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STEM Graduates in Non STEM Jobs

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Executive Summary

This research set out to investigate why some STEM graduates do not work in occupations related to their degree. This question has arisen from previous research looking at the extent to which the supply of graduate-level STEM skills meets employer demand. While there is evidence of high demand from employers (of whom many report difficulties recruiting STEM graduates) and an apparent salary premium for many STEM qualified graduates who work in 'scientific' occupations[1], why is it that a significant proportion of STEM graduates do not enter these occupations? What factors are influencing STEM graduates' career decisions, especially to move 'away' from STEM careers? More knowledge of STEM student and graduate career decisions was felt to be needed to help current efforts to improve the supply of STEM-qualified entrants to the graduate labour market. The research was commissioned by the Department for Business, Innovation & Skills (BIS) and undertaken in 2009 and 2010.

Defining STEM

The research question was not simple or straightforward. A particular issue is the definition of STEM (and thereby also "non-STEM"). While degree disciplines can be grouped relatively easily into a STEM cluster (subjects grouped as Science, Technology, Engineering and Mathematics), it is much more difficult to classify STEM employment in the absence of a generally accepted definition of what comprises either a STEM job or STEM skills. Neither Standard Occupational Classification (SOC) system codes or Standard Industrial Classification (SIC) codes are particularly valuable to do this, so it was necessary to develop a working definition of STEM and its scope for our research.

The degree subjects with which we were primarily concerned were Physical and Biological Sciences, Engineering and Technology, Mathematics and Computer Sciences, but we also included Subjects allied to Medicine (but excluding Nursing), Architecture/Building, Psychology and Geography within our STEM discipline scope as these other subjects include courses with a scientific focus. We developed our own STEM employment framework, consisting of:

- *A STEM Specialist* sector where employers seek core STEM competences in graduates, a *STEM Generalist* sector where STEM graduates might be suitable or preferred, and *non-STEM* employers where there is no overt demand for STEM graduates; and
- *STEM Core* jobs where a STEM degree and associated competences are directly

[1] Analysis by DIUS, now known as BIS, in *Demand for STEM skills* (BIS, 2009a)

relevant, *STEM-related* jobs where STEM competences are of relevance but applied more broadly, and *Unrelated* jobs where a STEM degree qualification has little or no apparent relevance.

Only by using the combination of both our sector and occupational role classifications, which could be represented as positioning in a 3 x 3 Sector/Occupational Matrix, could we fully understand how much any particular job was a 'STEM job' or a 'non-STEM job'.

Student career decision-making

A second issue was that existing knowledge (from previous research) suggests that decisions to enter 'STEM jobs' at the point of, or after, graduation are often part of a longer process of career decision-making by individuals. So, aspects of career decisions at different stages in the 'journey' through higher education and into work, needed to be covered in our investigations, as well as career intentions at the transition between degree study and work and graduate employment outcomes. This meant exploring the reasons behind choosing to study STEM as a degree, development of career thinking from entry to university onwards, influences on certain career decisions taken (especially career 'direction', i.e. towards STEM jobs or not) and the factors that appeared to have the most impact on graduates' outcomes. We particularly wanted to assess the extent to which STEM graduates were making conscious decisions to follow paths towards or away from STEM-based occupations, or whether they drifted into them accidentally, or whether they wished to take up STEM careers but were prevented from doing so, by employers' recruitment requirements or for other reasons.

Research methodology

We needed to see how graduates' decisions differed according to STEM subject and if other factors, such as type of higher education institution, qualification, ability, work experience or demography, might interact with this. An important requirement was therefore to generate sufficient data on STEM students and graduates to understand such potential differences. A mixed method approach was used in the research:

- Reviews of existing evidence drawn from other studies and data sources;
- A survey of STEM students on their career decision-making and intentions, focusing on final-year undergraduates but also taught masters and PhD students (c.7,000 in total sample);
- Interviews, face-to-face and by telephone, with over 550 graduates now in early-career employment about their actual decisions to take up either STEM or non-STEM occupations and their employment experiences;
- Discussions with over 50 employers of their requirements and strategies in relation to recruitment of STEM graduates and how these might affect graduates' decision-making

and career outcomes.

Key research findings

A 'STEM job' or 'STEM career' is not a clear concept

- Employers and graduates tend not to think of 'STEM' but more about degree subject (groups). Students are anchored in their subject rather than in STEM, and consider career/occupational directions in relation to their degree subject, rather than in relation to STEM.
- This results in complexity for analysis and policy – a job like accountancy is seen as strongly degree-related by a Mathematics graduate but unrelated by an Engineering graduate, while a specialist IT role regarded as degree-related for a Computer Science graduate could be in any industrial sector. For a Sports Scientist, working at a local authority fitness centre would be degree-related, but neither the role nor that sector is likely to be regarded as being within or related to STEM in most policy discussions or analyses.
- The definitions used in any analysis of STEM employment are therefore crucial; the 'matrix' approach using both role and sector for any particular job was useful to tell how much it was a 'STEM job' or not, although subjectivity remained in classifying some roles.

Do STEM students/graduates want a STEM career?

- The vast majority of final-year students, at undergraduate, masters and PhD level, report that they do want to pursue a career related to their degree subject, although that proportion varies somewhat with degree subject, and some are more definite about this than others. As many as two-thirds of those in more 'vocational' subjects like Engineering *definitely* want a degree-related career, but nearer to a half in other subjects. However, between a half and a third are not fully decided.
- Many of the undergraduates who want to pursue postgraduate study also wish to progress to degree-related occupations in the longer-term. Entering a postgraduate course is often a deliberate path towards a STEM career.
- Among those with career ideas, about half are considering a career in a STEM Specialist sector and/or in a STEM Core job function (i.e. the 'core' of STEM employment as we defined it). This varied considerably by subject, with the highest proportions in the more narrowly 'vocational' STEM subjects, but this partly reflects that degree-related STEM employment will be outside this 'core' for many subject disciplines within STEM (e.g. Mathematics, Geography).
- Only a very small minority report that they want to work in employment not related to their degree (11% might not or don't, and even fewer postgraduates), but a larger and more significant proportion have only vague or no career plans. A substantial

proportion of final-year students had not made job applications half way through their final year, and roughly a quarter expect to take time out or enter temporary work next, deferring any long-term career direction decision.

Why choose a non-STEM career?

- The main reasons students seek a STEM degree-related job are aspirational, chiefly the potential for interesting work and to use their learning and specialist skills. There is no one dominant factor. Career-related and more pragmatic reasons, including expected earnings and job availability, are uppermost for a few but secondary for most that are considering entering a STEM career.
- The most likely reason students seek employment in a direction away from STEM is because other fields are seen to be of more interest, although more practical and career-related reasons are also significant for graduates considering 'leaving STEM'.
- Earnings (expected pay) is an important factor (somewhat more important for males) but not the main motivating factor either to choose STEM degree-related work or not to. Career prospects and earnings are seen as positive reasons both to enter STEM careers and not to, i.e. there are mixed perceptions about where earnings are best.
- In parallel with the student survey, most graduates interviewed had chosen their current job (whether in STEM or unrelated) because it offered interesting work, with starting salary and prospective earnings a main driver for only a minority of graduates, almost exclusively male.
- The profile and reputation of certain major employers, especially in our STEM Generalist and non-STEM sectors, with well-established and substantial graduate schemes, were attractive and powerful influences on 'undecided' graduates at the transition stage between university and work. For many strong STEM graduates this was considered to be the 'mainstream' career route – rather than into specialised STEM jobs – an impression reinforced by peers and some careers services.
- Although few students reported this as a reason for not staying in STEM, employers – especially in some STEM Specialist sectors – were much more likely to feel that STEM had a less attractive image (as employer or working environment) in the eyes of students. In some cases, they felt this perception arose from a lack of real knowledge about STEM employment and unrealistic expectations among many STEM graduates.
- Almost no students and very few graduates reported that rejection by STEM Specialist employers had led to a shift in their direction away from STEM work; if anything rejection from non-STEM corporate graduate schemes was more significant in their decision-making.

Progressive development of career thinking

- Most students did not originally choose to study a STEM degree primarily for a career-related reason, but rather for interest/enjoyment in the subject or based on their aptitude. Of those that did cite career-related reasons, more thought a STEM degree kept career options open than thought it would accelerate them to a specific STEM occupation, even those studying a subject like Engineering.

- Most started university with few career ideas but developed and firmed them up during their degree study, the majority focusing towards a STEM degree-related direction. The profile and reputation of employers became more important with time, and some began to have some understanding of the graduate labour market.
- Different career routes were progressively adopted depending on degree subject and the firmness of career plans, and the firmness of plans also varied with subject.
- Those who were more career-motivated (i.e. had firmer career plans when starting the STEM degree, or at any later stage), were more likely to wish to enter a STEM occupation. The more 'decided' they were at any stage, the more likely they would seek a STEM career direction.
- Although partly related to career motivation, degree-related work experience had a strong influence on developing a career plan, mostly towards a STEM occupation.
- A substantial proportion of final-year students had not made job applications by the time of survey, nearly half way through the academic year. The majority of graduates who did had applied both to STEM Specialist employers for STEM jobs or graduate schemes *and* to more general graduate schemes with employers related to or outside STEM.
- Many STEM students and graduates did not use their university careers service, yet most felt they would have benefited from additional career support at some point, particularly before they went to university in order to understand better how different degree courses related to potential careers or occupations.
- In principle, most would study a similar degree if they had their time again, although perhaps a quarter would study a different course (and higher for some subjects).

Complex and individual paths post-graduation

- Many graduates interviewed had still been undecided about career direction by the time they graduated and delayed job applications until after university. Those choosing to take time out or enter temporary work were amongst the least 'decided' and potentially the most likely to drift away from STEM.
- Graduates' eventual job destinations often did not correlate simply with their career thinking before graduation; significant numbers who had applied only for STEM jobs when finishing at university ended up outside STEM, while the reverse was also the case with some who had only applied for non-related jobs at that time ending up in STEM jobs.
- For a minority, particular individual circumstances became more important than strategic career-thinking, as they had to take into account their own personal responsibilities or the impact of potential decisions on personal relationships.
- For those that secured jobs after leaving university, quite complex and often very

individual decision-making had taken place, as pragmatic and tactical considerations were combined with what remained of their prior aspirational thinking.

- Some graduates had changed jobs since graduation, due to redundancy or their own tactical choice for similar but higher quality employment. Others had taken until this time to recognise the true direction they wanted in their career; overall, these changes tended to result in shift away from STEM employment.

STEM graduates doing non-STEM jobs

- STEM graduates were found working for employers right across the economy, in both private and public sectors, in a wide variety of job roles, although most of the graduates interviewed worked for larger employers.
- Within the workplace, few graduates interviewed used their specific degree subject knowledge a great deal (even those in STEM Specialist work), although their degree subject was perceived as vitally important in gaining such jobs. On the other hand, almost all the graduates – irrespective of employment sector – used the general and broader skills learned while doing a STEM degree to a much greater extent.
- Some skills of high value to non-STEM employers were unique to STEM graduates, such as a particularly logical approach to solving problems, enabling some STEM graduates to progress faster in their careers than non-STEM graduate colleagues.
- Levels of satisfaction with current job and career progress were found to be very high amongst the graduates interviewed irrespective of employment sector, reflecting that many in the sample were in 'good' jobs with 'good' employers. Although many working outside STEM would like more degree-related work, as it might be more interesting, few considered it would be feasible to re-enter STEM occupations, largely due to the expected drop in earnings they thought would result. On the other hand, many did not want more degree-related work as they perceived it might be narrower than their current work.

Employer perspectives

- The interviews with employers confirmed previous research (and the student and graduate survey findings) that a wide range of employers seek to recruit STEM graduates, and that classifying employers by type can be 'fuzzy' with overlaps in places, especially between our defined STEM Specialist and STEM Generalist employers.
- The employers using the most targeted approaches to securing the STEM skills they need tended to be STEM Specialist employers recruiting graduates for STEM Core jobs (usually into a graduate development programme). Some of these graduates would later move to STEM-related or unrelated jobs as they progressed with that employer. Many STEM Specialist employers also recruited STEM graduates directly into STEM-related or unrelated job functions too.

- STEM graduates could be recruited into a range of job roles or functions in STEM Generalist employers, from investment banking and accountancy to education, as well as commercial and specialised (‘STEM Core’) functions in non-STEM employers in both private and public sector. Although STEM degrees were frequently welcomed by these STEM Generalist employers, only in a few places was a particular need for a STEM degree qualification specified on entry.
- STEM Generalist (and also non-STEM) employers recruit STEM graduates for different reasons – some focused more on their numeracy and analytical skills, others their approaches to problem-solving, yet others their technical knowledge and skills. It was the ability to apply some STEM knowledge and derived employability skills more broadly which seemed most highly valued.
- The interviews confirmed much of the existing evidence on STEM recruitment problems. STEM Specialists mainly perceived deficiencies in some STEM graduates’ technical ability and subject knowledge, and in some cases also in their lack of commercial awareness. STEM Generalist employers did not generally encounter recruitment difficulties.
- There was a wide and sometimes contrasting range of views held about specific STEM discipline deficiencies. All types of employers felt that some STEM graduates lacked some of the broader behavioural skills sought of graduates, such as particular team-working, communication and time management /organisational skills, as well as more commercially-related skills.
- Targeting certain universities or degree courses, or both, was seen as a necessary and valuable part of graduate recruitment strategies of most STEM firms, in order to deliver a sufficient supply of recruits of the calibre they required, and to compete with non-STEM employers. It did not necessarily mean that STEM students from other places were excluded, as any student could apply online, although potentially from a lower information base. Many employers were actively working with schools, especially, and selected universities, to try to improve STEM students’ (and potential STEM students’) knowledge of STEM careers.
- The majority of STEM Specialist employers were concerned about potential, and some actual, shortfalls of STEM graduates to fill their core functions, arising from graduates preferring other employers and unrelated jobs. STEM Generalist and other employers, on the other hand, were more likely to see economic benefit in wider dispersion of STEM graduates across the economy. The two main reasons seen by employers as causes of an outflow of STEM graduates ‘away’ from specialised STEM jobs/careers were the perceived greater attractiveness of careers outside STEM (not least the perception of higher salaries) and the graduates’ lack of real knowledge about working in STEM core functions.

Overall conclusions

The research has given insights to many issues in the career decision-making of STEM students and graduates and their recruitment to a wide range of jobs and employers. It has been shown to be an area of greater complexity than often recognised; and there is not a clear or simple main reason why some STEM graduates are not in STEM jobs. It may result from many individual factors, but the most likely one reported is that students and graduates find other (non-STEM) work potentially to be more interesting, and/or that their chosen STEM degree turns out less interesting or enjoyable than expected so they actively seek a change of direction.

The decision on whether to apply for and enter STEM work is often more a matter of individual choice which takes in a number of push and pull factors, both personal and employment-related, over a period of time. Few students appear to be primarily motivated by pay in choosing a STEM or non-STEM career (despite the economic evidence that financial returns in STEM are better), or are turning away from seeking a STEM job because they have experienced rejection on the grounds of inadequate skills. Some can be influenced strongly away from the degree-related areas of work which they thought they might pursue by the pull of individual employers; for quite a number this is after they leave university as many delay job applications until after completing their degree. Furthermore, it seems that, rather than them seeing STEM Specialist employers or STEM Core job functions as the expected or mainstream career option for STEM graduates like themselves, a good number (although not the majority) prefer corporate graduate schemes , the majority of which are outside STEM Specialist sectors. For many, and particularly those that have not done degree-related work experience, this is reinforced by their lack of knowledge or experience of what STEM Core jobs and careers are really like, or what the wider opportunities to use their skills and learning open to them might be in STEM-focused jobs, in STEM Specialist or Generalist sectors. Increasing opportunities for STEM-degree related work experience would be beneficial in developing better understanding in these areas.

The research has called into question the widespread assumption that STEM students expect themselves to become STEM workers/employees. This ‘default’ career direction is clearly not what many STEM students or graduates have in mind or are adhering to. The situation is more complex and career paths less simple and less predictable than generally thought. The research has also highlighted the fluidity of the students’ and graduates’ career decision-making (and lack of career thinking in many cases) which lies behind many of the observed individual outcomes. A number of policy messages arise from the research:

- Limitations need to be put on an expectation that choosing to study a STEM subject leads to entering a STEM job. This link has been an important part of the STEM pipeline model which has formed part of the Government’s STEM skills strategy, and may require some rethinking.

- A wide range of job opportunities is open to STEM qualified students, and they can secure employment if they develop the appropriate academic and personal skills sought by employers. But there is insufficient awareness of the full range of opportunities available to them and employers' requirements. Furthermore, not enough get the opportunity to gain experience or knowledge of work in STEM which would be beneficial to them in understanding what STEM work entails and how STEM careers can develop. Many acknowledge they would have benefited from additional career support either before they went to or during their time at university.
- For employers, especially those in STEM Specialist sectors, the research confirms that many STEM graduates are attracted to other areas, often because of a lack of knowledge of what STEM work and careers look like but also because the graduates perceive other areas to be of more interest. It appears to be more a case of ignorance rather than decisions to go in other directions due to well-founded negative views. With so many students apparently undecided and without well-founded views, there is much potential to help STEM students firm up career ideas while at university and beyond (especially in the first year or so after graduating when many appear to 'drift away' from STEM). STEM employers need to make their case more visibly, both in terms of the attractiveness of the offer and career prospects but also the opportunities for interesting and rewarding work within STEM employment sectors..
- Employers in STEM specialist sectors are still reporting mismatches between their requirements and the skills offered by STEM student applicants, a problem highlighted by previous studies. Weaknesses in core discipline knowledge and understanding and a lack of high calibre applicants was widely commented upon, as well as for some, specific skills (in Mathematics, for example) and their general employability. Though action has been taken by universities to align many STEM degree courses more to employer demand, it seems that more needs to be done by them to engage effectively with employers and take account of their needs in the curriculum.

1. Context and methodology in brief

This report documents extensive new research, commissioned by the Department for Business, Innovation & Skills (BIS) in 2009, into the early careers and career decisions of STEM (Science, Technology, Engineering and Mathematics) students and graduates in order to understand why many elect not to enter STEM occupations and/or STEM employment sectors and what influences these career choices. This section outlines very briefly the context to the research, its objectives and questions, definitions used and the research methodology. A more substantial treatment of these issues is given in Appendix A.

1.1 Context and research questions

Behind the research lay evidence that significant proportions of STEM-qualified graduates are found in employment not related to their degree – that is to say not in ‘STEM work’. This is despite an apparent salary premium for STEM graduates who are and reports of employer demand for STEM graduates and shortages of specialist STEM skills – an apparent paradox or at least a suggestion that this part of the graduate employment market is not operating predictably in terms of conventional economic supply and demand. It could not be explained sufficiently from evidence collated and analysed by DIUS (now BIS) in its 2009 report *The demand for STEM skills* although several possible hypotheses were suggested there.

The issue raises concern because of the widely held view that the future success of the UK economy depends increasingly on high ‘added value’ and knowledge-intensive industries, many of which rely on a workforce with graduate-level STEM skills and qualifications. These include both ‘traditional’ STEM employers in manufacturing and R&D as well as service sector employers where the value of science and technology is also increasingly recognised. As a consequence, recent Government policy has supported the funding of activities to encourage greater numbers of young people to study STEM subjects at school or college post-16 and to enrol for STEM degrees in Higher Education, with the expectation that most will help to satisfy growing requirements for an increasingly STEM-qualified workforce.

This study focused on what happens during and immediately after Higher Education, which is a potential point of ‘leakage’ from the STEM ‘pipeline’; and crucially *why*. The primary research aim was to understand **why some STEM graduates do not work in occupations related to their degree**. In order to understand this fully, it was felt necessary also to understand better the reasons why many other STEM graduates do. The research objectives therefore were to:

- Provide an understanding of the decision-making process and reasons underlying STEM undergraduates’ and postgraduates’ decisions about careers;

- Learn from the experiences of STEM graduates, in both STEM and non-STEM occupations, about their actual career and job decisions at and after graduation, and their subsequent experiences and career decisions while in employment;
- Understand employers' requirements and strategies in relation to recruitment of STEM graduates and how these might affect graduates' decisions and careers.

The research aimed to explore the extent to which STEM graduates make conscious decisions to follow career paths away from STEM jobs, or whether they seek to enter STEM jobs but are prevented from doing so. Thus, the study sought to identify the main factors shaping STEM graduates' decisions and employment outcomes, and which have most impact on their decision-making and subsequent paths. It sought also to understand the extent to which the decision-making of STEM students at graduation (or first job) determines their long-term career direction, or whether opportunities might exist for subsequent re-entry to STEM occupations later in their careers. The extent to which there is variation in decision-making of people studying different STEM subjects was explored to see how this could account for the differential rates of entry to STEM occupations previously reported[2]. We also aimed to identify such variation according to the graduate's type of institution, qualification or other personal factors such as gender.

1.1.1 Evidence to explore further and hypotheses to test

Prior to this research, DIUS (which preceded BIS), in '*The demand for STEM skills'* (BIS, 2009a), analysed existing evidence and made a series of observations relating to the supply and demand of graduate-level STEM skills. It suggested some possible hypotheses which could potentially explain the observed employment patterns of STEM graduates and also the co-existence of a shortage of STEM graduates with apparent market forces encouraging them to enter STEM employment. These are discussed further below, along with some further exploration of the contextual evidence undertaken at the outset of the study (reported in more detail in Appendix A) which formed the basis of our investigations.

<u>A significant proportion of STEM graduates are not in STEM occupations</u>

Historically, the manufacturing industry has been the main employer of STEM graduates but this pattern has shifted over time and there is now a much broader spread of STEM graduates across industrial, business and services sectors. Analysis conducted by DIUS (in BIS 2009a) of the Labour Force Survey (LFS, 2008) estimated that, approximately, just over a third of STEM graduates were working in 'non-STEM' occupations, although this figure varied between graduates of different degree subjects. It also acknowledged that defining STEM occupations was not easy as there can be problems in 'fitting' certain identifiable STEM jobs into Standard Occupational Classification codes (SOCs), especially in new and

[2] See Appendix A for data on employment outcomes of graduates from different STEM disciplines

emerging employment fields. BIS used a series of SOCs to define 'science-related occupations', and also included financial and teaching occupations, to arrive at its estimate of STEM employment. It showed that just under half of STEM graduates were in its defined 'science-related occupations', a further 4-8% in financial occupations (but this rose to over 20% of mathematics graduates), and 9-10% were in teaching. The latest L-DLHE ('Longitudinal' *Destinations of Leavers from Higher Education*) survey from HESA (2009), which measured employment outcomes of 2005 graduates 3.5 years after graduation, provides further evidence of the spread of STEM graduates across different areas of employment. It shows the extent to which graduates from certain disciplines are working outside manufacturing or other industries, for example: 22% of Mathematics and 10% of IT graduates were in the finance sector, and 15% of Biological and Physical Science graduates worked in the public sector (such as in administration, defence or social security).

A wage premium exists for STEM graduates in STEM-related work

Analysis by BIS of the LFS and L-DLHE data on earnings revealed there to be an earnings premium for STEM graduates at the level of annual first-degree earnings, reinforcing the findings of other studies which suggest a premium over the course of a working career for many STEM qualified graduates. Deeper analysis, however, suggested that the wage premium mainly exists for STEM graduates who work in science and financial occupations, rather than all those who possess a STEM degree. Although there was again considerable variance according to degree subject, for all subjects analysed there appeared to be at least some premium for working in a science or financial occupation (referred to as STEM employment there), either as early-career wage or average annualised pay. The existence of a wage premium for such occupations would be consistent with a shortage of STEM graduates to work in these fields, on the basis of conventional supply and demand.

Is there a mismatch between employers' requirements and graduate applicants' skills?

It is possible that there is some mismatch between the types of STEM and other skills offered by current STEM graduates and the needs of the employers. This could result in some STEM graduates being unable to secure employment in STEM occupations, and entering alternative sectors or career paths instead. There is evidence for certain STEM skills mismatches (see reports form CBI, e-skills, HEFCE, ABPI etc. in Appendix A), including long-established, though often anecdotal, impressions that some technically able graduates (and postgraduates) have weak transferable or employability skills, and also recently highlighted perceptions of employers about the overall quality of STEM graduate supply. Therefore, it could be that a higher proportion of STEM graduates are actually seeking to enter STEM occupations, but some may be prevented from doing so by individual skill shortfalls or stringent skills requirements on the part of STEM employers.

BIS cited two further strands of evidence which would possibly be consistent with this, i.e. that some STEM graduates were taking up roles, including non-graduate roles, outside STEM occupations, after failing to secure STEM jobs. Analysis of L-DLHE data showed that STEM graduates working in science occupations have been just over one month less unemployed than STEM graduates working in non-STEM occupations. There was also evidence from the L-DLHE survey that STEM graduates in science-based jobs were less likely to be classified as over-educated for the job they were doing, than STEM graduates working in other occupations (where ‘over-education’ was taken to mean working in a ‘non-graduate’ job).

Are STEM occupations or employers seen as undesirable by STEM graduates?

If substantial numbers of STEM graduates are choosing not to enter STEM occupations, this could be due to the existence of, or perception of, certain undesirable characteristics which are not compensated for by a wage premium. On the other hand, evidence from the L-DLHE survey on satisfaction with career to date suggests that STEM graduates in science-related jobs report somewhat higher satisfaction rates than those working in other jobs. Equally, a higher proportion of those working in science-related jobs stated that they would study the same subject if they had to do it again, than those in other occupations, which is also consistent with broad ‘satisfaction’.

However, a range of factors relating to STEM occupations, such as undesirable locations of STEM employers, poor images or reputations of jobs or employers, or other perceptions relating to work and career, have been shown to contribute towards negative views about pursuing STEM careers (discussed further in Appendix A). Some of these potential factors could largely be issues of perception, while others (such as the differential availability of STEM jobs by geographical location, or the nature of the working environment) might be more physical.

