careers was a little over half that of their female counterparts. Girls also more readily chose education and training, healthcare, and social work and counselling services – the difference between boys' and girls' preferences for the social work and counselling profession jumping from around 12% in year seven to around 26% in year nine.

Boys also often chose according to stereotypes and in accordance with earlier subject preference patterns. Namely, likely industry destinations for boys relative to girls included leisure, sport and tourism, security and armed forces and building and construction. Other careers such as science, mathematics and statistics and manufacturing and production yielded less of a difference in gender preferences. Computers and IT became much more of a male choice in year nine – the difference between the proportions for girls and boys choosing the subject rising to nearly 25 percentage points – while the ratio of boys relative to girls selecting engineering also rose. Thus gender difference was found to be most apparent in the analysis of future likely careers, but certainly reflected subject preference differences already highlighted.

Graph 2.6

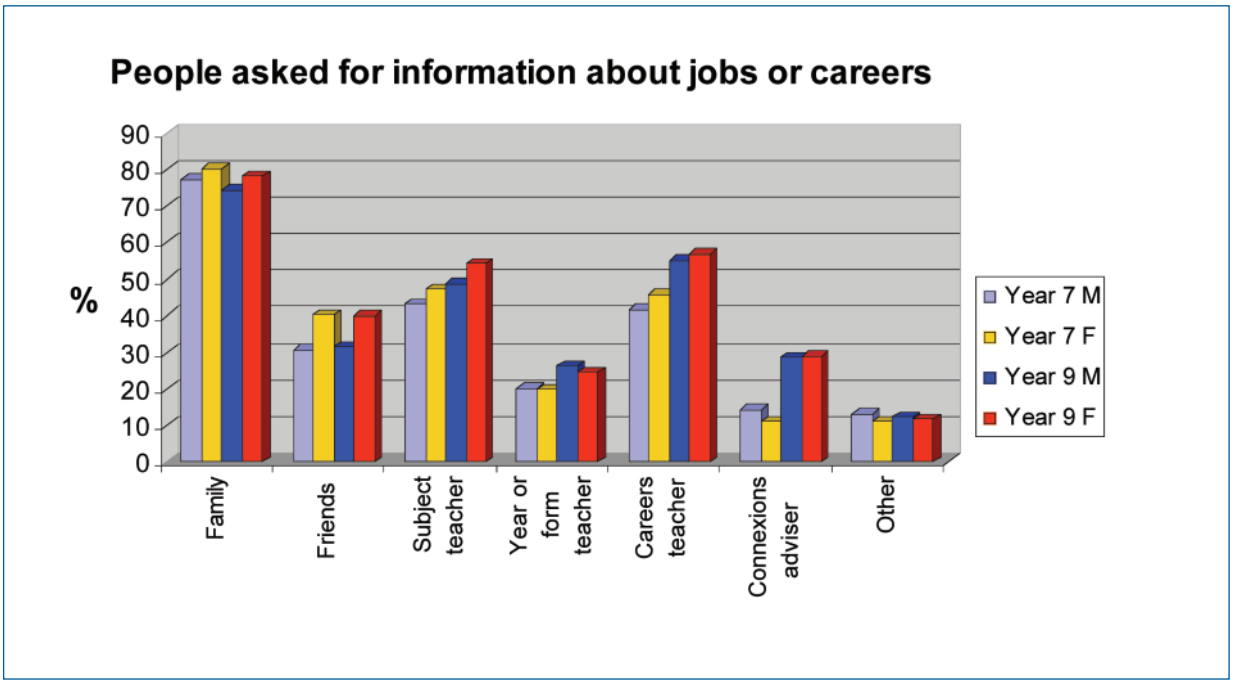

Consideration of STEM careers
Design, arts and crafts
Performing arts
Leisure sport and tourism
Computers and IT
Media, print and publishing
Security and armed forces
Education and training
Environment, plants and animals
Marketing and advertising
Healthcare
Science mathematics and statistics
Engineering
Catering and hospitality
Administration, business and office work
Financial services
Building and construction
Legal, and political services
Social work and counselling services
Transport and logistics
Personal and other services
Manufacturing and production
Languages, information and culture
Retail sales and customer services
0
10
20
30
40
50
60
%
Year 7 M
Year 7 F
Year 9 M
Year 9 F

2.6 Who do young people ask for information about jobs and careers?

As previous research has shown, family and friends are the most likely source of information about jobs and careers for young people, while subject teachers and careers advisers are generally less important for this process to the young people consulting them (Millward et al, 2006, Gender and Equalities Office, 2004). As can be seen in graph 2.7 below, family was by far the most important group for providing information on careers, and an average of 77.8% overall seeking the advice of this group. Around half (49.6%) of pupils specified subject teachers as being a source for advice, while 48.3% specified their careers teachers as being important sources of advice. It is perhaps worth noting that while many pupils would go to a 'careers teacher', many schools no longer have a staff member with this designation. Over one third of pupils chose friends as being important sources of advice, while around 20% chose year or form teachers and Connexions advisers. Thus those professionals who are the most likely to be able to support pupils are the least likely to be asked.