STEM jobs may not be perceived as high value in comparison with other jobs

It could be that students and graduates have ‘conscious constructs’ of STEM and non-STEM jobs, to which they might attribute different value. This could be interpreted as a perception that a STEM job is “worse” (or “better”) than a non-STEM job, in the same way that some attribute status to certain professions, and could lead to graduates feeling less successful if they had a STEM job, or the reverse. Potentially, this could also be affected if they were conscious of Government’s desire to assure sufficient STEM skills in the workforce. There is little in the research literature which investigates this, but it is possible that the poor public image of STEM and STEM careers, in particular the lack of recognition of the valuable contribution that science and technology make to wealth and human well-being, which has been demonstrated by prior research, could be a factor influencing students’ and graduates’ decisions to take up STEM jobs or careers.

Only the higher ability graduates may be getting STEM jobs

There appears to be evidence that STEM graduates working in STEM jobs are somewhat more 'able' (as measured by UCAS[3] tariff scores on entry to university) than those who are not working in STEM jobs – at least in overall terms, as some non-STEM employment sectors also require high levels of academic attainment and are very competitive. High proportions of all STEM students study for their degrees in high or highest tariff universities, relative to many other degree subjects, but the reasons for differential attainment (measured this way, such as on A-level grades) between those in different occupations are as yet not fully understood. However, this could be consistent with the entry requirements demanded by STEM employers being higher than those in some non-STEM sectors, and so a factor in some STEM graduates' decisions to seek work there.

Individual career choice can be affected by a variety of factors, operating over time

A range of factors, in addition to earnings and employer demand, are known to affect employment outcomes, including individual career choice. This in turn is affected by a myriad of factors, including chance events, as research has shown (see Appendix A). For some students the decision to go into a STEM career can result from an earlier decision taken at school, while for others it can be a part of a long-term process of career decision-forming at home and school which interacts with subsequent experiences at university, during periods of work and job searching. These influences can include school subject choices, careers advice and guidance, contact with employers, parental background and perceived image of STEM, peer group attitudes and so on, and can vary by gender, ethnicity and social class. There have only been a small number of studies which have focused on the career intentions of students, and only in some STEM disciplines, mainly engineering and IT. These have mostly focused on general career intentions while none has explored in detail the reasons why a STEM graduate might choose *not* to 'stay' in his or her discipline when making career choices.

1.2 Defining STEM

The term STEM (**S**cience, **T**echnology, **E**ngineering and **M**athematics) is increasingly used today by Government and others but its scope can be subject to differing interpretations.

Within this project, after reviewing approaches taken by others, we adopted the following definitions of STEM:

[3] UCAS: Universities and Colleges Admissions Service

As a subject of higher education study or qualification, our definition of STEM used JACS[4] codes in the following broad subject code groups:

(B)	Subjects allied to medicine
(C)	Biological sciences
(D)	Agriculture & related subjects
(F)	Physical sciences
(G)	Mathematical sciences
(G)	Computer science
(H,J)	Engineering & technology
(K)	Architecture, building & planning

Thus a graduate (with a first or higher degree) in any of these subject groups would be considered a STEM graduate. However, we deliberately excluded certain very vocational subjects (which were included in the scope of some previous STEM research) -- Medicine and Dentistry, Veterinary Science and Nursing – since graduates from these subjects are known predominantly to enter directly related STEM occupations (e.g. doctors, dentists, vets and nurses, respectively). It was specifically agreed with BIS to include in our research students of Psychology, Geography and Archaeological/Forensic Sciences. These are subjects within the JACS broad subject groups above but for which there is a spectrum of more and less 'scientific' courses and study.

When considering employment sectors, we identified three broad clusters and named them 'STEM Specialist', 'STEM Generalist' and 'non-STEM' employers, defined as follows:

- *'STEM Specialist'* employers: recruit graduates for roles where a degree in a certain STEM subject or group of STEM subjects is required for entry to a graduate programme or direct to appropriate jobs;
- *'STEM Generalist'* employers: recruit STEM graduates or consider them to be potentially suitable candidates within graduate programmes or roles which are open to holders of a range of degree subjects. Although they do not list a STEM subject as a

[4] JACS: Joint Academic Coding System (by HESA)

requirement for entry, they see the skills or knowledge gained from study of STEM courses as an advantage for the jobs being filled.

- *'Non-STEM'* employers: make no distinction by degree subject at recruitment (at least in relation to STEM subjects) and have no specific demand for STEM graduates, but may still recruit them into graduate programmes or directly to jobs.

In terms of occupation, we also identified three categories, which we defined as:

- *STEM Core* jobs, where STEM degree disciplines are closely related to the type of work; for example, scientific, research and development professionals, engineering and IT professionals and a range of other associate scientific professional and technical jobs (such as lab technicians, surveyors, ophthalmic opticians etc.).
- *STEM-related* jobs, where some STEM degree disciplines are more loosely related to the type of work; for example, certain business professionals (such as auditors, financial consultants, underwriters, also some marketing, sales and legal roles relating to STEM Specialist businesses), certain associate health professionals, but also science administrators and policy advisers, some education professionals (secondary science teachers), and business managers in relevant sectors (healthcare, conservation);
    - All other jobs were classified as '*Unrelated*' (to STEM) jobs.

We then 'positioned' individual jobs by combining our classifications of employment sector and occupational role/function (Figure 1.1). Although boundaries between categories are somewhat fuzzy, and there may be some subjectivity in positioning a particular job, the resulting 'matrix' is useful in illustrating to what extent a job is a "STEM job" or a "non-STEM job". Although no specific boundary can be drawn between the two, "STEM jobs" range outwards from the lower left corner of the matrix, while "non-STEM jobs" were those towards the upper right corner. Illustrative job roles within Figure 1.1 demonstrate this approach.

Figure 1.1 Plot of illustrative jobs using both employment sector and occupational role classifications

Occupational

	STEM	STEM Generalist	Non-STEM
Unrelated	HR manager for engineering firm Sport/fitness equipment sales Surveyor Sound engineer	Social care manager IP/patent lawyer Management consultant	Retail manager Policy adviser Commercial lawyer
STEM related	Pharma marketing manager Finance manager for telecom company Logistics firm analyst	Accountant Investment banker Secondary science teacher Product designer	Scientific publisher Museum explainer Science policy adviser
STEM core	Pharma lab chemist Software engineer Electronics designer Environmental consultant Medical physicist	IT manager for bank Actuary	IT manager in local authority (LA) LA highway engineer LA fitness instructor

Employment sector

If SOC codes are allocated to these illustrative jobs, what this also shows is that the same SOC code can appear in more than one matrix segment. This reinforces the observation that it is necessary to have both the SOC and SIC code of a job in order to determine how much it is a “STEM job” or not. We have given details in Appendix A on how our classification relates to both the SIC and SOC coding systems, and also give there further details on other approaches to defining STEM jobs and how they differ from ours

1.3 Methodology and samples

The methodology comprised three strands:

- *Quantitative online surveys of STEM students*, i.e. STEM undergraduates (mainly final year), postgraduates on taught courses (mostly Masters degrees) and Doctoral students, to obtain information on the career thinking and decision-making of those studying STEM subjects in Higher Education, and their career intentions in particular;
- *Interviews with STEM graduates in early career employment* to learn about the real experiences of STEM graduates who had entered the labour force. The principal targets were STEM graduates who were not working in STEM occupations or sectors, although some STEM graduates who worked in STEM occupations, and some non-

STEM graduates, were included for comparison. 'Early career' was taken to mean those who had been in the workplace for 1-5 years, close enough to graduation to have good recollection of their perceptions and decisions while in HE but long enough for them to be in stable employment. These were chiefly conducted by telephone, with a proportion of face-to-face interviews for greater depth.

- *Interviews and discussion groups with employers* across a range of sectors encompassing our three defined groups, including both private and public sector organisations and a range of types and sizes of employer.

1.3.1 Samples achieved

Over 7000 complete responses were received to the undergraduate and taught postgraduate survey, of which almost 4300 were both from the UK/EU/EEA *and* were in their final year or were taught postgraduate students (i.e. the target sample). A parallel survey of PhD students received over 2,900 responses within STEM subjects.

Full details of the characteristics of the survey respondents are given in Appendix A. The undergraduate and taught postgraduate survey responses were from students at 115 UK HE institutions, with 42% at Russell Group universities, 23% within the 1994 Group and 36% from other UK universities. By degree subject studied, there was good coverage across the target STEM subjects, although it somewhat under-represented students in Subjects allied to Medicine and somewhat over-represented those studying Physical Sciences. The STEM PhD students were studying at 106 universities and research institutes, including 61% at Russell Group institutions.

Over 480 interviews were conducted with working graduates by telephone, with a further 70 in depth conducted face-to-face. Interview candidates were mostly identified and recruited via employers, as well as through a range of other networks. The individuals interviewed worked for 128 different employers (including 10 different Government departments), as well as a few who were self-employed; detail of their personal characteristics is in Appendix A.

The sample of working graduates was not aimed to be representative statistically but instead to be illustrative of the range of employment sectors and occupations in which STEM graduates are found. The sectors and occupations in which they worked are detailed in Appendix A. Using our classification, of the STEM graduates, about 40% were working in STEM Core jobs, 37% in STEM-related jobs and 22% in unrelated jobs. By employment sector, they were split relatively evenly between those working for STEM Specialist (36%), STEM Generalist (34%) and non-STEM employers (30%), reflecting the targeting achieved during volunteer recruitment.

In terms of their HE background, a good spread was achieved across the target degree disciplines. Just under a quarter had a higher degree, while 64% had been to Russell Group universities and 85% had obtained a first or upper second class undergraduate degree.

Employers covering a wide range of industrial and services sectors were targeted for interviews and within discussion groups, structuring the sample around the three main employment sector groups defined (STEM Specialist employers, STEM Generalist employers and Non-STEM employers). Thirty individual interviews and two discussion groups were undertaken, covering 51 different employers (i.e. organisations or divisions of business groups), classified as 15 STEM Specialists and 36 STEM Generalists or Non-STEM employers.

1.3.2 Implications and limitations of the samples

The samples achieved in the quantitative surveys of undergraduates and taught postgraduate students, and doctoral students, were substantial and compared reasonably well with national cohort proportions in terms of key demographic characteristics, for the main subjects under scrutiny. The main attraction strategy, using a range of subject-based organisations and other groups to contact HE staff, who in turn forwarded e-mails to their students, added an element of “randomness” to the distribution, increasing the likelihood of the samples being representative of the broader national STEM student cohorts.

The sample of graduates interviewed was not representative either of STEM graduates in early-career employment or of STEM graduates working in ‘non-STEM’ jobs. It was purposive, designed to include graduates working in a wide range of sectors and functions, to illustrate the range of choices made and to understand how those career decisions had been made. However, the reliance upon employers within the attraction strategy led to an over-representation of graduates who worked for larger organisations, as their more significant human resources and recruitment teams had sufficient capacity to assist in the research. The high recruitment criteria for these ‘premier’ graduate employers are reflected in the relatively high academic achievement of many of the interviewees, in terms of their degree class. Equally, it is likely that relatively few graduates interviewed had not been successful in finding employment. The sample therefore needs to be considered mainly to be ‘strong’ graduates in ‘good’ jobs, rather than a full cross-section of STEM graduates in employment.

2. Overall findings

We here summarise the main findings of the research and our conclusions. The full results of the three strands of the study are presented in Chapters 3, 4 and 5, while additional background information and tables of data are provided in Appendices A and B.

2.1 Why do some STEM graduates not work in STEM jobs?

In simplest possible terms, **STEM graduates' career decisions appear to be driven by individual choice rather than any one dominant 'rational' factor such as earnings or career prospects, or a 'practical' factor such as skills mismatch or job availability.** Individuals' choices take in a number of 'push' and 'pull' factors and influences which are both personal and employment-related, and which operate over a period of time.

2.2 Underpinning observations

Three main general observations are drawn from the research results which underpin many of the more detailed findings and conclusions, and so these are discussed first.

Neither a STEM degree nor, especially, a STEM career/occupation is a clear concept for students, graduates or employers, nor universally to policymakers or analysts either.

This was seen in all strands of the research:

- In the initial literature review, where a lack of consistency was highlighted in the ways STEM has been defined, especially in terms of employment, (and sometimes it is not defined at all); this has led to differing and inconsistent estimates of STEM supply and demand;
- In the student survey, where students of certain subjects identified particular occupations as degree-related but others did not. For example, Mathematics students considered accountancy, teaching and banking as closely related to their degree, and Sports Science students saw teaching the in same way, but Engineering students had a greater focus on R&D work and manufacturing when considering what constituted degree-related employment;
- In the graduate survey, again, graduates seemed not to have any construct of a STEM degree (or a STEM-related occupation) but tended, perhaps not surprisingly, also to view potential jobs and careers in relation to their own degree subject. Many graduates were unsure of the meaning of certain letters in the acronym STEM;
- In the discussions with employers, the STEM acronym was widely recognised but variably interpreted, in terms of the academic disciplines and the meaning of the letters, especially by those outside our defined STEM Specialist sector. The generic

term ‘STEM’ is not in the ‘business language’ or terminology used by many firms in graduate recruitment. Rather, terms like ‘scientist and technologist’ or ‘engineering or technical’ are preferred, or graduates are sought only from certain STEM subject disciplines (e.g. Computer Science, Engineering).

These issues, around the lack of clarity, added complexity throughout the research and tend to hinder the ability to draw clear conclusions in relation to the key research question – why not go into STEM?

A wide range of jobs is open to STEM graduates within an equally wide range of employers. We identified a very wide range of jobs open to STEM graduates, both in the graduate survey and employer dialogues. These were where graduates from STEM disciplines were either directly sought or where such applicants had an advantage over others, in some cases for specific subject knowledge but especially for the broader skills that accompanied them and which had been developed during a STEM degree. There were also jobs open to graduates in any degree subject for which STEM graduates apply. Our mapping of jobs into STEM Core, STEM-related and Unrelated occupations, and of employment sectors into STEM Specialist, STEM Generalist and non-STEM, was a refinement on the simple STEM vs. non-STEM dichotomy used by some researchers and policymakers. It helped to highlight both the significance of STEM graduate opportunities across a wide range of sectors and also to give more insight into the wide demand for some STEM graduates across the economy, for which reason traditional, solely SIC-based or SOC-based, classifications prove insufficient. However, the approach adopted is recognised as being only a first step, and rather crude, and further work might improve our categorisation (i.e. through adaptation or revision). This could aid greater clarity in future research and, perhaps more importantly, encourage its use in careers advice and guidance practice with future STEM graduates.

For many STEM graduates, career plans are not well developed. A thread running through both the student and graduate survey findings is the extent to which career decision readiness (or, more simply, the level of ideas about careers) is relatively under-developed. We found nearly a quarter of the undergraduates to have no or only vague career ideas when surveyed almost mid-way through their final academic year. Only around a third of students had a definite career plan by then, with the majority of students considering various options; and just over a third (37%) had applied for jobs (although this was about 60% of those who intend to enter long-term employment directly after graduation). This pattern varied by subject: higher proportions of students in Architecture, Building and Planning (52%) and Subjects allied to Medicine (48%) had a definite career plan than students in Geography (22%), Chemistry (24%) and Forensic Science/Archaeology (24%); and more final year students in Engineering/Technology (58%) had already applied for a job than in Psychology, Sports Science or Biological Sciences (all around 20%) or Forensic Science/Archaeology (17%).

Around half of the working graduates interviewed had made long-term[5] job applications by the time they left university, but over a third had made none at all – reflecting a similar position to that reported by the final-year undergraduates. However, these proportions did represent ‘progress’ over time, as only 16% of the graduates (and 19% of the students) surveyed had a definite career plan when starting their degree. Furthermore, the vast majority had chosen their degree course for reasons other than strategic career thinking. ‘Interest/enjoyment of the work’ was the reason given by almost all graduates (85%), while a third gave ‘personal ability’ and fewer still, just under a quarter, chose it for ‘improved job prospects’. Students mainly cited ‘personal interest/aptitude in the subject’ (77%) and ‘enjoyed studying subject at A-level’ (67%) as the main reasons for choosing their degree course, though around half wanted to pursue a career in this field while, interestingly, a similar proportion thought it would keep their career options open. Again we saw variation by STEM subject; desire for a career in the field was less frequently mentioned by students in Chemistry and Geography (around a third) and Physics and Mathematics (around 40%). ‘Keeping career options open’ was more likely to be mentioned than ‘wanting to follow a career in the field’ by Engineering and Technology, Physics, Chemistry, Geography and Mathematics students, while the reverse was the case in most other subjects.

Their experiences at university, and the influences upon them, did appear to have had a generally positive effect in terms of firming up career ideas. However, this pattern varied by STEM subject, with those in Engineering and Computer Science being more definite about career plans generally than others, especially those in the sciences. The situation for postgraduate research (PhD) students was markedly similar, although more taught postgraduates had firm career ideas (after all, many had pursued postgraduate study for career reasons).

This is perhaps not an unsurprising result or one that only applies to STEM students, as other research has shown (see, most recently, the 2010 *Graduate Real Prospects* Survey). Many graduates leave university today with few ideas about the career they will follow and before making any applications for long-term graduate jobs, often with unrealistic expectations about the kinds of jobs employers will recruit them to. Many of the observations in our surveys may apply similarly to non-STEM graduates (and did appear to, from our limited non-STEM graduate sample). However, it is has been shown in other research to apply much less to very vocational subjects like Medicine, Veterinary Science or Nursing, where there is a more visible and well recognised link between degree study and career (hence their omission from our study). It would seem that there is potential here to reduce this uncertainty among STEM students, which could lead to an improved supply of graduates into STEM work. Some of the employers we interviewed recognised this and were actively working on improving the level of knowledge individuals had about careers in their own firms or industry. Most were focusing on young people before they went to university, which seems also to have merit given our finding that

[5] As opposed to applications for temporary or vacation-type work

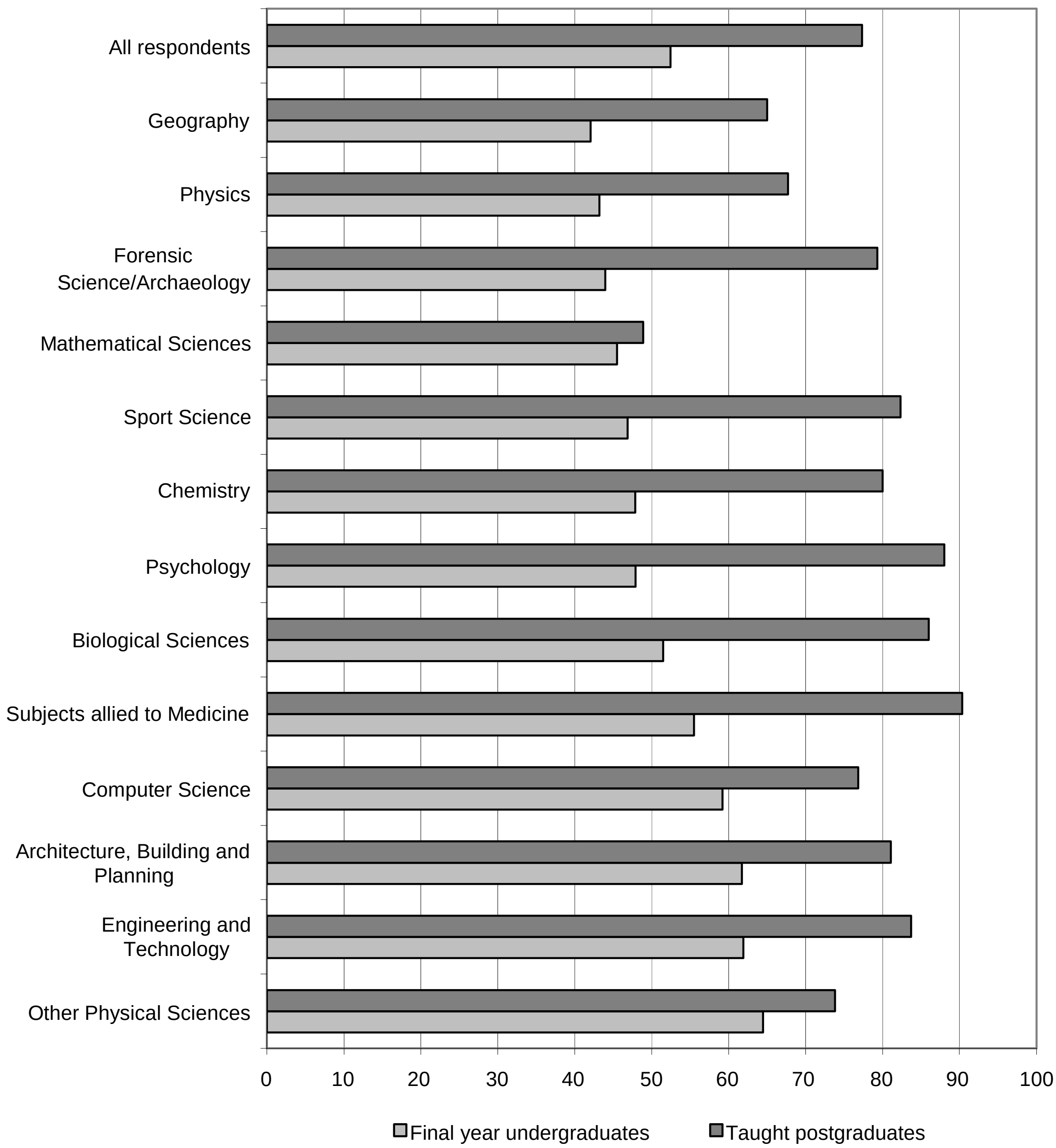
nearly a quarter of final year STEM students would do a different degree were they, hypothetically, to have their time again.

2.3 Do STEM graduates want a STEM degree-related career?

Only a very small proportion of STEM students report that they do not wish to pursue a STEM degree-related career by the time they are nearing graduation. About one in eight STEM final year students, one in ten STEM PhD students and one in twenty taught STEM postgraduates definitely *did not want to,* or *did not think they wanted to*, pursue a career directly related to their degree when they graduated**.** This proportion did vary by subject, but not hugely, so that in all subjects it was a small minority (none above one fifth or so of final year undergraduates), and did not seem to vary by gender.

Thus, the vast majority of STEM students in their final academic year are considering pursuing STEM careers, though some are more definite about this than others and some are considering various jobs or careers alongside STEM careers at this time. Overall, just over half definitely wanted to pursue a career in an occupation related to their STEM degree and a third might want to do so. Students in some subjects were more definite than others about staying in STEM, though the differences were not huge (Figure 2.1: ‘definite’ proportions ranged from around 60% in Engineering and Technology, Other Physical Sciences and Architecture, Building and Planning, to just over 40% in Geography, Physics, Forensic Science/Archaeology and also Mathematics. However, as mentioned, what is considered as degree-related employment varies considerably between subjects.

Figure 2.1 Percentage of respondents who definitely want to pursue a career in a degree-related occupation (Final year undergraduates and taught postgraduates)



Multiple careers and jobs/occupations are in many STEM students' minds around graduation – some unrelated to degree subject. Although most said they were likely to pursue a STEM career, many of them were looking at the possibility of working in a range of sectors or jobs using their learning from a STEM degree in different ways. Among those who had distinct careers in mind by their final year of study, about half overall expected a career in our defined STEM Specialist sector and just under half in our STEM Core jobs group (Table 2.1). A further 21% specified careers in *both* STEM and non-STEM sectors, while 18% specified *both* STEM and Unrelated job functions. However, this pattern varied considerably by STEM subject with, in particular, much higher proportions *not* planning to work in STEM Specialist sector or STEM Core functions in the less vocationally focused or broader subjects, such as Mathematics, Geography and Psychology.

Table 2.1 Expected occupational function for those with career plans, for selected subjects of study (final year UK undergraduates), expressed as percentages

Subject group	STEM Core	STEM related	Unrelated	STEM / Core related	Mixed functions	Don't know	*Number of cases*
Subjects allied to Medicine	65	6	8	9	9	2	*109*
Biological Sciences	51	9	11	11	18	0	*276*
Psychology	36	14	16	9	24	1	*234*
Chemistry	45	13	6	15	19	1	*157*
Physics	47	19	7	15	11	1	*162*
Mathematical Sciences	13	50	11	7	17	2	*151*
Computer Science	50	4	17	8	21	1	*194*
Engineering and Technology	65	2	7	6	19	1	*474*
Geography	31	18	13	11	23	4	*160*
All final year STEM	47	12	12	9	18	2	*2187*

Those students with firmer career plans are more likely to intend to pursue a STEM career, and vice versa. As highlighted above, many students' career plans were not well developed, and although they did improve during their degree study, there was a significant minority still very uncertain about which career to choose or employers/jobs to apply for, and likely not to decide until after university. It was clear though that a higher proportion of final-year STEM students with definite career ideas intended to pursue degree-related careers, than of those who were still 'undecided' about careers at this stage.

2.4 Why choose a STEM career or a non-STEM direction?

The main reasons for applying for STEM degree-related jobs are to have potentially interesting work and to use specialised skills/learning. High proportions of those final year STEM undergraduates who definitely intended to pursue a STEM career were motivated by expected excitement, interest and challenge in the work, wanting to continue in a field they had enjoyed, or wanting to put their learning into practice (all reasons given by over 60%). Those less certain about continuing in a STEM career direction (but who still might do so) were similarly motivated, although a proportion had not enjoyed their degree course and did not see the logic of continuing in it (43%). By contrast, career-based or practical/tactical reasons, including having better long-term career prospects or being better paid, were motivating factors for staying in STEM for only a minority of students. Expected pay was a stronger factor for

Engineering and Technology, Mathematics, Other Physical Sciences, Architecture, Building and Planning, and Computer Science students (mentioned by over a third of STEM career 'definites'), and more so for men than women (31% v. 25% of STEM career 'definites').

Graduates currently in STEM work (STEM Specialist employers/STEM Core jobs) had, similarly, in the main, chosen their current work for enjoyment/interest (over 50% gave this reason) or because it was the 'type of work they wanted' (over 40%), although salary, company benefits and location were also of importance (but mentioned by under 30%) and seemingly more so for them than for those in less STEM-focused work (i.e. those employed by STEM Generalists employers or in a STEM-related job). However, many individuals in the latter group rated factors relating to their employer's reputation or training/development scheme as more important reasons than interest/enjoyment, suggesting that other more practical or more individual employer-orientated factors may have greater importance for those choosing this kind of STEM-related career path.

Reasons for not staying in STEM are less polarised and mainly to do with students finding other fields of more interest. Most students seeking employment in a non-STEM direction (though relatively few) make a conscious decision to do so, primarily for potential interest in other fields (over half the undergraduates and nearly half of postgraduates gave this reason, Table 2.2). For most this was despite enjoying their undergraduate course, but 40% had not enjoyed it and this was also a reason for not wanting a STEM career. A quarter said they had never intended to work in the field of their degree. Potential earnings do not seem to have a strong role (mentioned by less than a third of students who might or definitely don't want a STEM career). We found little evidence of students being prevented from pursuing a STEM career by an external reason, although there were a few examples (e.g. students being rejected by STEM employers, too few jobs, or too few jobs in preferred location). Once decided on a non-degree related direction, issues like employer reputation or prestige, or graduate scheme quality, became important in rationalising their decisions.

Understanding the actual decisions made by graduates now in the workplace (i.e. why they chose their job) revealed that pragmatic or tactical reasons became increasingly important once they left university. Many decisions combined personal aspirations, some knowledge of the labour market and employers, and pragmatic personal issues, which could result in very individual decisions and pathways.

Table 2.2 Most commonly cited reasons for non-degree related career intention (UK final year students and taught postgraduates who might, might not or definitely do not want to pursue an occupation related to their degree)

	Final Year UK students			UK Taught Postgraduates		
	Might	**Might not**	**Definitely not**	**Might**	**Might not**	**Definitely not**
	%	%	**%**	%	%	**%**
I have become more interested in another field	31	54	58	21	42	43
There are too few jobs related to my degree in my preferred location	29	17	10	34	17	0
I will find it easier to get a job	27	22	11	12	25	0
There are too few career opportunities in my field	24	21	19	29	25	0
I will be better paid	20	29	31	18	42	29
My course did not prepare me well enough to get a degree-related job	15	8	8	6	8	0
I have not enjoyed my degree course	12	23	41	6	8	0
I will have better long-term career prospects	10	26	32	11	25	29
Number of cases	*1024*	*237*	*101*	*112*	*12*	*7*

External influences while at university could pull in different directions. With the majority of students developing and changing their career ideas while at university, there is much scope for external influences to play a role in their choice of career direction. Beyond the intrinsic influence of their own personal development and ideas, and the impact of their own university course, the most significant extrinsic influence was degree-related work experience, at least for those students who undertook it (around half of the undergraduates had done so, though this varied by subject). Although its impact also varied by subject, generally work experience was very positive – more students were minded to pursue similar work in the long-term, some with that particular employer. For others, although fewer, the experience was pivotal in developing the understanding that they were *not* well suited to that kind of work. There was also evidence of the influence of peer group, and the strong profile of large employers on campus – principally STEM Generalists and non-STEM employers in our definitions – which were very keen to recruit STEM graduates. It was clear that for many of the graduates interviewed who did not have strong prior STEM career plans, entry to the graduate scheme of one of the large accountancy firms, consultancies or banks was perceived as a ‘mainstream’ route for STEM graduates. They gained this impression from peers, visits to campus by alumni employed by those firms, and also some careers services.

STEM Specialist employers, often (but not always) smaller and recruiting fewer graduates annually than these large recruiters, somehow did not achieve the same profile with undecided graduates. Although individual stories varied, it was clear that for many such graduates, the resulting impact of these external influences was greater knowledge and enthusiasm for careers outside STEM, while the strong ‘pull’ into STEM of work experience tended only to occur for those who had been sufficiently career-motivated to apply for it in the first place.

As highlighted above (section 2.2), we found fairly low career awareness, or career motivation, when we asked why they had chosen a STEM degree in the first place. **Students had chosen a STEM degree mostly because of personal interest and enjoyment, and career-related reasoning was a less significant factor.** Almost four out of five students reported that they had chosen their degree course on grounds of personal interest and/or aptitude, and enjoyment at A-level (or similar) at school was cited by two thirds. The desire to follow a career in the field came third in importance, cited by around half. Barely one in six chose their STEM degree because it was essential for a known career goal.

Evidence from graduates reflected the student survey results, and **those now working outside STEM were more likely than those working in STEM to have chosen their degree subject for interest alone or because they excelled at the subject at school,** i.e. not for career reasons. Many commented that they had little understanding before university of how degree subjects and career directions related to each other, and with hindsight wished that they had known more about this. Some graduates did have a STEM career in mind when they went to university, and a higher proportion of those entered STEM careers than of the remainder. This suggests that improved career information prior to university could be beneficial.

Almost all final year students with a career in mind thought that their degree was at least preferable to achieve their career goal, but only half thought it essential. Taught postgraduates were more likely to think their degree was essential, reflecting the stronger career motivation behind taking postgraduate study. Students in Engineering, Chemistry and Other Physical Sciences were more likely than students of other subjects to consider their degree to be essential for their career goal.

2.5 Influences on career thinking

Changes in students’ career plans were more likely to be influenced by changes in personal interests or values or by their course than by employers or employment experiences. Course content was more influential on students in Engineering, Forensic Science/Archaeology and Other Physical Sciences than others, while employers and employment experiences were more influential on Chemistry, Computer Science and Engineering students than others. Graduates tended to see employers and work experience as being more of an influencing factor than did students. However, this may be a reflection of the nature of the graduate sample and its bias towards the ‘stronger’ students.

The majority (60%) of final year students had used the careers advisory service at university and four out of five had found it helpful; this did not appear to vary with their eventual career direction. As many as 40% felt they would have benefited from additional help or advice before they went to university, chiefly because they had little understanding at that time of how different degree courses related to career directions or job opportunities.

2.6 Employment decisions and destinations

The individual career paths of STEM graduates are not simple or always predictable. With significant numbers of students lacking firm career ideas and leaving job applications until they leave university, it is not entirely surprising that their subsequent career pathways are not straightforward and reflect individual circumstances. This is partly explained by the absence of career ideas from the outset, and paucity of knowledge about STEM career opportunities. However, it is also due to the wide variety of possible jobs that STEM graduates can take up, as well as the range of different influences on their career thinking. As seen in the illustrative case studies presented, some graduates' paths were directly impacted by external constraints (restricted location due to caring for a parent, or to follow a partner's career), while others reflected progressive development and understanding of personal beliefs (desire for public service, or recognition that they took the 'wrong' degree).

Irrespective of employment sector, most make good use of their broader graduate skills in their current jobs. Once in the workplace, the number of graduates in this sample that considered they used their specific degree skills and knowledge to a great extent in their current job was small (one in six) though rather more (a third) were using them to some extent. Use of specialist degree skills or knowledge was much higher in some subjects, especially Computer Science (almost a third used them to a great extent). Those in STEM Specialist employers or STEM Core occupations were also more likely to be using them in their current job (70% to at least some extent), though this seems lower than might have been expected. Most graduates in STEM Generalists were unlikely to be using their STEM degree specialist skills. By contrast, almost all the graduates said they used the general and broader skills gained while studying a STEM degree a significant amount in their current job, and there was little variation in this by type of STEM work, suggesting that these broader skills were universally useful. These were mainly communication/presentation (written stronger than verbal), problem-solving and analytical skills. Some graduates felt these skills were unique to STEM degrees, notably their particular and logical/rigorous ('scientific') approach to problem-solving in the workplace, which was highly valued by employers. Their inherent numeracy (as a STEM graduate) and ability to understand risk and probability were valued in non-STEM work environments, and there was evidence that some had benefited in career progression within non-STEM work as a result of possessing these skills.

Interviews with employers highlighted variations between STEM Specialist, STEM Generalist and non-STEM employers in their STEM graduate skill requirements. STEM Specialists sought STEM graduates primarily for their STEM core competences, and in some cases there was a tight match between STEM discipline or course and job specification. Academic excellence in science and engineering was seen as a key requirement, echoing other research on STEM demand; but broader (employability) skills were needed also from STEM graduates. Among STEM Generalists, some focused more on the relevance of their degree subject for certain job roles (e.g. environmental management), but others said they required the specialist skills (e.g. in computing, analysis, mathematical modelling) gained in their degree. Though reasons for taking STEM graduates were sometimes not clear and varied between employers, as a general rule, it was **graduates' ability to apply STEM knowledge and skills more broadly and other (employability) skills were of most value to employers outside STEM Specialist sectors.**

Most of the graduates were very satisfied with their job and career to date. Levels of satisfaction with both current job and career progress to date were very high amongst the graduates interviewed, in all employment sectors, although this may reflect the sample (mainly 'strong' graduates working in 'good' jobs). However, many working outside STEM would in principle like more degree-related work – chiefly because they perceived it would be more interesting than their current work. This appeared to be most overt in a minority now working for large companies in financial and professional services, who essentially now regretted their chosen career direction. However, few considered it would be feasible to re-enter STEM occupations in the short term, even if they wanted to, mainly because of an expected resultant drop in earnings. Many did not aspire to having more degree-related work, largely because they feared it would narrow their work and reduce its interest.

2.7 Variations by discipline and other factors

As has already been highlighted, some variance by STEM subject was observed in the evidence, which supported our expectations that certain subjects are more narrowly 'vocational' than others in terms of careers and employment outcomes. The relatively small number of students in Architecture, Building and Planning, a discipline group within our scope but not a core focus for our attention, came across as the most 'vocational' in terms of being more career-motivated than others, with many results related to this. To a somewhat lesser extent, Engineering & Technology and Computer Science students and graduates also displayed similar trends in responses, although the Engineers in particular seemed well aware of their potential value in other parts of the labour market, some even before they entered university (in that they chose their subject to keep options open). Their career 'awareness' appeared to be relatively high but that did not necessarily drive them into engineering (although the majority would take that career route in the end).

Amongst the other subjects, including the 'core' sciences, there was less consistent variation. Mathematics students and graduates were perhaps the least straightforward, giving certain quite ‘vocational’ types of responses (similar to those of Computer Scientists) in some places but not in others. This is possibly a reflection of a small number of very significant career directions which Mathematics students view as closely degree-related (e.g. accountancy), but *not* viewed as closely related to the degrees of other STEM students, while they appear to have few other clearly degree-related options.

In terms of other factors, there appeared to be relatively little evidence for systematic variations by gender, other than a slightly greater attraction of earnings for men, and some indication of higher importance of pragmatic and tactical factors for women, such as the availability of jobs or their location.

There was some evidence that students in Russell Group universities tended to be more ‘advanced’ in terms of making job applications than those in other universities, but no clear evidence that students from different institution types were more or less likely to enter STEM careers. If anything two trends in different directions might have offset each other. More of those outside the Russell and 1994 Groups tended to study the more vocational degrees for career-related reasons, but the ‘higher quality’ graduates in the Russell Group in particular were perhaps more confident in making earlier applications, and were more likely to secure the prestige jobs, although many of the latter appeared to be outside STEM Specialist sectors. The latter trend would be reinforced by the targeting of many graduate recruiters.

2.8 STEM skills mismatch

Employers, especially those in STEM Specialist sectors, commented on **deficiencies in some STEM graduates’ technical ability and subject knowledge** and also, for some, their lack of business awareness. Some STEM students were also criticised for weaker behavioural skills, in particular time management and organisational, team-working and communications skills. This was a contributing factor to many employers’ recruitment problems, especially for STEM Specialists. They would like to have a larger and better pool of UK applicants from which to select. While there would seem to be some evidence to suggest that the skills of STEM graduates are not well enough matched to STEM employer requirements, which could be a reason why some might not apply to them or not succeed in the selection process and so seek jobs elsewhere, employers tended to see other factors as being far more significant reasons for STEM students applying to other sectors. In particular several felt the greater attractiveness to graduates of many other employers and jobs outside STEM was highly significant. Second, they worried about the lack of genuine knowledge among students, and young people generally, about what scientists and engineers really do and what careers in STEM are actually like (in contrast to other professionals like doctors and lawyers).

Many large employers, STEM Specialists and Generalists, target their recruitment effort on a relatively small number of universities and/or particular courses. These are mainly universities where (A-level or similar) entry requirements are high or where particular STEM disciplines are seen as strong, and so are likely to produce candidates of the quality the STEM employers seek. This strategy potentially could exclude other candidates of the quality required who are studying at other universities – and who could then be driven to look elsewhere. To counter this, employers also operate ‘open’ application systems so that students at non-targeted universities can apply, but their profile is much lower at non-targeted institutions. They saw targeting strategies as beneficial in helping to deliver a stronger set of STEM degree-qualified applicants but frequently find they have to compete strongly with large non-STEM employers for these graduates at the same targeted universities.

2.9 Overall conclusions and implications

2.9.1 Reasons why STEM graduates are not in STEM jobs

Thus, it seems from the research findings that there is not one clear or simple main reason why many STEM graduates are not in STEM jobs. While there is partial support for some of the hypotheses proposed by BIS (section 2.1.1) as possible reasons, we found little or no evidence for others. It is important to note, though, that in detail the situation is often more complex and career decision-making more individualised and multi-factorial than could be accounted for by any single hypothesis. In relation to the hypotheses and evidence presented at the start of the research (in section 1.1):

- **Significant numbers of working STEM graduates are not in STEM occupations.** We found evidence to support this in the graduate and employer strands of the research. STEM graduates are working across all sectors of the economy and in a wide variety of occupational roles. The graduates we interviewed, admittedly mostly ‘strong’ graduates in ‘good’ jobs, were almost all satisfied with their jobs and career progress, and used their degree-related broader skills widely, some of which were highly valued by non-STEM employers. Employers are recruiting STEM graduates into a range of job roles, many of which are also open to non-STEM graduates but where those with STEM degrees may have an advantage.
- Four main career tracks after graduation are evident: (1) obtaining employment related to a long-term career plan; (2) enrolling on a full-time postgraduate course (seen as an essential route to a STEM career in some subject areas); (3) taking a gap year or two, to travel or time out; and (4) taking temporary or non-career related employment. Higher proportions of students on tracks (1) and (2) are found in some subjects than others. What is important here is that many of the graduates on tracks (3) and (4), where numbers can be fairly substantial (especially in some subjects), are still undecided about career directions, and many of them end up, in the long term, in work outside STEM.
- If a wage premium exists, pay does not seem to be a major motivating factor in most decisions about taking up STEM or other work, although it is not unimportant to most graduates. **There seem to be divergent views from students about whether STEM jobs are actually better paid than those outside STEM, or vice versa. Employers**

see students' higher salary expectations (especially in early careers) outside STEM sectors as a major reason for STEM graduates to enter non-STEM jobs. About a quarter of students mentioned better pay as a reason to enter degree-related occupations, but a similar proportion seeking non degree-related work reckoned that pay would be better elsewhere. Pay seems a stronger motivating factor for men than women. Isolating particular factors like pay is made more complex by students' different views of which sectors and occupations are degree-related, especially students in different STEM subjects, as we have mentioned. Equally, BIS (2009a) reported an earnings premium for STEM graduates only in scientific and financial occupations, rather than for all STEM occupations. To complicate this further, the employers we interviewed thought that the high levels of *starting salary* available to a small number of recruits in some City firms (particularly investment banks) were a very strong pull factor away from STEM, but in reality this only applies to very small proportions of STEM graduates overall. Furthermore, most large STEM firms ensure that their initial graduate salaries are competitive with *most* other graduate schemes. Meanwhile, students and graduates in our surveys and interviews probably based earnings perceptions on starting salaries, so prospective earnings over a longer period may not have been considered.

- **There was some evidence from employers, but little or none from the students or graduates, to support the suggestion of a mismatch between employer requirements for skills and those offered by graduates as a cause of 'losses' from STEM Specialist/Core jobs**. Very few graduates said that they had been rejected by STEM employers, and none that such a rejection had changed their intended career direction. Instead, they might then have applied to less prestigious employers in the same sector. This could partly be a reflection of the nature of the graduate sample, i.e. those who were relatively successful in obtaining employment. On the other hand, the employers interviewed did report insufficient skills in many applicants, although they tended to highlight weaknesses in STEM graduates' core discipline knowledge and understanding, or their mathematical capability, as much as or more than weaknesses in more generic ('employability') skills like communication (although some highlighted both).
- Our research was not designed to obtain direct evidence on levels of unemployment of STEM graduates or how long they took to find work, but there was no evidence that the graduates interviewed had been quicker or slower into work in different sectors. In fact as the majority of students are not making applications for career-related jobs prior to graduation, and many are deliberately taking time out for a break, which appears to be an increasing trend in the graduate market generally, this measure may be of decreasing value in terms of assessing the long-term employment of graduates.
- Of the graduates interviewed, although never intended to be a representative sample, we did find some variety of academic attainment in different employment sectors. Roughly equivalent proportions of those with 1st and 2.1 degrees seemed to have entered STEM Specialist and STEM Generalist employment, but fewer went into non-STEM jobs. On the other hand, a higher proportion of those with 'lower' degree classes

had entered STEM Specialist work than STEM Generalist sectors (in which the major graduate schemes tended to be found). The evidence does not provide strong or simple support for higher attainment or over-education within STEM Specialist jobs; certainly there was no evidence that students believed, or graduates had believed, that higher academic attainment was a requirement of STEM Specialist employers and which had put them off applying. If anything the graduates reported that the hardest employers to satisfy were STEM Generalists, such as consultancies, where there was very strong competition. The instances recorded where graduates felt their limited academic performance affected their career decisions were those who chose not to attempt to research jobs while within higher education, and some who gained insufficient grades to pursue Medicine in the first place, and entered other STEM fields for degree study instead. On the other hand, some specifically targeted less prestigious employers within a particular sector, tactically, where they felt they were not strong enough to succeed with the top employers.

- A number of employers expressed the view that certain STEM Specialist firms or sectors were less attractive environments in which to work than some others outside STEM. They thought this could be a significant factor turning STEM students or graduates away. However, there was varying evidence from students or graduates about this. Certainly, amongst those interviewed, **many STEM graduates viewed some non-STEM and STEM-related employers as the most prestigious and desirable places to work**, and were motivated by issues like company reputation and the training environment they offered. However, amongst students there was little or no overt evidence that perception of working environment was a significant reason behind choice of career direction. A small number of students were put off applying to some STEM employers, having been influenced by their own work experience, but this was only a minority and the experience in a work placement was positive for most in terms of confirming a STEM career direction.
- Although some graduates felt that the most prestigious employers were not STEM Specialists, it was clear that neither students nor graduates had a conscious construct of a ‘STEM career’ that might be ‘better’ or ‘worse’ than that in another sector. We came across only one exception to this (a graduate whose path was determined by her perception that a STEM-focused career would be less respected in her cultural community than a traditional profession like law).

Although detailed work is required to distil the influence of each of these factors independently, in Table 2.3 a series of factors are summarised which appear to have a significant impact on the number of STEM graduates that definitely intend to pursue a STEM career.

Table 2.3 Percentage intending definitely to pursue a degree related career with certain factors/attributes (UK final year undergraduates)

If Yes %	Factor (i.e. Did undergraduate…)r	If No %
68	Choose undergraduate course with career motivation	37
65	Have a definite career in mind at entry to university	49
60	Study an enhanced/M level course (selected subjects)	49
64	Undertake degree-related work experience	41
72	Have definite careers in mind at time of survey	43
63	Not change career plans during university	48
63	Have aim for next year either full-time higher degree or employment related to longer term career plans	32

2.9.2 Broader implications

Although we found many individual reasons behind STEM graduates' decisions to enter careers unrelated to the field of their STEM degree, the reasoning for the majority was a perception that other work would be more interesting. Related to this, for some, their chosen STEM degree turned out to be less interesting than expected and they actively sought a change. **The decision for most seems therefore to be very much a matter of individual choice** – taking into account lots of different and rather personal as well as employment factors – rather than being fully based on one or two 'rational' factors such as earning potential or career prospects, or external factors such as difficulty or inability to obtain STEM employment due to skills/job mismatch, or a lack of jobs in the graduate's desired location. However, for a minority these more 'rational' reasons were the more significant ones.

We observed a considerable number of cases of what might be called 'career drift'. Whether they end up working in STEM employment or not, **many graduates' paths are affected by a lack of career decisiveness** at graduation and even later. This may be linked with a lack of knowledge about real STEM jobs and their environment, about the career opportunities that exist for STEM graduates, and also the relationship between a STEM degree course, either in general or as a specific subject, with particular jobs and careers. It seems that **the firmer the career thinking, at any stage, the more likely the STEM student or graduate is to pursue a STEM job and career**.

A positive benefit of this position – where most students are not fully decided on their career goal – however, is that they remain potentially "influenceable" at university, and even beyond. As such there are opportunities for employers and other stakeholders to make their case more vigorously, in order to compete with others in the labour market. Although many STEM Specialist employers are relatively small organisations (smaller than the largest graduate recruiters and with much lower profile), this is not universally the case. Also, it does not appear that only small STEM employers are reporting recruitment difficulties.

The observation that few students are primarily motivated by pay should offer comfort to STEM employers. Indeed, if it is interesting work and job satisfaction that students seek, then opportunities abound within STEM employment fields which promote just those qualities in such a way that graduates are attracted more strongly. This is reinforced by evidence that degree-related work experience encourages more to apply for STEM jobs in the long term; i.e. that 'real' knowledge is positive in terms of increasing STEM career attractiveness. If STEM students are exposed to and gain better knowledge of what it is really like to work in STEM employment, this ought to improve the prospect of higher proportions applying for STEM jobs. This appears to be a similar finding to that reported in CRAC's work with students considering IT careers (2008), where many chose other fields based on the perception that work in IT would be boring. Across the range of STEM employers and jobs, there will be many opportunities to promote the intrinsic interest of working in STEM, and its benefit to society and the environment, as well as its competitive career returns. It seems, on the surface, somewhat counter-intuitive that many students appear to 'leave' STEM on grounds of seeking interest at work, yet one of the career destinations many such graduates enter is accountancy / financial services, which does not have a reputation for interest.

Another aspect of this issue of career decisiveness (or rather indecisiveness) is our important finding that **relatively few STEM students or graduates chose their degree course with a specific career direction in mind**. This has also been found in other studies (see most recently the *Futuretrack* study of 2006 degree entrants, HECSU, 2008a). Also, many of those that did give future careers consideration at that stage realised that a STEM degree could keep open or even advance them in lots of different career directions. This was as apparent for subjects seen as strongly vocational, like Engineering, as those that are less so like Physical Sciences, and was stronger still in Mathematics. This is important for policy implications, as it calls into question, to some extent, the concept of a 'pipeline' of STEM-qualified graduates and skills, and the expectation that the 'default' direction for STEM graduates will be to adhere to a STEM career pathway. Not doing so is seen as something 'wrong' or a 'loss' in the pipeline model, but this does not hold true for the graduates. Although our cohort of graduates were mostly strong and many worked for larger employers outside specialist STEM sectors, it was clear that for them at least the 'default' direction while at university had been Generalist or non-STEM corporate graduate schemes.

What this perhaps highlights is that there should at least be some limitation on expectations of the proportion of STEM graduates who will emerge from the 'pipeline' at the end, i.e. into STEM employment. Many students appear to enter the pipeline without knowingly intending to travel its length – hence the expectation needs to be reduced that they will emerge at the end into STEM occupations. It also is apparent from this study (and others) that there is value in a wider recruitment of STEM graduates to sectors across the economy and society, in the skills they bring to job functions and workplaces, and this should be more positively recognised and encouraged (though not at the expense of meeting the needs of the specialised STEM sectors).

The potential 'broadening' career benefit of studying STEM qualifications needs more recognition within the higher education community. It has become recognised within 14-19 education policy and in recent initiatives to encourage more young people to study STEM subjects post-16. Our research has shown that a wide range of jobs are open to STEM graduates, and that they can be highly sought by employers, in both STEM and non-STEM sectors. This should be an underpinning element of careers advice given prior to higher education or other post-18 choices.

As the students progress through their degree studies, their career thinking firms up and seems to shift from purely aspirational early on to a combination of aspiration and pragmatism by the time of graduation. However, many do not apply for jobs until after they leave university; this is the case both for those intending to secure career-related employment after university as well as for those on our 'tracks' (3) and (4), described earlier. Accordingly, as it is conducted only six months after graduation, **the *Destinations of Leavers from Higher Education* (DLHE) survey is unlikely to give a good indication of the career-related employment of graduates**, and more attention needs to be given to measuring employment outcomes at least a year, and ideally several years, after graduation.

During their period of degree study, students become more aware of certain issues in the labour market, and some develop rather negative perceptions of STEM employment while many respond positively to the high profile and substantial public relations efforts of the major corporate recruiting employers on campus (mostly non-STEM and STEM Generalist employers). We observed many cases of such job applications in parallel with those to STEM Specialist employers, which reinforces the impression of a lack of decisiveness or indicates that they were consciously keeping options open. Accordingly, issues like employer reputation, opportunities for professional training and even how corporate cultures might conflict with their personal beliefs, enter their thinking, as well as practical issues such as the ease of getting a job or its potential location. **The net effect of all these influences seemed to be to encourage a higher proportion of them to make job applications and enter jobs unrelated to their degree than we might have expected from the headline results on students' career intentions,** where the vast majority said that they were likely to stay in STEM fields. Their subsequent career decisions seem to have been even more individually orientated than underlying subject, HE institution type, gender or other external factors would suggest.

For STEM students, there is clearly a wide range of job opportunities open if they develop the appropriate academic and personal skills and knowledge sought by employers. However, **more opportunities are needed to develop work experience and genuine knowledge about work and careers in STEM, in order that more students can make more informed career decisions**. For employers, especially those in STEM Specialist sectors, there is the potential to help students shape and firm up career ideas while at university and beyond. They need to make their case more visibly and strongly, for the attractive features of STEM jobs and careers, especially where there is interesting work. In that way they might influence more students, especially the less decided and the 'career drifters', of whom there are many. Additional provision of information of this contextual nature, before students choose their degree courses, would also be welcomed by them.