School differences were marked in student preferences for consultation on jobs and careers possibly reflecting a number of factors, including the integration of Careers, Education, Information, Advice and Guidance (CEIAG) into the curriculum, and the scale and range of industry links. For example, as can be seen in the appendices, the range of responses for consulting 'family' were from 90% at one school, to 54.3% at another. Likewise, the range of responses to the question of whether they would ask their year or form teacher for careers information or advice ranged from 3.4% at one school to 33.8% at the other end of the scale. The overall results reported in this paper do in some cases, mask some quite large school level differences

Graph 2.7



Year group differences were slight, but revealed interesting trends. Namely careers, year and subject teachers and Connexions advisers were more likely to be chosen in year nine. This reflects the general practice that while schools have a statutory duty to provide careers education from year seven, Connexions staff are introduced to, and start working with pupils in year nine. This,

together with the greater imminence of subject choices helps to explain the response from year nine pupils compared with year seven.

Slight gender differences in preferences for sources of information existed with regard to the sources of information consulted about careers. Namely, girls were slightly more likely to consult friends and family than boys (this was especially the case with friends). Both boys and girls however, were equally likely to consult with outside sources of advice such as teachers and Connexions advisers.

3. Summary

The choices that young people make regarding their option choices and eventual career pathways are influenced by a variety of factors based on their personal histories and experiences, self-awareness and belief, and school-based support. Research studies have found that young people turn to parents first and foremost when making choices, with schools careers education and guidance professionals having a much more modest role in those decision making processes. However, by the time they reach year 11 young people have often either consciously or instinctively introduced physical, emotional or cultural "boundaries" within which they will shape their choices – the "bounded rationality" approach to decision making. Such boundaries begin to form when children are quite young and move from thinking about "dream" or aspirational futures such as wanting to be a princess or a professional footballer, to more realistic assessments of their futures – it is important to note that according to Gottfredson (2002) this transition takes place in Key Stage 3 at ages 11-14. However, this survey found very few differences between the reported attitudes of year seven and year nine, the main differences being a move away from science study during Key Stage 3 – particularly for girls, and an increasing awareness of sources of career related information and advice. So, while one would expect a noticeably different set of responses from young people during this critical stage, there are in fact very few. This issue would benefit from further research; however, this suggests either that young people are making their choices before year seven (which has implications for the provision of effective career related learning in primary schools), or those choices are being made after year nine when subject choices, and in some cases the choice of learning providers have already been made. The follow up survey among year nine in 2010 will be carefully scrutinised to assess whether an enhanced focus on careers learning as it relates to STEM study has affected the responses of those pupils studying in the pilot schools.

The second significant finding is further reiteration of the well established link between gender and career aspiration. There is a clear parallel between enjoyment of study of a subject, and industry choice. We can conjecture that there is little real awareness of the range and variety of job roles that exist within industry areas so pupils are resorting to generalisations and received wisdom to inform their choices. There is work to be done to raise awareness and interest in the role of design skills and creativity in engineering for example, or technical and mathematical skills that can be applied to careers in the performing arts that could challenge stereotypical views, and could enthuse young people about the range of ways that they could apply the skills they learn through study of STEM subjects.

The third key finding relates to sources of careers information, advice and guidance. The study reinforces findings from other studies that most pupils go to their family for information about careers and subject choice. It also shows that few pupils are aware of the Connexions service at year seven – not least because they probably have had no interaction with the service, whereas about a third of pupils are aware by year nine. However, the fact that half of pupils would ask

their subject teacher for careers related information is significant. Subject teachers may be able to provide well informed, impartial quality careers information and advice to their pupils, but anecdotal evidence would suggest that many would not feel confident in fulfilling this role. The paradox with these findings is that the people who are best placed to offer impartial career information and advice are those who are the least likely to be asked by pupils in Key Stage 3. This is currently being addressed through policy developments such as those outlined in the recent DCSF (2009) white paper: Quality, Choice and Aspiration, a strategy for young people's information, advice and guidance. However, there is a clear need to ensure that teachers are aware of their role in relation to subject choice and career destination, and that they are able to refer pupils to professional sources of impartial careers information, advice and guidance, including members of staff, Connexions services and web-based resources.

The survey raises further questions about whether there are differences in responses from schools sharing similar characteristics, such as those schools with larger proportions of black and minority ethnic pupils, or those in more deprived neighbourhoods, those that offer engineering as a subject for study and single sex schools. The study team are examining the data further to highlight any significant trends or findings between groups of responses to explore any differences by group or by type of school, and this will be published in due course. In the meantime, findings from this survey are being used by the schools who are participating in the timeline study to inform their activities and the follow-up survey in 2010 will repeat most of the core questions used to inform this study, together with some additional questions to address some of the queries raised by the findings so far.

4. Appendices

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