2.9.3 Recommendations for further research

This study has explored in detail with samples of STEM students and graduates the reasoning behind their decisions to enter STEM or non-STEM work. It has shown that we may have underestimated in the past how complex career choices are and the range of factors, often interacting with each other differently over time, that influence employment outcomes, including individual career choice. They are not easy to capture in cross-sectional research studies. Several areas stand out for further research which would help to take forward some of our findings.

- One is the need to improve our STEM definition, especially in relation to employment. There needs to be consistency in terms of the disciplines and occupations included. In particular, further work is needed to see how the Standard Occupational Classification codes (SOCs) can be used better to define STEM work, or to develop a better system based on SOCs specifically for STEM, and also to improve how occupational coding is undertaken in the LFS and DLHE surveys in relation to STEM occupations. This would help give greater clarity in the evidence base, as well as helping with careers information and guidance.
- The second area is the need to strengthen evidence on the 'career journey'. Most research, like this study, focuses on career decisions of a cohort of students at one point in time and, although they are asked about past events and decisions, there is inevitably some post-hoc rationalisation and also possibly other memory issues. More research on career decision-making processes over time is needed and how factors we have highlighted here, as influential on STEM and potential STEM graduates, actually operate individually and together at different stages. This can best be done through longitudinal research, starting before higher education and going through into employment. We have one such national study at present, the *FutureTrack* (HECSU 2008), but it has not yet produced data on graduate outcomes. We urge that this stage is completed as soon as possible and that data relevant to STEM can be made accessible for others to use in more detailed analysis to help explore further some of the issues highlighted here. There is also a case for undertaking new longitudinal work, to capture a new cohort of STEM students affected by recent changes in higher education financing and the evolving graduate labour market. An option could be to follow up cohorts of recent STEM graduates at intervals after graduation to provide a better evidence base on the different graduate employment tracks than we can currently obtain from the DLHE and L-DLHE

surveys in their current form. A follow-up after one, two and five years of samples of specific groups of STEM graduates in the DLHE surveys should be considered.

- Thirdly, it would help to know much more than currently about why students choose particular degree subjects and how this relates to their career goals. So, further research among new degree entrants on their motivations for taking a STEM course and their expectations of getting a job in their degree discipline would be useful in assessing how close the ‘fit’ is between choice of degree study and employment and how this might change over time, particularly as changes to higher education policy come into effect and employability is increasingly under scrutiny. It would also be helpful to explore in more detail than possible here how this varies between students, with different socio-economic backgrounds, qualifications or experiences in the discipline they have chosen to study.

3. Career intentions of STEM students

The results of our survey work with STEM students are presented in this chapter. As described in Chapter 2, two online surveys were carried out, one for undergraduates and taught postgraduates, the other for PhD students. The purpose of the surveys was to understand the factors that shape STEM students' career choices and, in particular, to gain insight into what influences their decisions to pursue, or not to pursue, a career in a STEM employment field. The survey questionnaires not only looked at the students' future career intentions but also collected information about their past decisions including choice of degree course and how their career ideas had changed over time. The intention, therefore, was to understand a students career journey from initial entry to university through to either their final year as an undergraduate or, where appropriate, as a postgraduate.

A distinctive feature of the two surveys was that they included students studying at three different levels – undergraduates, Masters and PhD students. This allowed analysis to be conducted by level of qualification as well as by subject. In certain subjects (Chemistry, Physics, Other Physical Sciences, Mathematics and Engineering/Technology), substantial proportions (over 25%) of UK final year students were studying for enhanced/integrated Masters degrees and where appropriate these undergraduates are identified separately.

For convenience, the analysis presented in this chapter focuses mainly on UK final year undergraduate students who are seen as the core group of respondents. Data from postgraduates on taught courses and from the final year PhD students are used to highlight similarities and differences in the experiences and intentions of survey respondents. In certain subjects a high proportion of final year undergraduates intend to go on to postgraduate study and in these subjects a postgraduate qualification is often seen as a prerequisite for entry to degree-related work.

The first three sections of this chapter focus on the students' current intentions. This has three aspects:

- their intention to work in STEM or not – that is whether they seek STEM degree-related work or not;
- the type of work they plan to do;
- the practical steps they are taking to realise those plans – i.e. their actual plans for the year after they graduate.

The second part of the chapter examines how the students' career thinking has developed over time from their initial choice of university course and their career ideas at that time. In particular, it looks at what has influenced the development of their career thinking and decision-making.

Understanding what has influenced these students is likely to be crucial to the development of any strategies to encourage more students to consider STEM careers.

3.1 Future career intentions

3.1.1 Are they likely to stay in STEM?

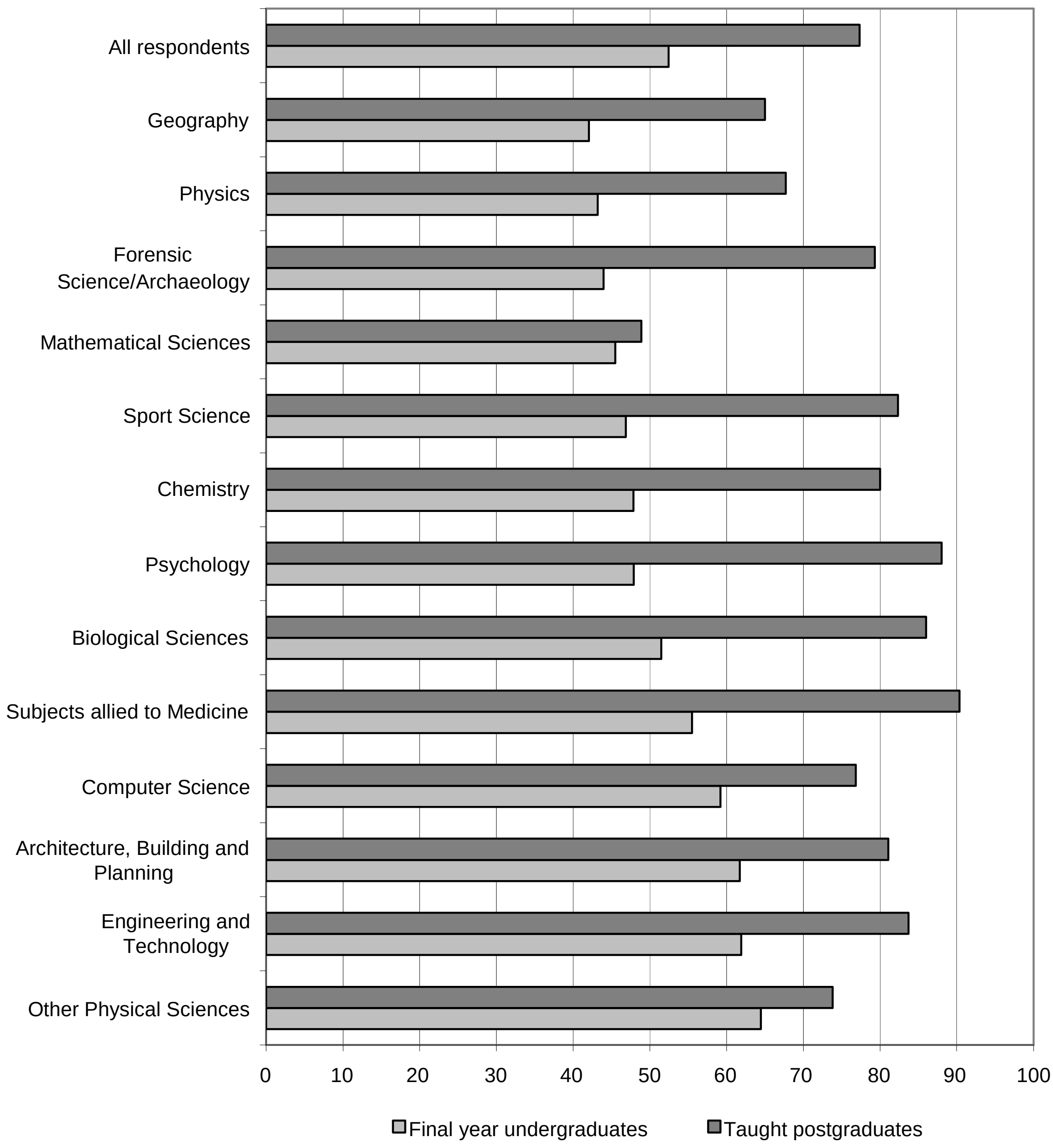
Most final year undergraduates (86%) indicated that they were likely to try to pursue a career in an occupation related to their STEM degree when they left university, with over half (52%) reporting that they definitely wanted to do so and a third (34%) saying they might. Only 3% reported that they definitely did not intend to, a further 8% might not do so, and 2% did not know whether they wanted to or not. These indicators of career intention were almost identical for male and female final year students.

UK postgraduates on taught courses were more likely than final year undergraduates to want to pursue a career in an occupation directly related to their degree. Over three-quarters (77%) of these STEM postgraduates said that they definitely wanted a career in an occupation directly related to their degree and a further 18% said they might want to. The main exception were Mathematics postgraduates where just less than half (49%) wanted a (Mathematics) degree-related career. Female postgraduates were also slightly more likely than male ones (80% compared to 75%) to say they definitely wanted a degree-related career.

For both groups, however, there was some variation by subject (see Figure 3.1 and Appendix Table B3.1). The percentage of UK final year STEM undergraduates definitely wanting to pursue a degree-related career was highest among those studying Other Physical Sciences (64%), Engineering and Technology (62%) and Architecture, Building and Planning (62%) and lowest in those studying Geography (42%), Physics (43%), Forensic Science /Archaeology (44%) and Mathematics (45%).

When final year students on M-level courses in the five subject areas where they make up more than 25% of the cohort are compared with those on conventional 3-year programmes, 60% of M-level final year students definitely wanted to pursue a degree-related career compared to 49% of those on three-year courses (see Appendix Table B3.2). The difference was least pronounced in Mathematics (47% for M-level compared to 45% of others).

Figure 3.1 Percentage of respondents who definitely want to pursue a career in a degree related occupation (Final year undergraduates and taught postgraduates)



In contrast to the postgraduates on taught courses, UK final year PhD students were only slightly more likely than UK final year students to say that they wanted to pursue a career in a directly related occupation (see Appendix Table B3.3). Just over half (55%) said they definitely wanted to and 34% that they might want to work in an occupation related to the broad subject of their research. PhD students in Mathematical Sciences (45%), Biological Sciences (50%), Physical Sciences (51%) and Engineering/Technology (52%) were less likely than PhD students in other STEM subjects to say they definitely wanted to work in an occupation directly related to the broad subject of their research.

Two conclusions from this analysis are:

1. Only a small minority (about one in eight STEM final year students, one in ten PhD students and one in twenty STEM taught postgraduates) did not or might not want to pursue a STEM career (or did not know if they wanted to). However, about a third of final year undergraduates and PhD students and a fifth of taught postgraduates only *might* want to pursue a STEM career. Nevertheless, the majority (more than half the final year undergraduates and PhD students and three-quarters of the taught postgraduates) said that they *definitely* wanted to pursue a STEM career.
2. There was clear variation by subject area with, in general, those students studying traditionally 'vocational' subjects being more likely definitely to want to pursue a career in STEM. PhD students in Engineering/Technology were the one possible exception to this but this may indicate only that they were less likely to work in an area directly related to their research rather than outside STEM.

The implications are that there are some differences in career intentions between students by level (undergraduate, taught postgraduate and PhD) and by subject group and we need to understand how these differences arise. We start by looking at the reasons students give for wanting or not wanting to stay in STEM.

3.1.2 Reasons for wanting to stay in STEM

Almost nine out of ten of the final year students who *definitely* wanted to pursue a career directly related to their degree (i.e. those with a definite STEM career intention) said they would do so because they 'will find the work interesting and challenging' (87% gave this reason). Other important reasons were: 'want an opportunity to put their learning into practice' (74%), 'enjoyed their degree course and so it seems logical to work in this field' (63%), and 'always wanted to work in this field' (53%). None of the other reasons was chosen by more than half the respondents. The figures for taught postgraduates were very similar (see Table 3.1).

However, 60% of final year students who definitely wanted to pursue a career directly related to their degree had undertaken some degree-related work experience. Over half (58%) of these students with work experience gave that they 'enjoyed their degree-related work experience' as a reason for wanting to pursue a career in an occupation directly related to their degree making it their fourth most commonly mentioned reason.

Table 3.1 Reasons for STEM career intention (UK final year students and taught postgraduates who definitely, might and might not want to pursue an occupation related to their degree)

	Final Year UK students			UK Taught Postgraduates		
	Definite	Might	Might not	Definite	Might	Might not
	%	%	%	%	%	%
I will find the work interesting and exciting	87	71	31	85	73	42
I want an opportunity to put my learning into practice	74	68	43	70	62	33
I enjoyed my degree course and so it seems logical to work in this field	63	43	24	53	42	8
I have always wanted to work in this field	53	19	4	49	18	17
I will have better long-term career prospects	40	35	11	46	39	0
I enjoyed my degree-related work experience	39	16	5	20	8	8
I will be better paid	28	31	22	34	36	8
I will find it easier to get a job	19	23	18	16	23	8
I know other people who do this kind of work	13	10	7	12	9	0
There are plenty of degree-related jobs in my preferred location	13	10	10	3	5	0
I have knowledge through a parent/relative who does this kind of work	7	6	2	4	5	0
I will be letting people down if I don't	3	6	9	3	6	8
Already employed in this field	1	-	-	1	-	-
Other reason	3	2	5	4	4	17
Not answered	0	0	0	0	0	0
Number of cases	*1557*	*1024*	*237*	*474*	*112*	*12*

Both final year and taught postgraduate students who *might* want to pursue a degree-related career had a broadly similar pattern of replies but with slightly lower percentages endorsing each reason. However, they were much less likely to say that they 'have always wanted to work in this field' and also less likely to say that they 'enjoyed their degree course and so it seems logical to work in this field' than those definite about staying in STEM (see Table 3.1). They were also less likely to say that they 'enjoyed their degree-related work experience'.

Not only had fewer of these final year students undertaken any degree-related work experience (40%), but only just over a third (36%) of those with work experience mentioned 'enjoying their degree-related work experience' as a reason for wanting to pursue a degree-related career compared to 58% of those with definite career intentions.

Final year students and taught postgraduates who *might not* want to work in a STEM degree related field were even less likely to endorse these reasons for pursuing a STEM career. Nevertheless, 43% of these final year undergraduates and 33% of taught postgraduates cited ‘want an opportunity to put their learning into practice’ and 31% of the undergraduates and 42% of the taught postgraduates ‘will find the work interesting and challenging’ as reasons to stay in STEM.

The pattern of replies from final year PhD students was broadly similar (see Appendix Table B3.4). However, PhD students who might or might not want to work in an area related to their research were much less likely to say they had ‘enjoyed their research so it seems logical to work in this field’, or that they had ‘always wanted to work in this field’, than those who definitely wanted to.

Further analysis was undertaken to explore subject differences in the reasons given for wanting a degree-related career. Among final years who *definitely* or *might* want a degree-related career the same reasons dominated students’ thinking in all subjects with just a few minor exceptions (see Appendix Tables B3.5 and B3.6). ‘Always wanted to work in this field’ was more frequently mentioned by Psychologists (69%) and Computer Scientists (66%) who *definitely* wanted a degree-related career and ‘having better long-term career prospects’ by students in Architecture, Building and Planning (62%), Engineering/Technology (53%) and Other Physical Sciences (51%). Being better paid was mentioned by a third or more of students who *definitely* wanted a degree-related career in Subjects allied to Medicine, Other Physical Sciences, Mathematical Sciences, Computer Science, Engineering/Technology, and Architecture, Building and Planning.

‘Being better paid’ was also a more important reason to students who *might* want a degree-related career in certain subjects, notably Chemistry (37%), Mathematical Sciences (47%), Computer Science (59%) and Engineering/Technology (44%) suggesting that, in some subjects, pay might be a more significant factor in keeping some students in STEM than others.

Only limited analysis by subject is possible among students who *might not* want a degree-related career, due to the restricted numbers, but it is noteworthy that ‘being better paid’ was the most frequently mentioned reason for considering degree-related work among the relatively small number of Mathematicians (67%) and Computer Scientists (50%) and ‘finding it easier to get a job’ among Engineering/Technology students (42%) (see Appendix Table B3.7).

There were only limited gender differences (see Appendix Table B3.8). Male final year students who definitely wanted degree-related work were more likely to mention that they will ‘find it easier to get work’ than female final year students (24% compared to 14%) and male students who definitely or might want degree-related work were more likely to mention ‘being better paid’ (Males: 31% and 36% compared to Females: 25% and 26%). Female final year students who might consider degree-related work were more likely than their male counterparts to say they 'enjoyed their degree course and it seems logical to work in this field' (49% compared to 38%) but less likely to say they 'will have better long-term career prospects' (31% compared to 40%). Female students who might not want to work in a degree-related career were more likely to consider degree-related work because they 'will find it interesting and challenging' than their male colleagues (36% compared to 26%).

3.1.3 Reasons for not wanting to pursue a career in STEM

Although only a small minority of final year students and taught postgraduates said that they *definitely did not* (3%) or *might not* (8%) seek a degree-related career, the most commonly mentioned reason for seeking work not related to their degree was that they 'have become more interested in another field'. This was the case for just over half the undergraduates and slightly under half the postgraduates who definitely or might not want a degree-related career (see Table 3.2). Among the rather small number of final years who were definitely not seeking a degree-related career, 'not enjoying their degree course' was mentioned by 41%. Other reasons mentioned by more than a quarter of this group were 'being better paid' and 'having better long-term career prospects' (in other sectors).

In order to obtain a better understanding, the larger group (34%) of students who said they *might* pursue a degree-related career were also asked why they might not (see Table 3.2). Just under a third (31%) of these final year undergraduates reported that they had 'become more interested in another field' and 29% that 'there are too few jobs related to my degree in my preferred location'. This suggests that for a minority of STEM students work location is a constraint.

Analysis was also carried out to examine how reasons for not wanting a STEM career varied by subject. In order to have larger numbers, final year students who *might not* and *definitely did not* want a degree-related career were combined for this analysis. Even so the number of students in six of the subject areas was very small (less than 20). The results are shown in Appendix Table B3.9.

Table 3.2 Reasons for non-degree related career intention (UK final year students and taught postgraduates who might, might not or definitely do not want to pursue an occupation related to their degree)						
	Final Year UK students			**UK Taught Postgraduates**		
	Might	**Might not**	**Definitely not**	**Might**	**Might not**	**Definitely not**
	%	%	**%**	%	%	**%**
I have become more interested in another field	31	54	58	21	42	43
There are too few jobs related to my degree in my preferred location	29	17	10	34	17	0
I will find it easier to get a job	27	22	11	12	25	0
There are too few career opportunities in my field	24	21	19	29	25	0
I will be better paid	20	29	31	18	42	29
My course did not prepare me well enough to get a degree-related job	15	8	8	6	8	0
I have not enjoyed my degree course	12	23	41	6	8	0
I will have better long-term career prospects	10	26	32	11	25	29
I was put off by my work experience	7	14	11	3	8	0
I have tried and failed to get jobs directly related to my degree	7	3	1	12	0	0
I was put off by knowledge of other people doing that kind of work	6	10	11	8	0	0
I never intended to work in this field	4	18	27	6	33	29
I was put off by knowledge from a relative doing that kind of work	2	1	2	0	0	0
Other reason	8	17	13	16	25	57
Not answered	1	0	0	6	0	0
Number of cases	*1024*	*237*	*101*	*112*	*12*	*7*

In all the subject areas where there were more than 20 respondents, 'becoming more interested in another field' was the most frequently mentioned reason for not wanting a degree-related career. 'Being better paid' was also mentioned more frequently by final year students in some subject areas, notably Biological Sciences (39%), Chemistry (49%) and Physics (40%), as a reason for not wanting degree-related work. Other reasons were also mentioned more frequently by students from some subject areas. These included:

- 'Having better long-term career prospects' in Biological Sciences (41%)
- 'There are too few career opportunities in my field': Geography (50%)
- 'I will find it easier to get a job': Psychology (33%), Geography (33%)

- ‘I was put off by my work experience’: Computer Science (31%), Engineering (30%).

For comparative purposes the same analysis was also carried out with the larger group of final year students who *might* want a degree-related career in order to understand whether there are differences by subject area in the reasons given for possibly not wanting to work in a STEM degree-related occupation (see Appendix Table B3.10).

It is clear that a significant reason for students in some subjects for considering not working in their field was to do with work availability. The following three reasons that are clearly linked to work availability were mentioned more frequently by students in certain subjects:

- ‘There are too few jobs related to my degree in my preferred location’ in Biological Sciences (39%), Sports Science (36%), Psychology (35%), Other Physical Sciences (39%), Architecture, Building and Planning (41%), Geography (37%) and Forensic Science/Archaeology (48%);
- ‘There are too few career opportunities in my field’ in Subjects allied to Medicine (36%), Sports Science (54%), Psychology (32%) and Forensic/Archaeology (58%);
- ‘I will find it easier to get a job’: Psychology (39%), Other Physical Sciences (36%), Geography (35%) and Forensic Science/Archaeology (42%).
- In addition, it was only within Architecture, Building and Planning that a significant proportion of students reported they ‘tried and failed to get jobs directly related to their degree’ (29%), although this was of a small sample. This reason was mentioned by very few students of other subjects.

These findings suggest that there are push and pull factors at work. In some subjects, the difficulty of finding degree-related work is a significant issue, while in others it is the attraction of other fields and occupations that is more significant.

There were also some gender differences (see Appendix Table B3.11). Male final year students in both these groups (those who do not want degree-related work and those who might consider it) were more likely than females to mention being better paid (Males: 23% and 34%; Females: 17% and 24%). In contrast, more female students who might consider degree-related work mentioned that there were too few jobs in their preferred location than males (34% compared to 24%). More female respondents than equivalent male ones said they have become more interested in another field (60% compared to 51%).

Clearly, some of these differences might reflect the different gender balance across subjects. Nevertheless, these findings suggest that more female final year students were geographically constrained, while more male final year students were motivated by potential financial rewards.

The actual number of PhD students who definitely do not or might not want to work in a career related to the subject of their research was very small. About half of them had not enjoyed their postgraduate research and others had become more interested in another field or wanted to use their high-level skills but not in their current field (see Appendix Table B3.12). Half those who might want to work in a career related to their research would consider not doing so because there are too few career opportunities in their field, 38% because there were too few relevant jobs in their preferred location and 37% because they would be better paid doing other work.

Three key findings about reasons for choosing or not choosing degree-related work:

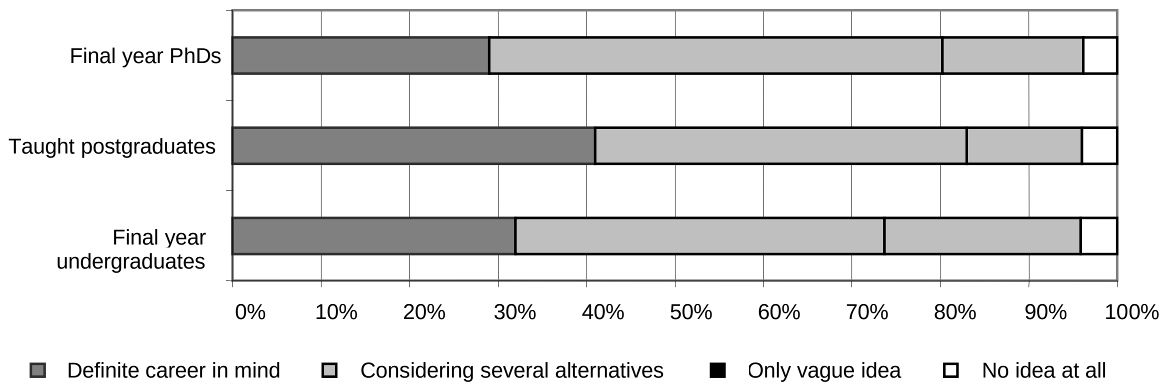
1. Being better paid was mentioned by approximately equal percentages as a reason for doing degree-related work and also for not doing it. However, it was only ever mentioned as a reason by a minority of respondents (around a third).
2. Interest in the work was the overwhelming motivating factor influencing the students' career intentions to work in a degree-related occupation, and becoming more interested in another field was also the main reason for deciding to pursue a career not related to their degree.
3. These findings suggest that most STEM students are happy to adopt a 'satisfying' approach (i.e. to look for a good enough level) as far as pay is concerned but a maximising one for intrinsic job interest/satisfaction. However, it is clear that pay is slightly more important to men than women and more significant in certain subject areas than others. It also appears that pay both keeps some students in STEM but tempts others out.

3.2 Current career thinking

3.2.1 Strength of career plans

The survey collected detailed information about STEM students' current career plans to see how intentions to work in a degree-related occupation might be turned into reality. At the time of the survey (January/February 2010), as highlighted above, the vast majority (86%) of final year students appeared to want to pursue a degree-related career, but when asked separately about their specific career plans, only about a third (32%) had a definite career in mind at this time. As shown in Figure 3.2, rather more (42%) were considering several clear alternatives, while the remainder had only a vague or no idea of possible careers. Taught postgraduates were more likely to have a definite career in mind (41%) than PhD students (29%).

Figure 3.2 Existence of current career plans (Final year undergraduates, taught postgraduates and PhDs compared)



Further analysis found that considerably more of the taught postgraduates who had been employed in a permanent job before they started their course now had a definite career in mind (52%), compared with those who had been undergraduates (36%), or had been doing casual/temporary work (30%) before their course. It is clear that many of the taught postgraduates were studying for career-oriented reasons (see Section 3.5).

Among the final year undergraduates, higher proportions of students of Architecture, Building and Planning (55%) and Subjects allied to Medicine (48%) had a definite career in mind than overall, with the lowest proportions seen in those studying Geography (22%), Chemistry (24%) and Forensic Science/Archaeology (24%) (see Appendix Table B3.13). This highlights again the divide between some of these very vocational STEM subjects and those which are less so.

Nevertheless, students' career plans had become firmer while they were at university. Only about one in five undergraduates (19%) had a definite career in mind when they first went to university and a quarter (26%) had some ideas about what they might do. The majority had only a vague idea of possible careers (35%) or no idea at all (20%); see also Section 3.5.

Final year students who had a definite career plan or were considering several career alternatives when they *first* came to university were more likely (than those with only a vague idea or no idea at all) to report that they *now* had a definite career plan (halfway through their final year). Just under half (46%) of this group *now* had a definite career in mind and only 10% had only a vague idea or no idea at all of possible careers. In contrast, only 20% of those who had been unsure about their career at university entry now had a definite career plan and 40% still had only a vague idea or no idea at all about possible careers. As we will see in Section 3.7, being career motivated has a major impact on intention to work in a STEM-related occupation.

3.2.2 What careers are being considered?

Those students with either a definite career in mind now or who were considering several alternatives were asked to list the careers they were considering. These were coded by STEM sector and function using the coding scheme developed for this survey (see Section 2.2). Each occupation listed by students who gave several alternatives was separately coded and then the student was allocated as a STEM Specialist if all the occupations were in that sector, and so on. If some of the occupations were in Specialist and others in Generalist sectors, these students were separately labelled as STEM Specialist/Generalist. A similar approach was used if they listed some occupations in non-STEM sectors (labelled as Mixed Sectors). Equivalent coding was carried out for job function. This resulted in six groups for sector and function to cover the range of occupations the students were considering.

Overall, just over half (51%) of the final year STEM undergraduates with either a definite career in mind or who were considering several alternatives expected to work in a STEM Specialist sector and slightly under half (47%) in a STEM Core function. Roughly a fifth (21%) specified both STEM and non-STEM sectors, while 18% specified both STEM and unrelated job functions. A further 7% listed non-STEM sectors and 9% Unrelated functions (see Tables 3.3 and 3.4).

By subject, the percentage considering working in a STEM sector or function ranged widely. The lowest proportions of final year students considering work in a STEM Specialist sector were in Mathematics (11%), Geography (24%) and Psychology (30%), well below the average. The lowest proportions considering work in STEM core functions were in Forensic Science/Archaeology (16%), Mathematics (13%), and Sports Science (23%).

Subjects in which the highest proportions wanted to work in STEM Specialist sectors were Subjects allied to Medicine (75%), Architecture, Building and Planning (76%), Biological Sciences (63%) and Engineering/Technology (64%). In terms of job function, the highest proportions seeking a STEM core function were in Subjects allied to Medicine (65%) and Engineering/Technology (65%).

Table 3.3 Expected employment sector for those with career plans, by subject of study (final year UK undergraduates), expressed as percentages

Subject group	STEM Specialist	STEM Generalist	Non-STEM	STEM Specialist/ Generalist	Mixed sectors	Don't know	*Number of cases*
Subjects allied to Medicine	75	5	5	6	10	0	*109*
Biological Sciences	63	8	3	9	17	0	*276*
Sports Science*	57	9	6	13	15	0	*47*
Psychology	30	14	14	11	30	0	*234*
Chemistry	52	11	4	13	20	0	*157*
Physics	50	17	6	14	13	1	*162*
Other Physical Sciences	61	8	4	11	15	1	*133*
Mathematical Sciences	11	51	5	12	21	1	*151*
Computer Science	56	7	6	9	22	0	*194*
Engineering and Technology	64	2	7	8	19	0	*474*
Arch., Building and Planning*	76	0	5	0	20	0	*41*
Geography	24	17	16	8	35	0	*160*
Forensic Science/Archaeology*	49	8	8	4	29	2	*49*
All final year	51	11	7	10	21	0	*2187*

*Note small sample size (less than 50) in these subjects.

Table 3.4 Expected occupational function for those with career plans, by subject of study (final year UK undergraduates), expressed as percentages

Subject group	STEM Core	STEM related	Unrelated	STEM Core/ related	Mixed functions	Don't know	*Number of cases*
Subjects allied to Medicine	65	6	8	9	9	2	*109*
Biological Sciences	51	9	11	11	18	0	*276*
Sports Science*	23	19	28	4	21	4	*47*
Psychology	36	14	16	9	24	1	*234*
Chemistry	45	13	6	15	19	1	*157*
Physics	47	19	7	15	11	1	*162*
Other Physical Sciences	53	7	16	9	15	1	*133*
Mathematical Sciences	13	50	11	7	17	2	*151*
Computer Science	50	4	17	8	21	1	*194*
Engineering and Technology	65	2	7	6	19	1	*474*
Arch., Building and Planning*	56	2	29	0	12	0	*41*
Geography	31	18	13	11	23	4	*160*
Forensic Science/Archaeology*	16	8	35	8	22	10	*49*
All final year	47	12	12	9	18	2	*2187*

* Note small sample size (less than 50) in these subjects.

Of those asked to specify their career intention (i.e. those with a definite career in mind or who were considering several alternatives), under half (43%) the final year students had a definite career in mind, but in all cases these students were more likely to be considering STEM Specialist sectors and, except for Forensic Science/Archaeology, work in STEM Core job functions (see Appendix Table B3.14).

Taught STEM postgraduates asked to specify their career intention were more likely than final year STEM undergraduates to want to work in STEM with 61% expecting to work in a STEM Specialist sector and 59% in a STEM Core function (see Appendix Table B3.15). The percentage mentioning STEM *and* non-STEM sectors was also lower (16% compared to 21%) as was the percentage specifying STEM Core and unrelated functions (12% compared to 18%). Similar proportions specified non-STEM/other sectors (8%) but slightly more mentioned other/unrelated functions (14%).

Taught postgraduates with a definite career in mind were also more likely than those considering several alternatives to be considering STEM with 73% of this group expecting to work in a STEM Specialist sector and 70% in a STEM Core function (see Appendix Table B3.16). The proportion of final year PhDs wanting to work in STEM is very similar to that of taught postgraduates (see Appendix Table B3.17).

Key findings are that:

1. More taught postgraduates than undergraduates want to work in STEM sectors and functions, and this implies that further study (either a taught postgraduate course or doctoral research) is seen as a major route to a STEM career by many STEM students.
2. Certain STEM subjects are much more explicitly vocational in terms of leading directly to particular careers than others and this confirms the career/vocational focus of these subjects.

3.2.3 How essential is the degree subject?

Those students with a career in mind were asked how essential they thought it was to have a degree in their subject to achieve their career goal (or their most favoured career option if they were considering several alternatives). Over half (56%) of these final year students thought a degree in their particular subject would be essential, a third (32%) that it would be preferred and 11% that it was not essential or not needed.

Reflecting their stronger career orientation, it is probably not surprising that 73% of taught postgraduates thought a degree in their particular subject would be essential to achieve their career goal and that a further 24% thought it would be preferred. However, only half the final year PhD students thought a doctorate in their subject was essential (i.e. the job could not be done without a doctorate in their subject) for the career they had in mind, while a third (34%) thought a doctorate in their subject would be preferred. There are several possible interpretations of this finding including that PhD students might still expect to use many of the skills they had gained from their doctoral research even if not working in the precise subject area of their doctorate.

Figure 3.3 How essential to have a degree in your particular subject (final year students with a career in mind or considering several alternatives, as percentages, N=2,187)

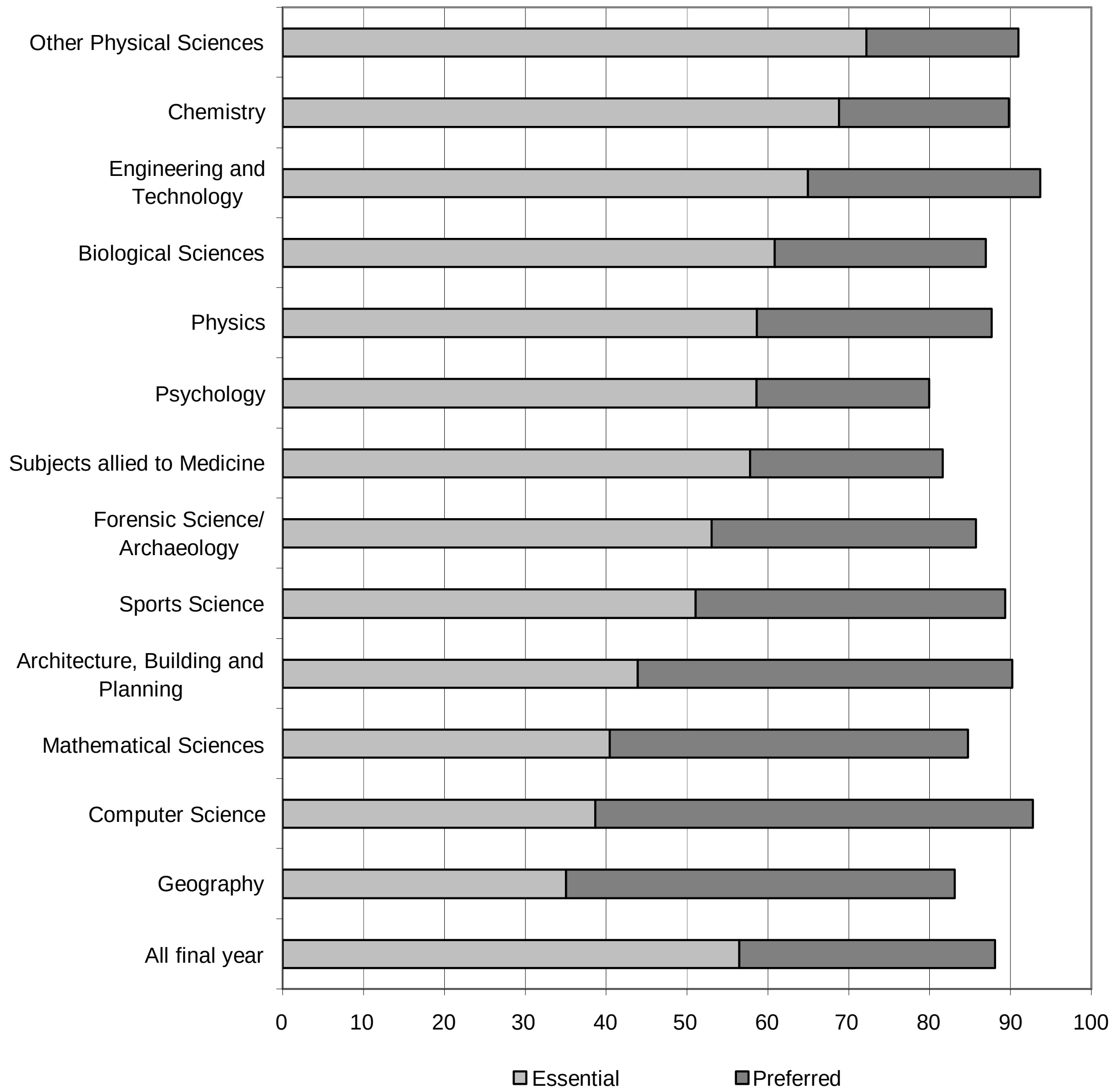


Figure 3.3 shows that the proportion of final year students who thought that a degree in their particular subject was essential to achieve their career goal varied quite considerably by subject from nearly three-quarters (72%) of students in Other Physical Sciences to only just over a third (35%) of Geographers. Overall, 88% thought a degree in their particular subject would be essential or preferred for their chosen career but this varied from 80% in Psychology to 94% in Engineering and Technology. Final year STEM students who thought having a degree in their subject was essential to achieve their career goal were much more likely than others to be planning to work in a STEM Specialist sector (63%) or STEM Core function (56%).

3.3 Plans after graduation

While most of the students had a career goal of working in STEM, others were planning to work outside STEM and yet others were still undecided in their direction. But how were they taking this forward in the short and longer term?

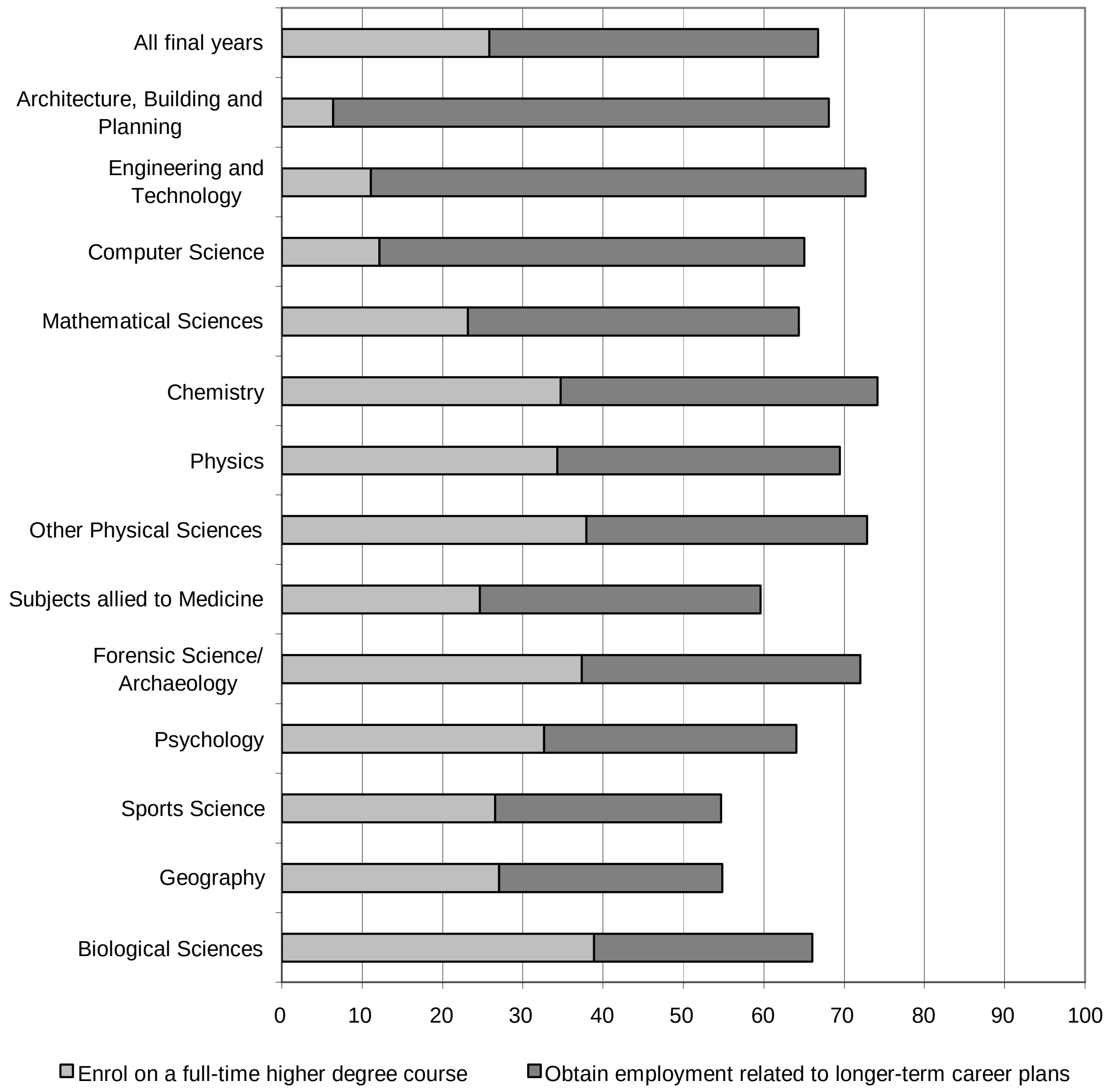
3.3.1 Plans for next year

Roughly four in ten (41%) UK final year STEM undergraduates aimed to obtain employment related to their longer-term career plans, a quarter (26%) planned to enrol on a full-time higher degree course, 3% to undertake further vocational training, 6% to obtain temporary employment and 5% to take other long-term employment (i.e. a permanent job but not related to their longer-term career plans – possibly just to earn money). Some planned to travel or take time out (11%), while the remainder had other aims or were undecided.

Figure 3.4 shows the different intentions of final year students by subject group for the two most common aims – employment related to longer-term career plans and enrolling on a full-time higher degree course. It shows that in Architecture, Building and Planning, Engineering and Technology, and Computer Science, the majority of students expected to obtain employment related to their longer term career plans and relatively few planned to enrol for a full-time higher degree.

On the other hand, there were a number of subjects where more students expected to enrol on a full-time higher degree course than enter employment related to their long-term career plans. These included Biological Sciences, Psychology, Other Physical Sciences and Forensic Science/Archaeology. Sports Science and Geography were two other subjects where relatively few students expected to enter employment related to their longer-term career plans after graduation and in both these subjects about one in six expected to travel or take time out. Just over a third of Physics and Chemistry students expected to enrol for a full-time higher degree, almost as many as expected to obtain employment related to their longer-term career plans (see Appendix Table B3.18). This is a similar pattern to findings from the HESA longitudinal DLHE analysis (see Appendix A, section A.1.5).

Figure 3.4 Main aim for year after completion of course, by subject of study (final year UK undergraduates), as percentages

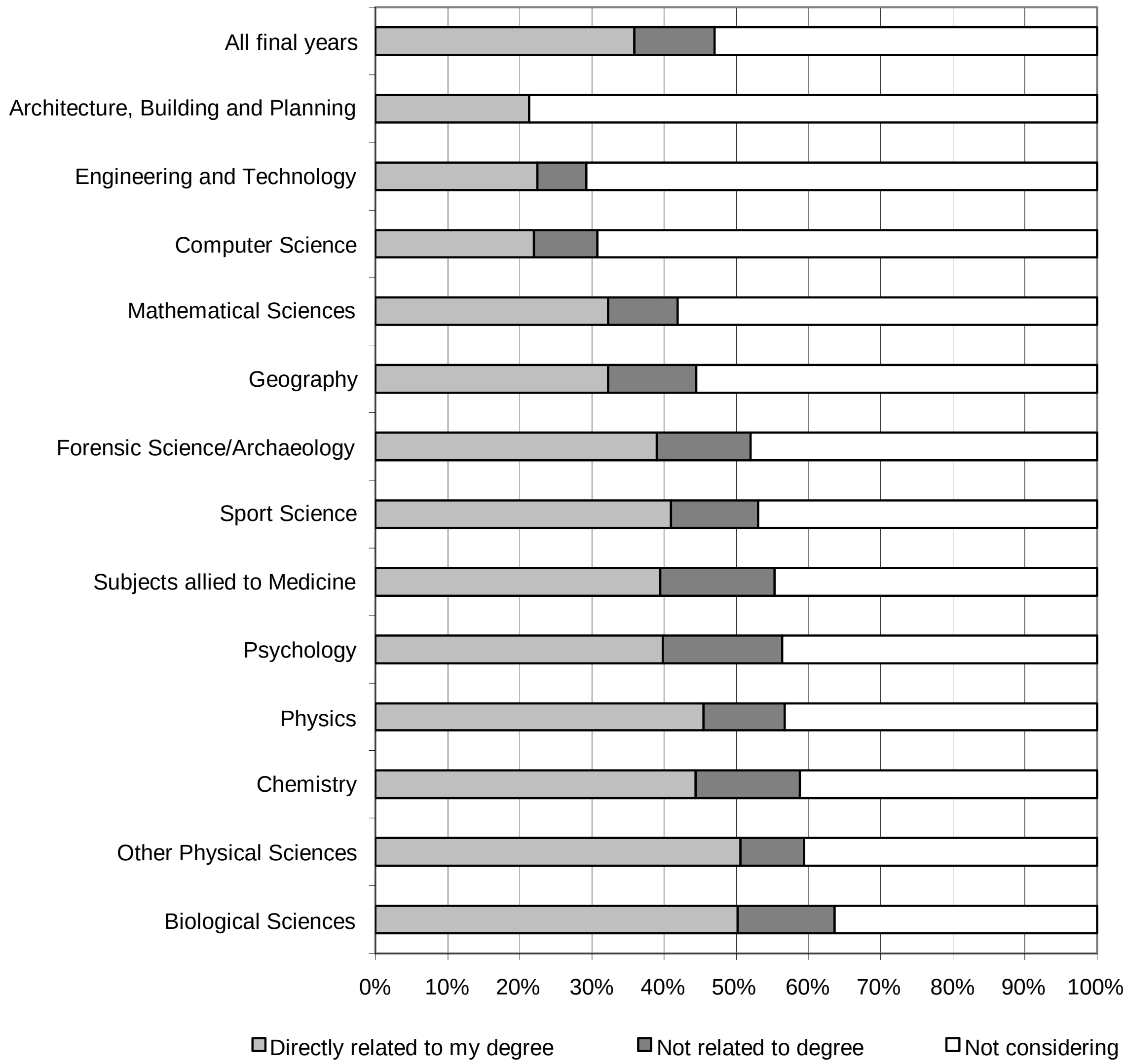


These differences suggest that by their final year STEM students may have a fairly realistic understanding of some distinctive features of the labour markets in which they will be seeking employment. In particular, we infer that students are aware whether graduate level jobs are relatively plentiful for students with first degrees in their subject or whether further specialised study is required (or might give them added value).

3.3.2 Further study options

Regardless of their main aim for next year, everyone was asked whether they had applied or expected to apply for another course, research degree or vocational training on either a full-time or part-time basis. Overall, 46% of final year students had already applied, or were expecting to apply, with 37% choosing a course directly related to their degree and only 11% a course not related to their degree. Relatively fewer students in Computer Science (28%), Engineering and Technology (27%) and Architecture, Building and Planning (21%) were considering further study, while students in Biological Sciences (51%) and Other Physical Sciences (52%) were the students most likely to be considering further study directly related to their degree (see Figure 3.5). Note that students could select more than one further study option as a number would have been considering or have applied for several different types of further study/training.

Figure 3.5 Further study/training, by subject of study (final year UK undergraduates), as percentages



In terms of the type of further study/training that these students were considering, just over a third (36%) were considering a PhD, 42% a Masters degree and 19% teacher training, while 12% were considering other vocational/professional training (see Table 3.5). Not only is there variation in the proportion of students studying different subjects who were considering further study but also differences in the type of study that they were considering. Nearly half (49%) the Mathematicians and 45% of Sports Science students were considering teacher training, while two-thirds of Chemists and over half (54%) the Physicists were considering studying for a PhD. Studying for a Masters degree was most commonly mentioned by Sports Science students (61%), Psychology students (59%), Architecture, Building and Planning students (60%), Geography students (63%) and Forensic Science/Archaeology students (74%).

Table 3.5 Type of further study/training being considered (Final year UK undergraduates, by subject of study), as percentages

Subject group	Post-graduate Teaching	Other vocational training	Other post-graduate diploma	Masters degree	PhD	Other training	*Number of cases*
Subjects allied to Medicine	4	22	4	28	22	27	*78*
Biological Sciences	13	13	6	39	35	18	*234*
Sports Science*	45	15	9	61	18	6	*33*
Psychology	17	13	4	59	33	8	*172*
Chemistry	20	5	2	19	66	7	*122*
Physics	21	16	3	23	54	8	*132*
Other Physical Sciences	14	2	2	46	47	5	*96*
Mathematical Sciences	49	12	2	27	22	5	*94*
Computer Science	22	10	4	46	26	5	*78*
Engineering & Technology	10	13	3	44	39	7	*157*
Architecture, Building and Planning*	0	10	40	60	0	0	*10*
Geography	29	12	3	63	8	4	*114*
Forensic Science/ Archaeology*	8	11	11	74	47	8	*38*
All final year	19	12	4	42	36	10	*1358*

*Note small sample size (less than 50) in these subjects.

Four reasons for undertaking further study were mentioned by over the half the students, two of which were clearly career-related. The most commonly mentioned were ‘wanting to develop more specialist knowledge and expertise’ (59%), ‘having access to better career opportunities’ (58%), ‘interest in the course’ (57%) and ‘essential for the career I wish to develop’ (56%). The reasons ‘essential for the career I wish to develop’ was most frequently mentioned by students in biologically-related subjects (Subjects allied to Medicine, Biological Sciences, Sports Science and Psychology) and Mathematics, while ‘developing more specialist knowledge and expertise’ was most often mentioned by students in Archaeology/ Forensic Science, Other Physical Sciences, Computer Science and Engineering and Technology. 'Interest in the course' was most cited by Physicists (Appendix Table B3.19).

Students considering different types of courses were motivated by different reasons (see Table 3.6). Three-quarters (74%) of students considering teacher training, and roughly two-thirds of those considering other vocational/professional training or other training, said that it was essential for the career they wished to develop. In contrast, 'access to better career opportunities' was most frequently mentioned by students considering Masters degrees (71%) and other postgraduate diplomas (66%), while 'developing more specialist knowledge and expertise' was most frequently mentioned by those considering a PhD (78%).

Table 3.6 Reasons for undertaking further study/training, by type of course (final year UK undergraduates), as percentages

	Postgraduate Teaching Certificate	Other vocational/ professional training	Other postgraduate diploma	Masters degree	PhD	Other training	Not answered	All
I want to develop more specialist knowledge and expertise	34	53	55	69	78	35	6	59
It will give me access to better career opportunities	47	53	66	71	64	41	11	58
I am interested in the course	47	39	38	63	70	62	17	57
It is essential for the career I wish to develop	74	65	63	45	53	67	11	56
I want to continue studying to a higher level	26	25	32	54	71	24	6	46
I want to develop a broader range of knowledge and expertise	27	43	38	46	40	31	6	37
It will be easier to find the type of job I want with this additional qualification	33	37	41	47	38	24	0	36
It is difficult to get the type of job I want at the present time	15	15	23	23	17	11	0	16
I want to change career direction	9	21	20	9	5	22	6	9
I have been unable to get work directly related to my undergraduate degree	5	4	7	5	3	2	0	4
Other	2	2	0	1	1	5	0	2
Not answered	0	0	0	0	0	0	67	1
Number of cases	*258*	*163*	*56*	*568*	*486*	*130*	*18*	*1358*

The overall pattern of reasons for undertaking postgraduate study given by the students currently on taught postgraduate courses (discussed in Section 3.4.2) almost exactly matched that for final year students who were considering Masters degrees (see Appendix Table B3.20). Getting access to better career opportunities was the most frequently mentioned reason. The main difference between the final years (intending postgraduates) and the actual postgraduates on taught courses is that more actual postgraduates mentioned changing career direction (21% compared to 9%) and slightly more mentioned being unable to get work related to my degree (12% compared to 5%), while slightly fewer mentioned it being difficult to get the type of job I wanted (18% compared to 23%).

3.3.3 Relating different career tracks to longer term career plans

It is apparent that there were four main career tracks that final year STEM students were aiming to follow when they graduated. The largest group (41%) were planning to obtain employment related to their longer term career plans, a quarter (26%) were planning full-time further study, 12% expected to enter other employment and 12% were planning to travel or take time out. The remaining 9% had a variety of other aims but no single aim involved many students.

How did those short-term plans of final year undergraduates match up with intention to follow a STEM degree-related career or not in the long term? Two-thirds of those whose main aim was to undertake full-time further study *definitely* wanted to pursue a career in an occupation directly related to their degree, as did 59% of those who aimed to obtain employment related to their longer term career plans (see Figure 3.6). In contrast, the majority (59%) of those whose aim was to obtain other employment only *might* want to pursue a degree related career, while many (47%) of those who plan to travel or take time out also only *might* do so.

There is a similar pattern when it comes to whether these students have a definite career in mind. Far fewer of those aiming to obtain other employment (10%) or those planning to travel or take time out (16%) have a definite career in mind, while 41% of those whose aim is to undertake full-time further study and 35% of those who expect to obtain employment related to their longer term career plans have a definite career in mind (see Figure 3.7).

When analysis is carried out to look at the nature of the career options that these final year STEM undergraduates were considering, those planning full-time further study or long term employment related to their career plans were more likely to be considering working in STEM Specialist sectors or STEM Core functions than those aiming for other employment or to travel/take time out (see Table 3.7). Although this analysis excluded those with only vague or no idea of possible careers, which was nearly half of those planning to travel/take time out and half of those planning to obtain other sorts of employment, the fact that so many of the remainder of both these groups were considering a mix of STEM and non-STEM sectors (and STEM and unrelated functions) is a reflection of career uncertainty, and perhaps an indication of a more exploratory stage of career thinking.

Figure 3.6 Level of STEM career intention, by career track (i.e. short-term plan): final year UK undergraduates

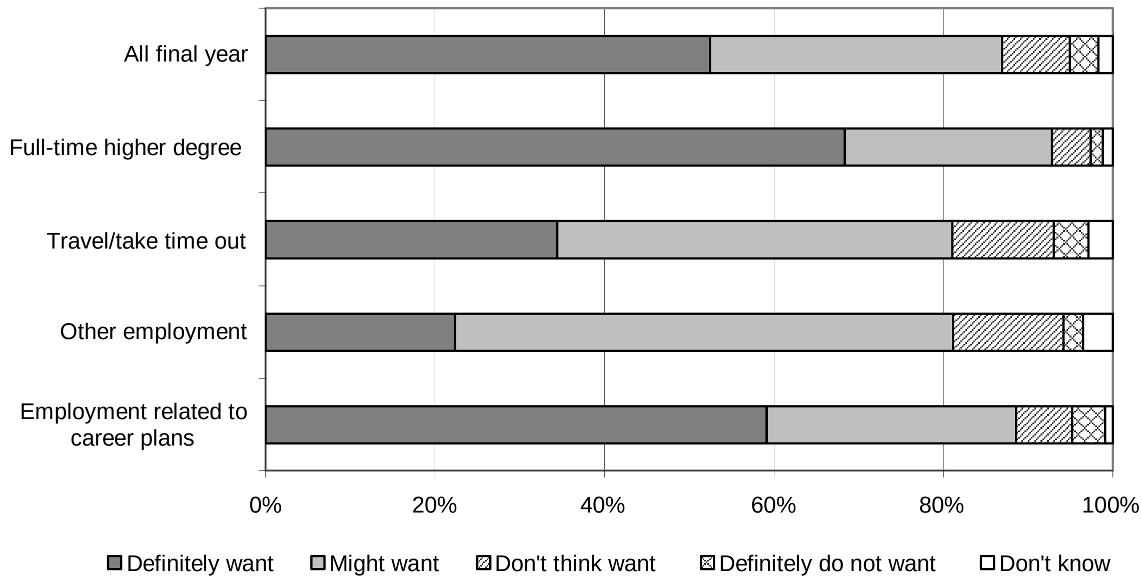


Figure 3.7 Firmness of current career plans, by career track (final year UK undergraduates)

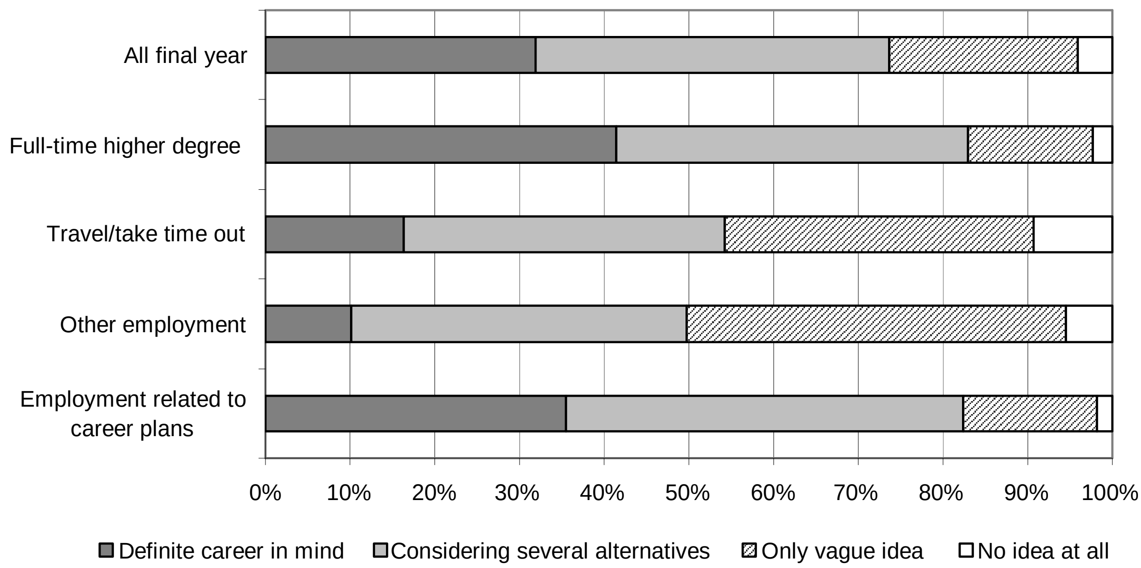


Table 3.7 Expected employment sector and function, by career track (UK final year students with definite career plans or considering several alternatives), as percentages

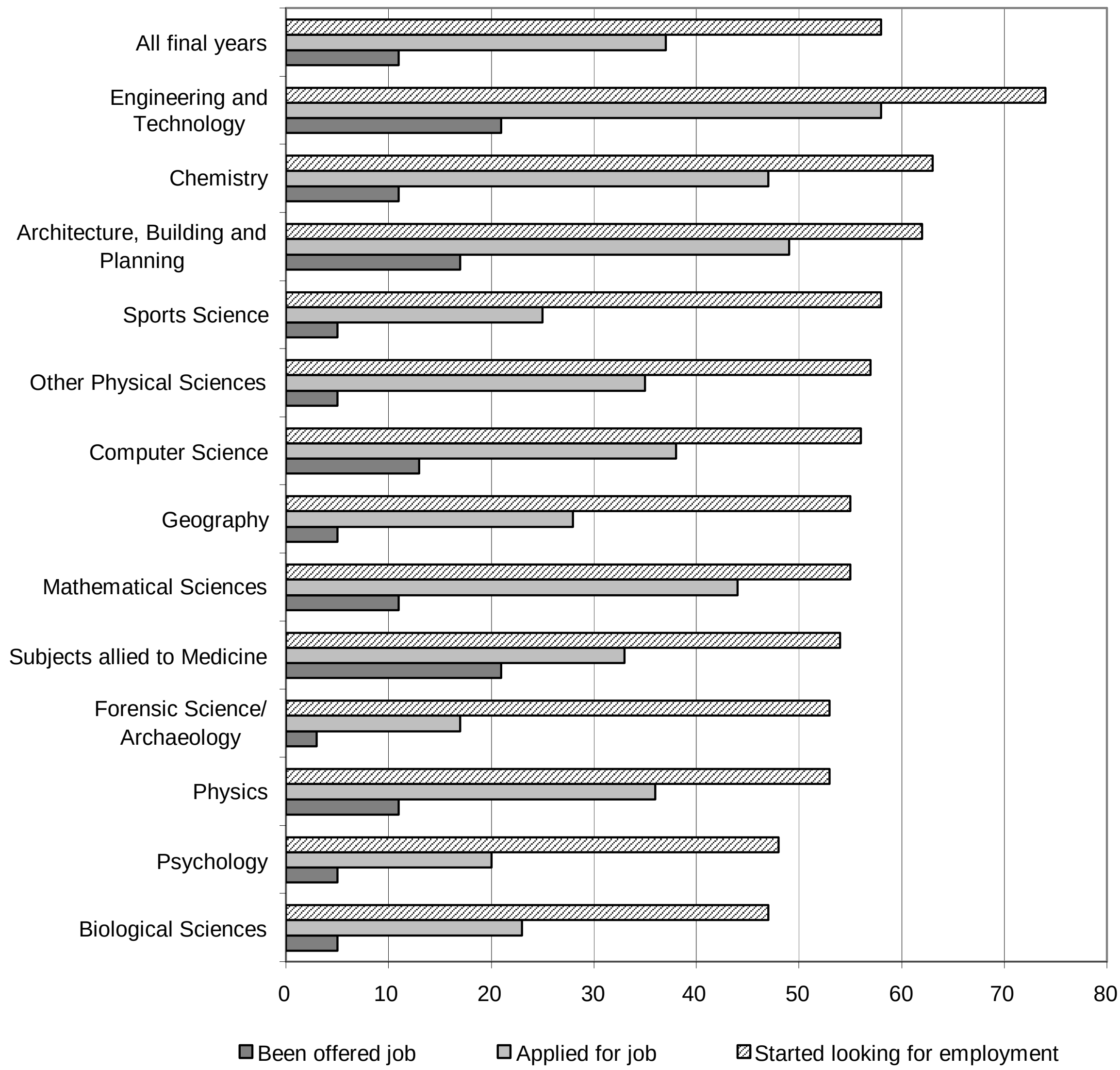
Sector	Employment related to longer-term career plans	Other long-term/ temporary employment	Travel or take time out	Enroll on full-time higher degree course	All with plans
STEM Specialist	56	36	31	56	51
STEM Generalist	9	6	11	16	11
Non-STEM/Other	7	8	12	4	7
STEM Specialist/Generalist	8	14	15	11	10
Mixed	20	37	31	14	21
Don't know	0	0	0	0	0
Function					
STEM Core	51	35	32	49	47
STEM related	9	6	13	17	12
Other/unrelated	12	16	15	8	12
STEM Core/related	7	11	11	12	9
Mixed	20	29	28	13	18
Don't know	2	4	2	1	2
Number of cases	*1001*	*171*	*186*	*637*	*2187*

3.3.4 Job-seeking behaviour

Half way through their final year, the majority (58%) of final year undergraduates had already started looking for employment (excluding short-term vacation work). The proportion who had started looking varied from 74% of Engineering/Technology students to 47% in Biological Sciences. Just over a third (37%) had already applied for jobs related to their long-term career plans but again there was considerable variation by subject with 58% of Engineering/Technology students having already applied for jobs compared to just 17% of Forensic Science/Archaeology students and 20% of Psychology students (see Figure 3.8).

Just over a fifth (21%) of students in Subjects allied to Medicine and Engineering and Technology had already been offered a job related to their longer-term career plans as had 17% of Architecture, Building and Planning students. Note that some final year students described themselves as already employed either because they had been on secondment from their employers while they were at university, or because they had accepted jobs offers from their work experience employers (6% of Architecture, Building and Planning students and 4% of Computer Science students were in this situation).

Figure 3.8 Job-seeking behaviour (final year UK undergraduates), as percentages



Although the overall proportion who had started looking for work or made applications seems relatively low (58%), nearly all (80%) of those whose main aim for next year was to obtain employment related to their longer-term career plan had already started looking for work and 62% had applied for jobs related to their longer-term plans. However, only 18% of them had already been offered a job related to their career plan at this point in their final year.

There was little variation in job-seeking behaviour related to students' intention to work in a STEM employment sector or function, or not (see Appendix Tables B3.21 and B3.22). The only exception was students with the intention of seeking work in STEM Generalist sectors or STEM related functions. Students with the intention of working in STEM Generalist sectors were less likely to have started looking for employment than students intending to work in other sectors (44% compared to over 60% for all other sectors) and also slightly less likely to have already applied for any jobs related to their long-term career plans (only 38% had started) but were more likely to have already been offered a job (22%). There was a similar pattern with those students intending to work in STEM-related roles. This may be a function of the fact that some large, prestigious recruiters (e.g. large accountancy firms) start their graduate recruitment early in the final year and that some of these students had already been successful in this recruitment process.

Final year students with a definite career intention, either to seek degree-related work or not to, were slightly more likely than those who might or might not seek degree-related work, and much more likely than those who do not know, to have started looking for employment. The small number of students who had definitely decided not to seek degree-related work were the ones most likely to have already applied for jobs (50%), or to have been offered one (22%), while the larger group of students (34%) who might be seeking degree-related work were the ones least likely to have applied for jobs (34%) or to have been offered a job (7%) (Ignoring the very small group of 'Don't knows'). This may be a reflection of the graduate recruitment cycle of major employers but also suggests that students who were less certain of their career plans were more likely to miss out on recruitment activity early in their final year.

Main conclusions from this analysis:

1. The likelihood of following a STEM career is strongly linked to the career track a student plans to follow after graduation; not all have firm plans and many of those who are least definite are likely to end up outside STEM.
2. Some students who plan a career outside STEM have already been recruited onto graduate programmes early in the final year.

3.4 Development of career thinking prior to and at university

The second half of this chapter seeks to understand what factors were most important in influencing the development of students' career plans while they were at university. The sections that follow explore what influenced their initial decision to choose a STEM degree subject, the impact of having a career plan when they first went to university, how their plans have changed over time and, in particular, the effect that certain activities, such as undertaking degree-related work experience or using their university careers service, had on the development of their plans.

Underpinning this is the clear finding from the survey that most students change their career plans while they are at university: more than two-thirds (69%) of final year undergraduates had changed their career plans, although most only to some extent (52%) rather than completely (17%) (see Appendix Table B3.13). The proportions of taught postgraduates and PhD students who had changed their career plans completely, or to some extent, while they were undergraduates were quite similar.

Plans also continue to change during postgraduate study, with slightly more than a half (57%) of the PhD students reporting that they had changed their career plans to some extent while they had been postgraduates, although only 12% had changed their plans completely.

3.4.1 Reasons for choosing a STEM degree course

It is helpful to understand how the students have made past decisions and how these decisions may influence future career intentions. In this case, why students originally chose a STEM degree could have a direct bearing on whether they intend to pursue at STEM career. Students were asked, therefore, to identify the factors that were most important to them when they chose their undergraduate course. Five factors were mentioned much more frequently than the others. The two factors cited most frequently by UK final-year undergraduates for their choice of degree course were ‘personal interest/aptitude in subject’ (77% overall) and ‘enjoyed studying subject at A-level’ (67%). Two career-related factors were mentioned by about half the final year students with ‘feeling this course would keep a lot of career options open for me’ and ‘wanting to follow a career in this field’ being mentioned by 52% and 49% respectively (see Table 3.8 and Appendix Table B3.23).

Table 3.8 shows that there was considerable variation by subject studied in the reasons given for choice of undergraduate course. In particular, ‘wanting to follow a career in this field’ was the most frequently mentioned reason by final year students studying Architecture, Building and Planning (67%) and frequently mentioned by Computer Science students (63%) but was less frequently mentioned by final year students in Chemistry (35%), Physics (40%), Mathematics (41%) and Geography (32%).

‘Feeling this course would keep a lot of career options open for me’ was the second most frequently mentioned reason by final year students in Engineering and Technology (62%), and was mentioned frequently by final year students in Physics (63%) and Mathematics (67%) but less frequently by those in Subjects allied to Medicine (28%), Biological Sciences (42%), Sports Science (36%), and Forensic/Archaeological/Other Physical Science (39%).

Table 3.8 Main reasons for choice of undergraduate course, by subject of study (final year UK undergraduates), expressed as percentages

Subject group	Personal interest/ aptitude in subject	Enjoyed studying subject at A-level	Felt course kept career options	Wanted to follow career in this field	Liked university/ department when visited	Required qual'n for chosen career	*Number of cases*
Subjects allied to Medicine	71	64	27	51	52	23	*146*
Biological Sciences	74	77	42	47	40	13	*371*
Sports Science	77	66	36	64	33	22	*64*
Psychology	84	68	50	59	39	21	*309*
Chemistry	72	85	52	35	58	15	*213*
Physics	83	81	62	40	41	12	*236*
Other Physical Sciences	82	61	39	50	55	14	*166*
Mathematical Sciences	81	89	67	41	36	11	*233*
Computer Science	82	58	59	63	36	12	*272*
Engineering and Technology	73	48	61	54	43	25	*578*
Arch., Building and Planning*	60	13	47	66	26	26	*47*
Geography	77	83	45	32	45	5	*259*
Forensic Science/ Archaeology	76	33	39	60	57	21	*75*
All final year	77	67	52	49	43	16	*2969*

* Note small sample size (less than 50).

These two career-related reasons for choosing a university course were not correlated. This means that 26% of UK final year students said both that they 'wanted to keep their career options open' *and* 'follow a career in this field', 23% *only* that they 'wanted to follow a career in this field', 25% *only* that they 'wanted to keep their career options open' and 25% mentioned neither of these reasons. The exact proportions will vary for different subjects reflecting the relative preponderance of these two orientations among students in a particular subject area.

Thus, while personal interest and enjoyment were the most frequently mentioned reasons for choosing a STEM undergraduate course, career-related reasons were also important for around half the students, although only about one in six students mentioned that their chosen course was a required qualification for their chosen career. Once again there was considerable variation by subject with 26% of Architecture, Building and Planning students and 25% of

Engineering and Technology students mentioning this reason, compared to only 5% of Geographers and 11% of Mathematicians.

The reasons given by postgraduates on taught courses and by final year PhD students for choosing their undergraduate course were broadly similar to those for undergraduates (see Appendix Tables B3.24 and B3.25) with the same five reasons being mentioned most frequently. However, both taught postgraduates and PhD students were less likely to mention having wanted to keep their career options open (43% and 42% respectively) than final year undergraduates.

3.4.2 Reasons for undertaking postgraduate study

The main reason taught postgraduates gave for undertaking postgraduate study was that ‘it will give me better access to career opportunities’ (73%), followed by ‘wanted to develop more specialised knowledge and expertise’ (68%) and ‘interested in the course’ (63%). However, reasons varied by subject (see Table 3.9) with, for example, less than half (44%) of the Mathematicians mentioning that postgraduate study ‘will give me better access to career opportunities’.

Nearly two thirds (65%) of the small number of Sports Scientists, but only 18% of Mathematicians and 23% of Physicists, mentioned that ‘it will be easier to get the type of job I want with this additional qualification’. ‘Essential for the career I wish to develop’ was mentioned by over half of postgraduate students in Subjects allied to Medicine, Sports Science and Psychology.

Final year PhD students, on the other hand, were not so focused on career-related reasons but much more likely to mention being ‘interested in this subject’ (77%), ‘wanting to continue studying to a higher level’ (65%), ‘wanting to develop more specialist knowledge and expertise’ (58%) and ‘wanting to develop more high-level skills’ (46%) as reasons for undertaking postgraduate research. There were fewer differences by subject (see Appendix Table B3.26) but final year PhD students in Biological Sciences (51%) and Psychology and Sports Science (50%) were more likely to mention that undertaking postgraduate research was ‘essential for the career I wish to develop’.

Table 3.9 Most common reasons for choice of postgraduate course, by subject of study (UK taught postgraduates), as percentages

Subject group	Access to better career opportunities	Wanted to develop specialist know-ledge	Interest in course	Wanted to study to higher level	Easier to get type of job wanted	Wanted broader know-ledge/ expertise	Essential for career	*Number of cases*
Subjects allied to Medicine	77	61	81	48	52	26	61	*31*
Biological Sciences	76	76	64	66	42	48	46	*50*
Sports Science*	88	94	47	47	65	35	53	*17*
Psychology	84	78	68	68	44	42	54	*50*
Chemistry*	80	70	60	50	50	50	40	*10*
Physics	58	65	58	52	23	32	39	*31*
Other Physical Sciences	79	76	74	69	55	43	43	*42*
Mathematical Sciences	44	62	87	73	18	44	18	*45*
Computer Science	76	74	66	63	44	51	28	*82*
Engineering and Technology	78	58	53	50	49	43	40	*129*
Arch., Building and Planning	70	38	46	22	38	32	46	*37*
Geography	70	67	53	45	53	35	35	*60*
Forensic Science/ Archaeology	59	86	72	69	55	34	38	*29*
All taught postgraduates	73	68	63	56	45	41	40	*613*

* Note very small sample size (less than 20) in these subjects

3.4.3 Changing degree course

Changing degree course is one indicator of unease with initial choice of university degree subject. Although such a change need not necessarily indicate a change in career plan, given that only about half had chosen their course for career-related reasons, it may well have career consequences. However, most final year undergraduates had stayed on their original undergraduate course: 17% changed their undergraduate degree subject at some stage during their time at university, but most of these changed to a different degree course in the same department (12%) (see Appendix Table B3.27). A similar proportion (15%) of the taught postgraduates and final year PhD students had changed their undergraduate degree subject at some stage.

Another indicator of unease with career direction or course is whether students would do the same course again if, hypothetically, they had their time again. Nearly a quarter (24%) of final year undergraduates, when asked, said they would do a different undergraduate course if they were to start their university education again, but only a few (3%) would not go to university at all or delay their entry to higher education (6%). The proportion who said that they would choose a different undergraduate course was highest in Architecture, Building and Planning (34%) and Subjects allied to Medicine (33%), and lowest in Mathematics (16%), Other Physical Sciences (16%) and Physics (18%) (see Appendix Table B3.28).

While slightly fewer taught postgraduates would do the same/similar undergraduate course again (see Appendix Table B3.29), this is mainly because of differences in just a few subject areas. In particular, more postgraduates who studied Subjects allied to Medicine (38%), Biology (31%) or Chemistry (32%) as undergraduates would do a different undergraduate course. Both Biology and Chemistry are net exporters of students with a higher proportion of students studying these subjects at undergraduate than postgraduate level (see Appendix A, section A.3.1) and so this is not altogether surprising. The converse is also true with more students now studying Computer Science and Architecture, Building and Planning as postgraduates (both net importers of students at postgraduate level), as well as more of those studying Physics, reporting they would do a different undergraduate course.

While only a small minority of STEM undergraduates had actually changed course, far more (around a quarter) would choose a different undergraduate course if they had the opportunity to start their university education again. Whether this means that these students had been badly advised, merely lacked information or just that their interests had changed over time is an open question. Most likely each of these reasons applies to some of the students.

3.5 Development of career plans

A key purpose of the survey was to explore how the students' career plans developed over time, and particularly how that related to an intention to pursue a career in or outside STEM. There is evidence from earlier research that not many students enter higher education with clear career goals (Roberts Review, 2002) but little research evidence about how students, in STEM in particular, develop or change their career plans while at university. Others may have had clear plans when they first came to university but have changed them for a variety of reasons. This research sought to understand not only whether students were being attracted to, or put off, following a career in STEM but also to identify what were the main factors influencing the development of their career plans.

3.5.1 Presence of career plans at entry to university

Overall, 19% of final year STEM undergraduates reported that they had a definite career in mind when they came to university but this was much higher in Architecture, Building and Planning (55%) and Subjects allied to Medicine (38%). Perhaps surprisingly, it was not as high as this in Engineering and Technology which is also generally considered as a more vocationally-oriented subject. It was lowest in Geography (9%) and Chemistry (11%) (see Table 3.10). Figures for taught postgraduates and PhD students were broadly similar (see Appendix Tables B3.30 and B3.31).

Table 3.10 Existence of career plan at entry to university, by subject of study (final year UK undergraduates), as percentages

Subject group	Definite career in mind	Considering several alternatives	Only vague idea of possibilities	No idea at all	*Number of cases*
Subjects allied to Medicine	38	18	27	17	*146*
Biological Sciences	19	29	34	18	*371*
Sports Science	22	30	30	19	*64*
Psychology	22	28	35	16	*309*
Chemistry	11	24	45	20	*213*
Physics	16	19	36	28	*236*
Other Physical Sciences	14	28	37	21	*166*
Mathematical Sciences	18	21	30	31	*233*
Computer Science	14	29	40	17	*272*
Engineering and Technology	24	30	35	11	*578*
Arch., Building and Planning*	55	21	21	2	*47*
Geography	9	17	41	33	*259*
Forensic Science/ Archaeology	25	33	25	16	*75*
All students	19	26	35	20	*2969*

* Note small sample size (less than 50).

3.5.2 Changing career plans during undergraduate study

As already noted just over two-thirds of final year undergraduates reported that they had changed their career plans (see Appendix Table B3.13). The proportion changing their career plans completely was highest in Psychology (24%) and lowest in Architecture, Building and

Planning (6%) and Engineering/Technology (12%). The proportion of taught postgraduates who had changed their career plans while undergraduates either completely (21%) or to some extent (38%) was quite similar, as was the proportion of UK final year PhD students (18% completely and 46% to some extent). However, slightly more than a half (57%) of the PhD students had changed their career plans to some extent while they were postgraduates but only 12% had changed their plans completely.

3.5.3 Nature of initial career plans

Final year undergraduate students who said they had a definite career in mind (19%) or were considering several alternatives (26%) when they first came to university were asked what career they had in mind at that time (see Figures 3.9 and 3.10). The majority of them (71%) had expected to work in a STEM Specialist sector and in a STEM Core function (68%) but there were some notable exceptions, especially in Mathematics but also to a lesser extent in Geography. Most Mathematics students (83%) had expected to work in STEM Generalist sectors (Education and Training 42%, Investment banking 19% and Accountancy and business services 16%).

Results for occupational function were broadly similar with 78% of Mathematics students expecting to work in STEM-related functions (Education/teaching 42% and Accountancy/ finance 31%). More than a third (36%) of Geographers and 42% of Sports Science students also expected to work in Education/teaching. Whether teaching is considered to be in a STEM Generalist sector or a STEM-related function, as we have classified it, clearly has considerable influence on these percentages for the subjects where a substantial proportion are considering teaching as a career.

Replies from UK taught postgraduates were very similar to those of final year students (see Appendix Table B3.32). When they first went to university most of those with definite plans or considering several career alternatives expected to work in a STEM Specialist sector (76%) and a STEM Core function (74%). Mathematicians were once again the main exception with the majority expecting to work in STEM Generalist sectors (54%) and STEM-related functions (62%).

The same pattern was found among final year PhD students with most of those with a definite career in mind or considering several career alternatives when they first went to university expecting to work in a STEM Specialist sector (71%) and a STEM Core function (76%).

It is apparent that most of the minority with a career plan when they first came to university expected to work in STEM employment. There were also clear subject differences; students in some subjects being much more likely to have had clear plans at this stage – justifying labelling these subjects as more ‘vocational’ not only because of their content but also because they attract more career-oriented students.

Figure 3.9 Planned employment sector at entry to university, by subject of study (final year UK undergraduates with some initial career plans)

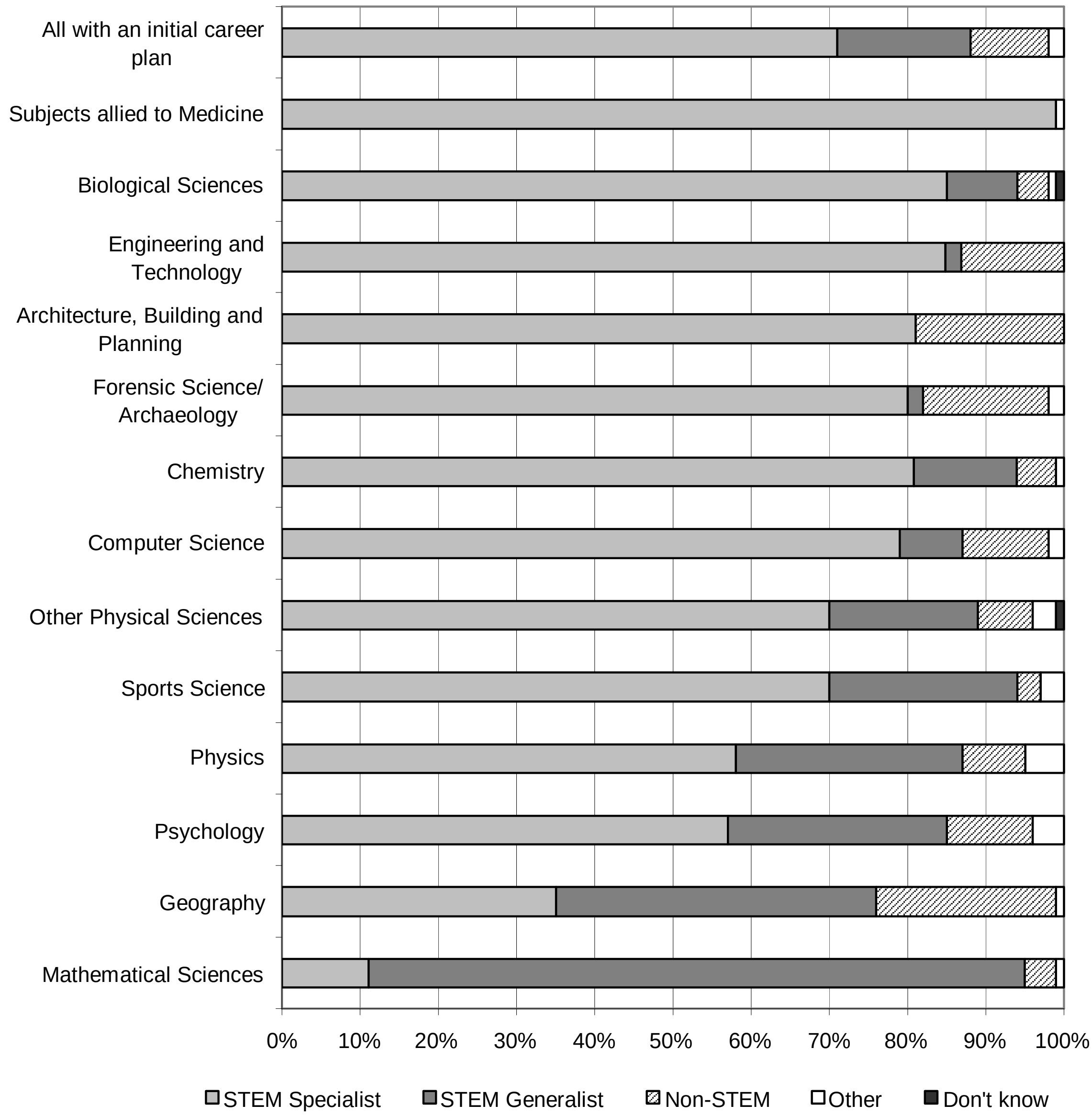
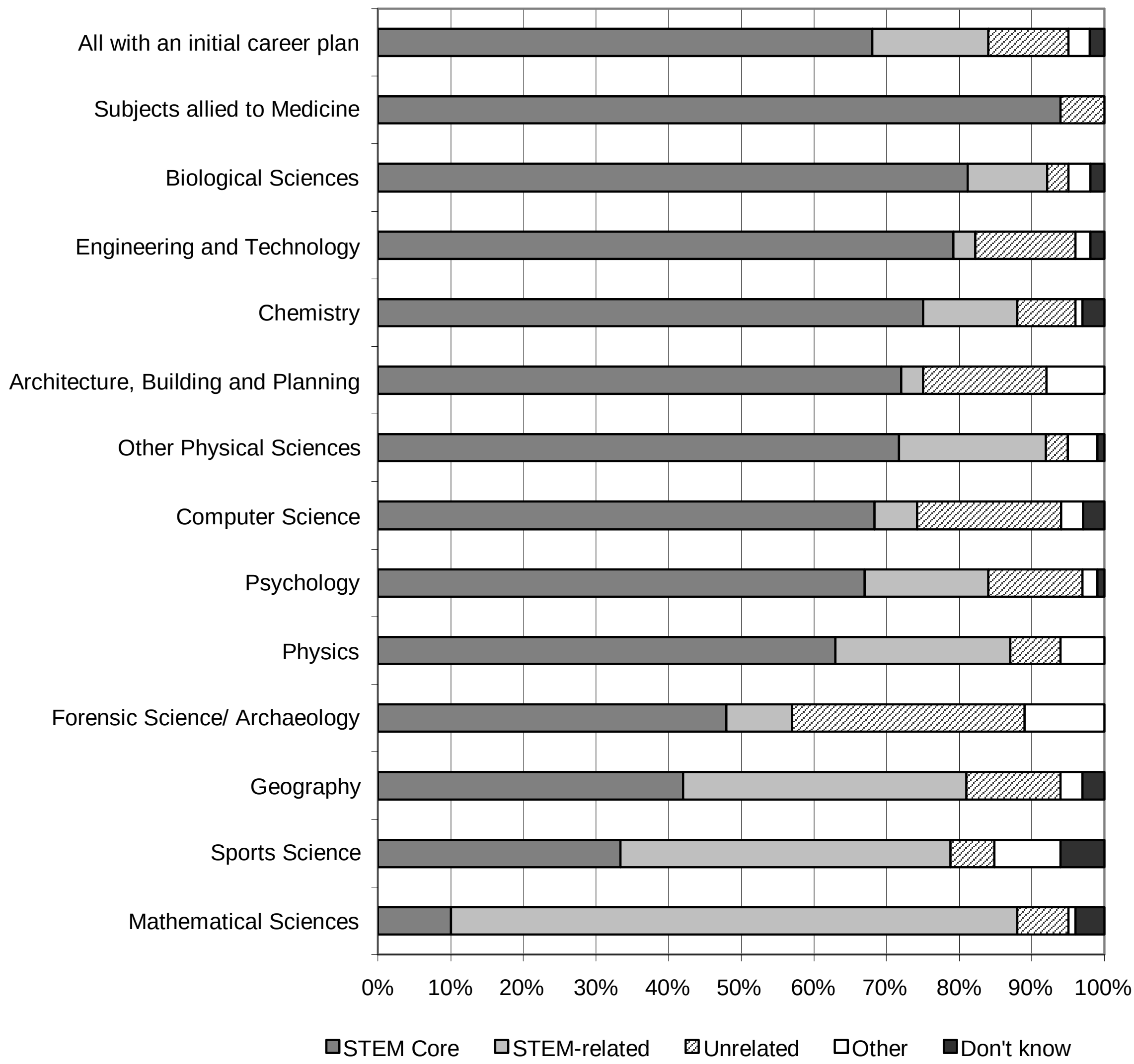


Figure 3.10 Planned occupational function at entry to university, by subject of study (final year UK undergraduates)



3.5.4 How plans changed with time

Another question the survey sought to answer was how students' plans changed over time, and whether this resulted in more or less electing to pursue STEM careers. At entry, the majority of STEM students with career plans reported that they wished to work in STEM sectors and functions; so how had this changed over their time at university?

When they went to university, 88% of final year students with a career in mind had been considering working in STEM Specialist/Generalist sectors and 84% in STEM Core/related functions. By the time of the survey in their final year, this had reduced slightly, to 76% considering working in STEM Specialist/Generalist sectors and 72% in STEM Core/related functions. However, a further 17% were considering *both* STEM and non-STEM sectors, and 14% were considering both STEM and unrelated functions. The percentage *only* considering non-STEM sectors had reduced to 7% now, from 12% at entry, while the percentage considering Unrelated job functions had not really changed (13%).

This appears to show no substantial dilution of the intention to work in STEM *among those initially most committed to it*. In addition, among those 55% of final year students who were unsure about their career at entry, 60% now had career plans of whom 67% were considering working in STEM Specialist/Generalist sectors and 63% in STEM Core/related functions, while a further 25% were considering both STEM and non-STEM sectors (and 23% considering both STEM and unrelated functions). Just 7% of this group were only considering non-STEM sectors and 11% Unrelated functions.

Taken altogether, and along with the finding that very few final year students either might not or definitely do not want to work in occupations related to their STEM degree (see section 3.1), there seem to be two clear messages from this analysis:

1. No support for the suggestion that large numbers of students in STEM subjects are being put off working in STEM while they are at university. It may be of greater significance that just over a quarter (26%) still only have a vague or no idea at all of possible careers at this stage in their final year.
2. It also seems likely that the many students who mainly selected their undergraduate courses for interest might now find that occupations linked to their degree subject are also interesting, and thereby attractive to them.

3.6 Influences on career thinking

Career plans change over time and the survey sought to understand what had influenced these changes and how this affected students' intentions to enter a STEM occupation or not.

Those final year students who had changed their career plans while at university were asked who or what had influenced them. 'My personal interests/values' (69%) and 'the content of my university course' (58%) were the most frequently mentioned (see Table 3.11 and Appendix Table B3.33). By comparison, employer or employee influences tended to be mentioned less frequently (by around 20-30%) but for those students who had undertaken some degree-related work experience, their work experience employer was the third most frequently mentioned influence (51%).

Table 3.11 Most common influences on career plans, by subject of study (final year UK undergraduates who had changed plans), as percentages

Subject group	Personal interests/values	Content of course	Friends/ students/peers	Tutors/ faculty	People I know working in this career	Work experience employer	Parents/ relatives/ friends of parents	*Number of cases*
Subjects allied to Medicine	72	48	45	34	30	33	29	*83*
Biological Sciences	71	58	40	39	27	27	28	*259*
Sports Science*	71	60	29	40	42	24	22	*45*
Psychology	77	57	35	35	26	17	28	*243*
Chemistry	63	58	42	36	31	38	23	*166*
Physics	70	55	42	30	28	26	32	*148*
Other Physical Sciences	74	70	38	54	26	19	27	*119*
Mathematical Sciences	61	47	42	21	26	18	33	*142*
Computer Science	62	57	40	33	35	39	26	*173*
Engineering and Technology	67	64	42	37	28	41	24	*392*
Arch., Building and Planning*	79	32	25	36	43	25	32	*28*
Geography	72	55	33	30	22	15	34	*189*
Forensic Science/ Archaeology	71	72	26	34	24	17	19	*58*
All who had changed plans	69	58	39	35	28	28	28	*2045*

* Note small sample size (less than 50) in these subjects.

Influences varied for students studying different subjects with, in particular, 'the content of my university course' being much less important for Architecture, Building and Planning students (32%) than for others.

Replies from taught postgraduates were very similar with 'my personal interests/values' (70%) and 'the content of my university course' (59%) being the most commonly mentioned sources of influence (see Appendix Table B3.34). For those postgraduates who had undertaken some degree-related work experience, 'my work experience employer' (43%) was the third most frequently mentioned ahead of 'my tutors/faculty staff' (38%).

3.6.1 Impact of changing career plans

Final year STEM students who had changed their career plans, either completely (43%) or to some extent (49%), were less likely than those students who had *not* changed their career plans (63%) to say that they definitely wanted to pursue a career in an occupation related to their degree, that is to say a STEM career of some kind. More significantly, 10% of those who had completely changed their plans definitely did *not* want to pursue a career in a degree-related occupation. They were also more likely to have had no idea at all about possible careers when they first went to university (29% compared to 18% of other students).

However, these students were now more likely to have a definite career in mind than those who had only changed their career plans to some extent (36% compared to 22%), although still less likely to have a definite career in mind than those who had not changed their plans (47%). This meant they were also less likely than other students to have only a vague idea or no idea at all about possible careers in their final year (19% compared to 28%).

Table 3.12 Expected career sector and function for those with career plans, by extent to which they had changed their plans (final year UK undergraduates), as percentages

Sector	**Changed plans completely**	**Changed plans to some extent**	**Not changed plans**	**All with plans**
STEM Specialist	37	49	63	51
STEM Generalist	16	8	14	11
Non-STEM/Other	11	5	7	7
STEM Specialist/Generalist	10	12	7	10
Mixed sectors	26	26	9	21
Function				
STEM Core	37	45	57	47
STEM related	17	9	13	12
Other/unrelated	13	10	15	12
STEM Core/related	10	11	5	9
Mixed functions	21	23	9	18
Don't know	2	2	1	2
Number of cases	*397*	*1121*	*669*	*2187*

Two conclusions are that:

1. The more that plans had changed, the less likely students were to report a desire to work exclusively in a STEM Specialist sector or Core function. Students who had changed plans completely were also somewhat more likely to want to work in non-STEM sectors.
2. The greatest difference was that more of those who had changed their plans either completely or to some extent expressed an interest in working in occupations in *both* STEM and non-STEM sectors and functions (see Table 3.12) which might suggest that many of these students were still at quite an exploratory stage in relation to their career thinking.

3.7 Impact of career motivation

Approximately half (49%) of UK final year STEM students said that one reason they chose their university course was that they wanted to follow a career in this field, although the proportion did vary by degree subject (see earlier Table 3.8). But do these more career-motivated STEM students behave differently from those who seemed less career-motivated (i.e. those who did not select their degree course for a career-related reason)?

Key findings from this analysis are:

1. More of the career-motivated students had a definite career in mind when they first went to university than those who were not career-motivated (28% compared to 11%) and far fewer of them had no idea at all (8% compared to 30%).
2. At the time of the survey, 37% of those who were career-motivated when choosing their university course now had a definite career in mind compared to 27% of those who had not been career-motivated, so this difference narrows over time but still persists. Equally, less than one in five (18%) of career-motivated students still had only a vague idea of possible careers or no idea at all at the time of the survey which was much lower than the proportion (34%) of the remaining students.
3. More significantly, roughly two-thirds (68%) of these career-motivated students said that they now definitely wanted to pursue a career in an occupation directly related to their degree compared to just 37% of remaining students. Only 5% of them might not, or definitely did not, want to pursue degree-related careers, compared with 18% of the other (i.e. non-career motivated) students.
4. Career-motivated students were also more likely to have undertaken some degree-related work experience than other students (55% compared to 43%), and were less likely to have changed their degree subject (14% compared to 19%).
5. Career-motivated students were less likely to have changed their career plans (65% compared to 73%) and, in particular, less likely to have changed their career plans completely (13% compared to 20%). They were also more likely to say that they would

do the same/similar undergraduate course again than those who were not career-motivated (80% compared to 67%).

There was a similar pattern of results for students on taught postgraduate courses. Those who mentioned that one of the reasons they chose their undergraduate course was because they wanted to follow a career in this field were also more likely than the others:

- To have had a definite career in mind when they first went to university (32% compared to 11%);
- To have undertaken degree-related work experience (50% compared to 36%);
- To say they have a definite career in mind at the time of the survey (45% compared to 36%);
- To definitely want to pursue their career in an occupation directly related to their degree (83% compared to 70%).

These students were also less likely to have changed their career plans completely while they were at university (16% compared to 26%).

Among those with career plans when they first went to university, more of the career-motivated students reported wanting to work in a STEM Specialist sector or STEM Core function at that time, and fewer reported wanting to work in a STEM Generalist or other sector or in a STEM-related or unrelated function. Career-motivated students were also more likely at the time of the survey still to want to work in a STEM Specialist sector or STEM Core function (see Tables 3.13 and 3.14).

Table 3.13 Initial intentions of career sector and function for those with initial career plans, by career motivation (final year UK undergraduates), as percentages

Sector	**Career motivated**	**Not career motivated**	**All with plans**
STEM Specialist	75	63	71
STEM Generalist	16	21	17
Non-STEM	7	14	10
Other	1	2	2
Don't know	0	0	0
Function			
STEM Core	72	59	68
STEM-related	15	20	16
Unrelated	9	14	11
Other	3	4	3
Number of cases	*899*	*442*	*1341*

Table 3.14 Current career sector and function for those with career plans, by whether career motivated or not (final year UK undergraduates), as percentages

Sector	Career motivated	Not career motivated	All with plans
STEM Specialist	57	44	51
STEM Generalist	9	14	11
Non-STEM/Other	5	9	7
STEM Specialist/Generalist	9	10	10
Mixed sectors	19	23	21
Don't know	0	0	0
Function			
STEM Core	52	41	47
STEM related	10	14	12
Other/unrelated	11	13	12
STEM Core/related	8	10	9
Mixed functions	17	20	18
Don't know	2	2	2
Number of cases	*1194*	*993*	*2187*

3.8 Work experience

Approximately half (49%) of UK final year undergraduates, but slightly fewer UK taught postgraduates (44%), had undertaken some sort of degree-related work experience as an undergraduate. Among UK final year students, less than 40% of students in Geography (28%), Mathematical Sciences (30%), Physics (36%) or Other Physical Sciences (38%) had undertaken any degree-related work experience, compared with over 60% in Architecture, Building and Planning (62%), Sports Science (63%) and Engineering and Technology (65%) (see Figure 3.11).

There was a broadly similar trend among taught postgraduates (the few exceptions tend to be linked to relatively small sample sizes for taught postgraduates, i.e. less than 50 respondents in a subject area). A similar proportion (52%) of the UK final year PhD students had undertaken some degree-related work experience as an undergraduate, but only a quarter had undertaken any work experience related to their postgraduate studies/research.

Likelihood of having undertaken some degree-related work experience was correlated with intention to pursue a degree-related career (see Figure 3.12). 60% of those who definitely want to pursue a degree-related career have undertaken some degree-related work experience compared with just 30% of those who might not or definitely do not intend to.

Figure 3.11 Percentage of UK final year and taught postgraduates with degree-related work experience, by undergraduate subject

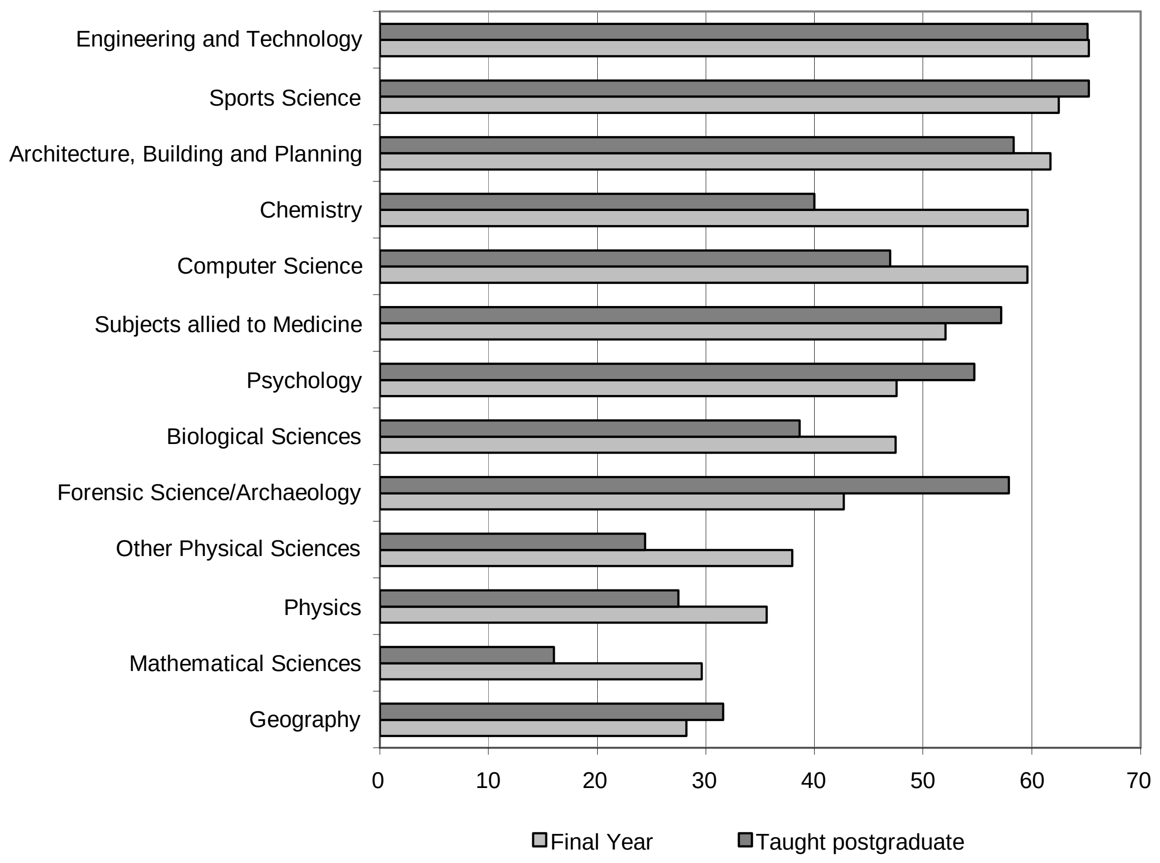


Figure 3.12: Percentage of UK final year students who have undertaken degree-related work experience by intention to pursue degree-related career

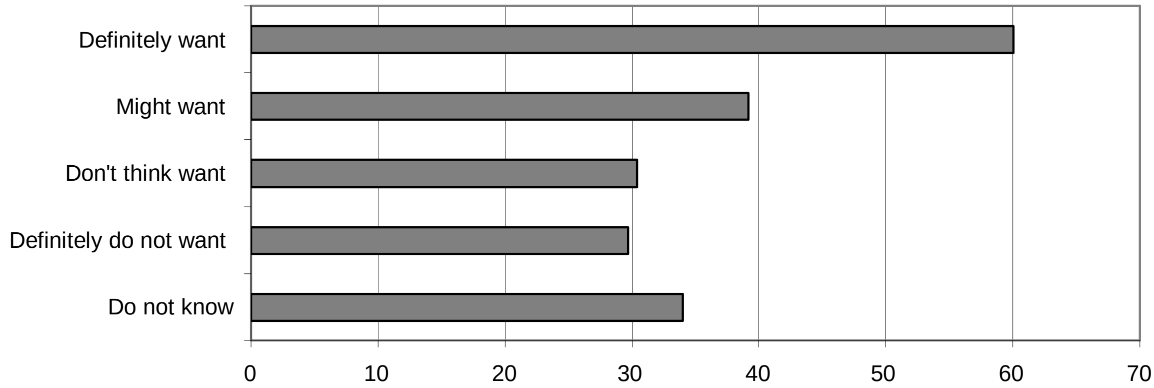
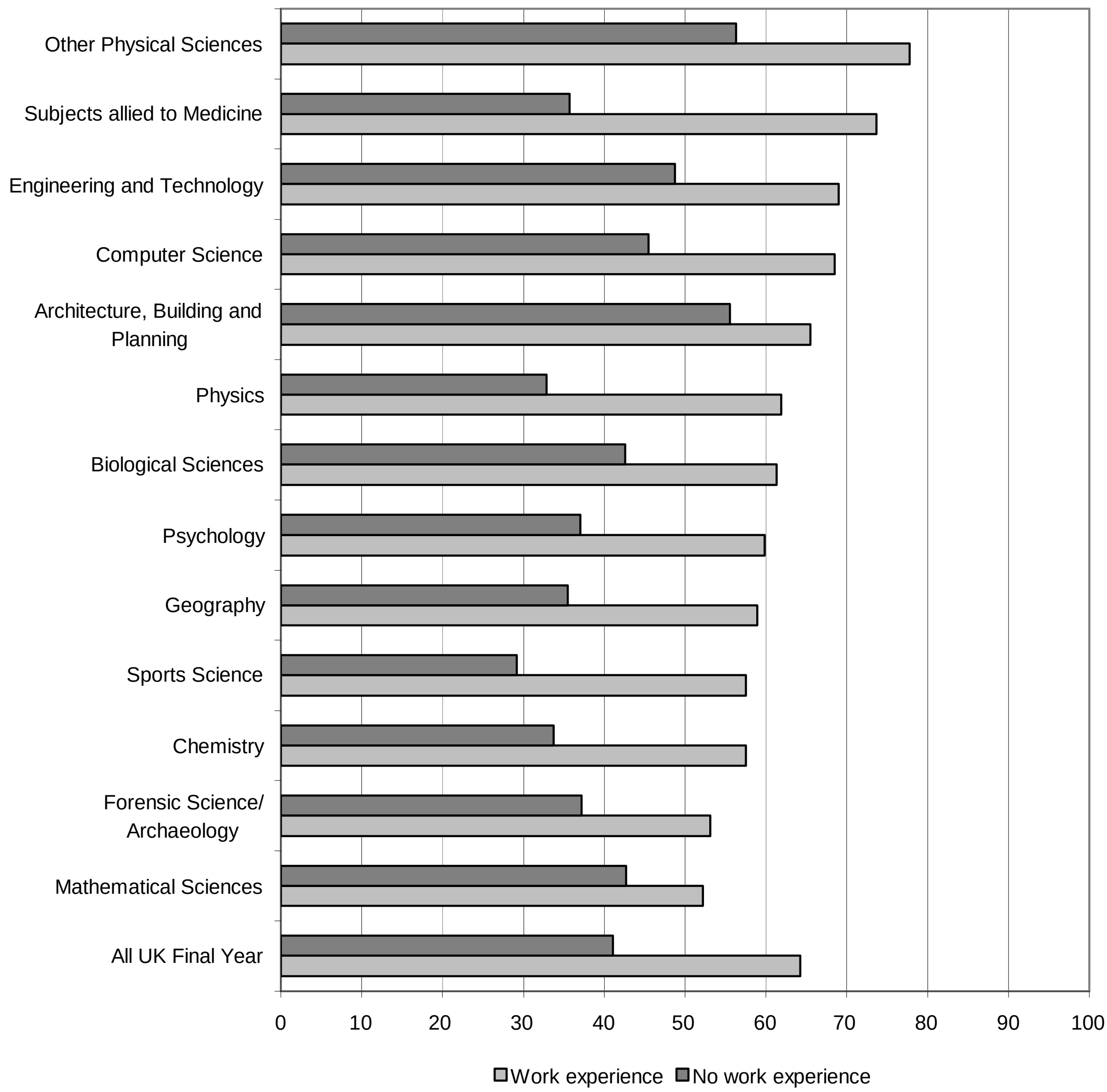


Figure 3.13: Percentage of UK final year students with and without work experience who definitely want to pursue a career in an occupation related to their degree



Final year students *with* work experience were also more likely to say that they definitely wanted to pursue a career in an occupation directly related to their degree when they graduate than those without work experience (see Figure 3.13). The difference was smallest in Mathematical Sciences (9%) and Architecture, Building and Planning (10%) and greatest in Subjects allied to Medicine (38%).

Just over a third (37%) described the skills and experience they gained from their work experience as very helpful on their undergraduate course and a further 37% as quite helpful. Far more (61%) described the skills and experience they gained from their work experience as very helpful to their career and work choices and a further 29% as quite helpful for this. Once again these figures mask substantial variation between the experiences of students studying different subjects. For example, work experience appeared to be particularly useful for the courses of students in Forensic Science/Archaeology (69%) and Architecture, Building and Planning (66%) but, less useful to Psychology students (16%) and Mathematical Sciences students (17%) (see Appendix Figure B3.1).

There was less variation in the percentage of final year students who rated the skills and experience gained on their work experience as very helpful for their career and work choices (see Appendix Figure B3.2) with the proportion describing it as very helpful ranging from just under half of Geography students (48%) and Mathematical Science students (49%) to 68% of students in Subjects allied to Medicine.

When asked about the impact of their work experience, about half (51%) of the final year STEM students with such experience reported that they had decided that this was the sort of work they wanted to do. Other ways in which work experience had an impact included: being offered a job after they graduate by their work experience employer (17%) and not wanting to work for their work experience employer (18%); being put off seeking a career in the area by the kind of work (13%) or for other reasons (8%); and realising that they would need further training/a postgraduate qualification to improve their chances of getting work in this field (17%).

However, the impact of work experience varied subtly by discipline and overall figures disguise considerable variation in their experiences (see Table 3.15). For example, a third of Engineering and Technology students and almost a quarter (24%) of both Computer Science and Architecture, Building and Planning students reported that they had been offered a job after they graduate by their work experience employer whereas the proportion in some other subjects was very low. On the other hand, Mathematicians, Engineering and Technology students, and Biological Science students were the three groups most likely to report being put off seeking a career because of the nature of the work.

The other major difference was in those subjects in which significant numbers of students realised, as a result of their work experience, that they needed a postgraduate qualification/further training to get work and those that did not. In particular, around a quarter of all the science students had realised they needed a postgraduate qualification/further training. It is not surprising, therefore, that more students in these disciplines were considering further study (see Section 3.3.1).

Table 3.15 Most frequently mentioned impacts of work experience on career plans, by subject of study (final year UK undergraduates with degree-related work experience), expressed as percentages

Subject group	Decided this is ort of work want to do	Decided did not want to work for employer	Was offered job after I graduate	Realised needed postgraduate qualification/ further training	No effect on career plans	Put off because of the kind of work	Put off for other reasons	Other reason	*Number of cases*
Subjects allied to Medicine	51	9	18	26	13	13	7	0	*76*
Biological Sciences	53	13	7	28	17	16	10	6	*176*
Sports Science*	63	10	3	25	28	5	3	3	*40*
Psychology	50	9	2	29	18	11	10	5	*147*
Chemistry	53	18	8	25	10	13	10	9	*127*
Physics	48	20	11	27	21	14	10	0	*84*
Other Physical Sciences	52	17	8	21	22	6	8	3	*63*
Mathematical Sciences	58	26	14	14	10	17	9	7	*69*
Computer Science	51	22	24	7	17	12	6	7	*162*
Engineering and Technology	49	25	33	4	14	16	7	6	*377*
Arch., Building and Planning*	48	10	24	0	24	3	7	3	*29*
Geography	56	15	3	22	18	5	10	3	*73*
Forensic Science/ Archaeology*	53	13	13	25	25	13	3	3	*32*
All who had changed plans	51	18	17	17	16	13	8	5	*145 5*

* Note small sample size (less than 50) in these subjects.

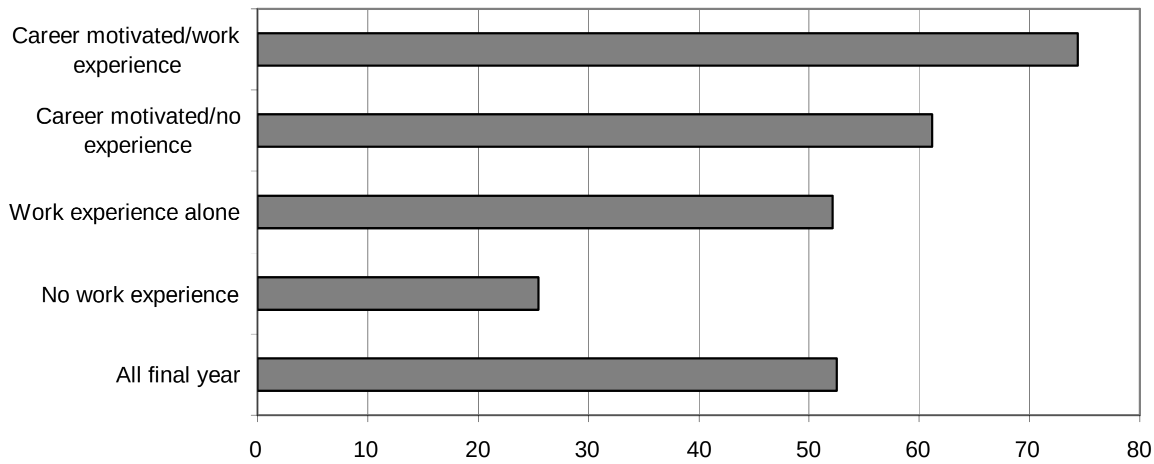
The pattern of replies from UK taught postgraduates was broadly similar with nearly half (48%) of taught postgraduates deciding that this is the sort of work they wanted to do but almost a quarter (22%) realising that they needed a postgraduate qualification/further training to get work in this field. Just over half (53%) the PhD students said undergraduate work experience was very helpful in deciding to undertake postgraduate study/research.

Among the quarter of final year PhD students who had undertaken work experience related to their research (i.e. while postgraduates), just under half (47%) felt that the skills and experience gained had been very helpful for their postgraduate study and 61% that it had been very helpful for their career and work choices.

3.8.1 Link to work experience

As we have seen, final year students with degree-related work experience were more likely than those without it to want definitely to pursue a career in a STEM degree-related occupation, but how does this interact with career motivation? In particular, is the impact of work experience just a reflection of differences in initial motivation or does it also motivate students towards staying in a STEM degree-related area of work? Figure 3.14 shows that only a quarter of final year students who were *not* career-motivated *and* without degree-related work experience definitely want to pursue a career in a degree-related occupation. Career-motivated students (as defined above) both with and without work experience were more likely to definitely want to pursue a career in STEM degree-related occupation than students with work experience alone. However, having work experience increased the likelihood of definitely wanting to work in degree-related occupations among both groups.

Figure 3.14 Percentage of UK final year students who definitely want to pursue a career in an occupation related to their degree



It appears, therefore, that undertaking STEM degree-related work experience increases the likelihood of both career-motivated and non career-motivated students pursuing a degree-related occupation, but with a greater impact on those not initially career motivated when choosing their degree. This may be because it was the first time that they had been exposed to the sort of work they could do once they completed their degree and, by implication, that it gave them the opportunity to see how interesting work related to their degree would be.

Figure 3.15 Impact of work experience on final year students' decision to undertake degree-related work

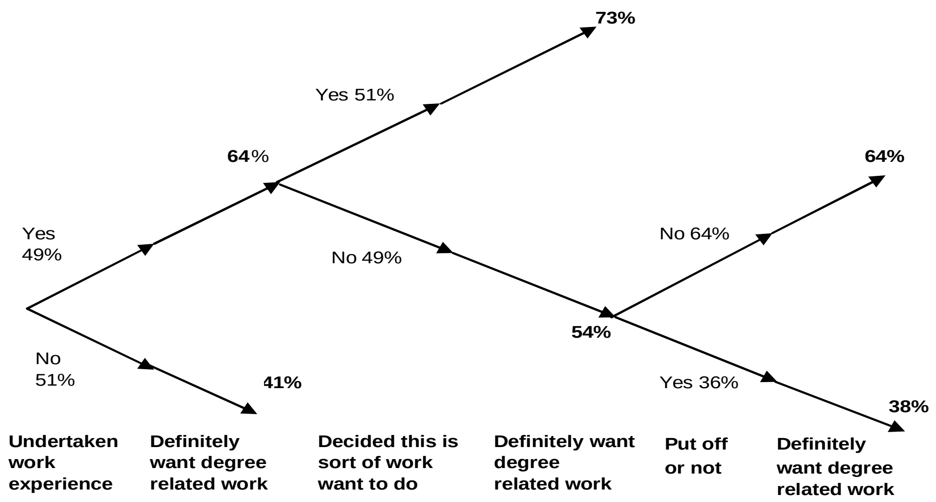


Figure 3.15 shows how work experience is linked to intention to *definitely* want to work in a degree-related occupation. It shows that:

- 64% of those who have undertaken work experience *definitely* want to work in a degree-related occupation compared to just 41% without degree-related work experience
- Nearly three-quarters (73%) of those with work experience who decided that this was the sort of work they wanted to do reported that they definitely wanted to pursue a career in an occupation directly related to their degree compared to 54% of those who did not decide this was the sort of work they wanted to do
- Among those (49%) who did not decide this is the sort of work they wanted to do, 36% were put off seeking a career in this field either because of the kind of work or for other reasons.
- Of these students only 38% definitely wanted to work in a degree-related occupation compared to nearly two-thirds (64%) of those not put off seeking a career in this field.

Work experience also had other effects on students. When we compared those who decided this is the sort of work they wanted to do with those who did not, and look at how their work experience influenced them in other ways, we found:

- No difference in the proportion who reported they were offered a job after they graduate, but far fewer of those who wanted to do this type of work had decided they did not want to work for their work experience employer (9% compared to 28%);

- Almost a third (31%) of those who had not decided this is the sort of work they wanted to do reported that their work experience had no effect on their career plans, compared to only 2% of those who wanted to do this sort of work.
- In certain subjects (Subjects allied to Medicine, Sports Science, Chemistry, Geography and Forensic Science/Archaeology) but not others, students who wanted to do this sort of work were much more likely to have realised they needed a postgraduate qualification/ further training to get work.

Work experience and career motivation were also linked to saying that respondents would do the same/similar undergraduate course again, although the differences were not so marked as for degree-related career intention.

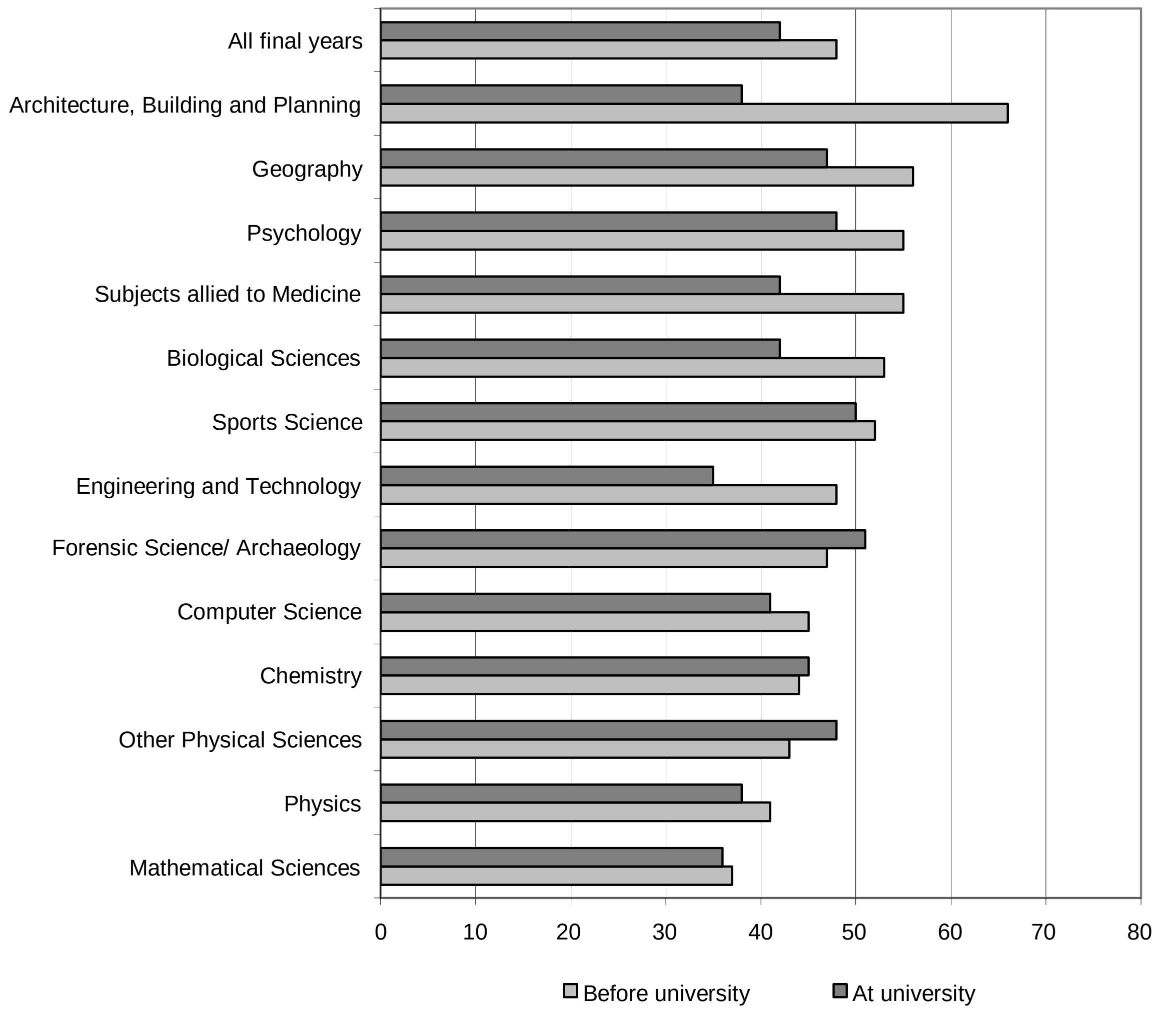
3.9 Career advice and guidance

What impact does career advice and guidance have on these students' career choices and were there times when these students would have benefited from additional career support? A majority (60%) of final year students had used their university careers service with 39% having used it so far in their final year and 36% in earlier years, although the nature of that use was not specified. Roughly one in seven (14%) had used the careers service in both their final year and earlier. Just over a quarter (27%) reported that they found the careers service very helpful and over half (54%) had found it quite helpful with less than one in five (19%) finding it not very helpful or not at all helpful.

Nevertheless, 60% of final year students (and similar proportions of taught postgraduates and final year PhD students) reported that they would have benefited from additional career support: nearly half (48%) before they went to university and 42% while they were at university. Two-thirds of Architecture, Building and Planning students and more than half the students in biologically-related subjects (Subjects allied to Medicine, Biological Sciences, Sports Science and Psychology) said they would have benefited from more career support before they went to university, while students in the Physical sciences and Mathematics were less likely to feel they would have benefited from additional support at that time (see Figure 3.16).

In contrast, most taught postgraduates (58%) had never used their university careers service either as a postgraduate or as an undergraduate and those that had used their university career services as undergraduates had found it slightly less helpful than the current final year students. The few who had used their university careers service as a postgraduate were slightly more positive with one in five rating it very helpful and over half (58%) quite helpful.

Figure 3.16 Percentage who believed they would have benefited from additional career support (final year UK undergraduates)



The consistent overall trend is that many STEM students do not use their university careers service, although use varies by subject with students in the most narrowly vocational subjects appearing to be the least likely to use it but also to be the ones who were most likely to think that they would have benefited from additional career support before they went to university. Postgraduates' use of the career service while they were undergraduates was very similar to that of the final year students but PhD students seemed less satisfied with their experience of the career service both as undergraduates and postgraduates.

Most of the survey respondents believed they would have benefited from additional career support at some point. Around a half would have benefited from more support before they went to university and slightly under half while they were undergraduate students.

3.9.1 Impact of use of the careers service

Final year STEM students were just as likely to *definitely* want to pursue a degree-related career regardless of whether they had used their university careers service or not. Students who had never used their university careers service were slightly more likely to have a definite career in mind (36%) than others. On the other hand, more of these students also had only a vague or no idea at all about possible careers (30%) than those students who had used their careers service. In contrast, more of those who had used their university careers service were considering several career alternatives. Those who had used it the most (i.e. in both their final year and earlier) were the least likely to have only a vague or no idea about possible careers (18%), perhaps unsurprisingly.

There is, therefore, evidence that using their university careers service had helped some students develop their career plans, but not that it promoted STEM careers over others; after all, careers advice should be impartial.

3.9.2 Consequences of a need for additional career support

Reporting that you would have benefited from additional career support at some point seems to have had a number of impacts on career and educational choices:

1. 30% of STEM final year students reported that they would have benefited from more career support both before and while they were at university and these students were slightly less likely to report that they definitely wanted to pursue a career in a degree-related occupation (48%) than other students (54%)
2. Final year students who would have benefited from additional career support (either only at university, or both before and at university) were also less likely to have a definite career in mind in their final year (30% and 21% respectively) compared to 38% of other final year students and more likely to have only a vague or no idea at all about possible careers (29% and 33% respectively).
3. Although only students who had a definite career in mind or were considering several alternatives were asked for their current career plans, among these students, those who felt that they would have benefited from additional career support both before and while they were at university were less likely to be considering working in a STEM Specialist sector or STEM Core function and more likely to be considering employment in *both* STEM and non-STEM sectors and in STEM and unrelated functions. As a higher proportion of these students had only vague or no idea at all about possible careers, this finding quite probably underestimates the impact of lack of career support on STEM career intentions.
4. Lack of career support before students went to university was also associated with being less likely to do the same/similar course again (67%), being more likely to do a different

course (30%), and to delay or not go to university (12%).

5. While it is hard, if not impossible, to quantify the impact that additional career support would have had on these students, it seems likely that at least some of those who said that they would have done a different undergraduate course would have done so. More of them might have formulated firmer career intentions by this time in their final year, which could result in a somewhat higher proportion having the intention to work in a STEM career.

The research evidence suggests that many students miss out on the career support they need at key stages but also that some of the career support available is not as effective as it should be. Effective career support post-16 should enable students to make the link better between university courses and career opportunities, which would assist students to make more informed choices about their future careers. However, some students are not ready to make career decisions at that stage; for them, continuation within a broader post-16 curriculum might enable them to keep their options open for longer.

3.10 Observations and conclusions

3.10.1 Overall observations

- The majority of STEM students at all levels definitely wanted to pursue a STEM degree-related career. Higher proportions of taught postgraduates (77%) and students on M-level courses (60%) definitely intended to pursue degree-related work.
- Final year undergraduates and taught postgraduates who definitely intended to enter degree-related work were mainly motivated by expecting to 'find the work interesting and exciting' and to 'want the opportunity to put their learning into practice'. Most had 'enjoyed their degree course' and about half had 'always wanted to work in this field'. Potential earnings (pay) seemed only to be factor motivating a minority.
- For the minority who might not or definitely did not want to pursue a STEM career, 'becoming more interested in another field' was the main reason given. A significant proportion of these final year undergraduates had not enjoyed their undergraduate degree course. Here too, only a minority (29%) of these respondents mentioned pay as a motivating factor to pursue a non-STEM career, while small but significant numbers in some subjects cited location and job availability as reasons.
- Career plans became clearer while students were at university. Most students only had a vague idea or no idea at all of possible careers when they first came to university but by the time of the survey, in their final year, most had either a definite career in mind or were at least considering several alternatives. However, a substantial minority (over a quarter) were still quite uncertain in their final year.
- Among those with careers in mind, about half were considering a career in a STEM Specialist sector and just under half in a STEM Core function. More of the students in

the more narrowly vocational subjects were considering careers in STEM Specialist sectors and STEM Core functions than of the other subjects.

- More postgraduates than undergraduates wanted to work in STEM sectors and job functions; further study (either a taught course or doctoral research) was seen as a major route to a STEM career by many students in certain subject disciplines. Some subjects were also much more explicitly seen to lead directly to particular careers than others.
- There were four main career tracks for STEM final year students after graduation:
    - i. to obtain employment related to their longer-term career plan (for 41%);
    - ii. to enrol on a full-time higher degree course (26%);
    - iii. to travel or take time out (12%); or
    - iv. to obtain other long-term or temporary employment (12%).

However, there was a divide between those subjects where the majority of students expected to obtain long-term, career-related employment after graduation and others where more students expected to enrol on a full-time higher degree course.

- At the time of the survey (half way through the final year), the vast majority (80%) of the final year students whose main aim for next year was to obtain employment related to their longer-term career plan had already started looking for work and over half (62%) had already applied for jobs.
- Most students changed their career plans while they were at university, with more than two-thirds (69%) of final year undergraduates reporting that they had changed their career plans either completely (17%) or to some extent (52%), while a fifth (21%) of taught postgraduates had changed their career plans completely.
- Personal interest and enjoyment were most frequently mentioned as important reasons for students' original choice of a STEM degree course but career-related reasons were also important for about half the students. Fewer than one in six said their particular course was a required qualification for their chosen career.
- About one in six final year undergraduates had changed their undergraduate degree course but roughly two-thirds of changes were simply to a different course in the same department. However, far more (around a quarter) would choose a different undergraduate course if they had the opportunity to start their higher education again.
- The majority of students with a career plan when they entered university now expected to work in STEM employment. There were clear subject differences with students' in some subjects much more likely to have had clear plans at that stage. Fewer of those who had changed their career plans, either completely or to some extent, definitely wanted to pursue a degree-related career.
- Personal interest/values and the content of their university course were the reasons most commonly mentioned for changing career plans, but for students who had undertaken degree-related work experience; their work experience employer was one of the influences most frequently mentioned.

- Being career-motivated (i.e. those for whom wanting a career in this field was an important factor in their choice of degree subject) and undertaking degree-related work experience were both strongly related to an intention to seek degree-related employment. However, undertaking STEM degree-related work experience had a greater impact on intention to pursue a degree-related occupation for those not initially career motivated when choosing their degree.
- Many STEM students did not use their university careers service, especially those studying the more vocationally focused subjects – although many of them thought they would have benefited from additional support before university. However, most felt they would have benefited from additional career support at some point, with around half reporting they would have benefited from more support before they went to university and slightly under half while they were undergraduate students.

3.10.2 Conclusions

Although most STEM final year students claimed that they definitely or might want to pursue a career in a degree-related occupation, about a quarter still have no or only vague ideas about possible careers in their final year. These students were more likely to be planning to travel, take time out, or to seek other long-term or temporary employment, presumably thereby delaying their career decisions.

It is possible that some of the trajectories pursued by students make it less likely they will pursue a STEM career. This may simply reflect the fact that a substantial number have not yet formulated career plans. Although they may not have completely rejected the idea of a STEM career at this stage, they may be considering non-STEM options too. Others may simply want to complete their degree and then take stock.

Few appeared to be strongly motivated by pay. Although some (about a quarter) mentioned being better paid as a reason to pursue degree-related work, a similar proportion of those not seeking to pursue degree-related employment reckoned they would be better paid in non-degree-related work. Pay was slightly more often mentioned by male students than female ones, and by students in some subjects, but appeared to work as a ‘push’ and a ‘pull’ factor: that is to say some students mentioned better pay as a reason for intending to work in STEM and others as a reason for not doing so.

However, what was unambiguous was that interest in the work was the overwhelming motivating factor influencing the students’ intentions, especially to work in a degree-related occupation but also in deciding not to do so. This might suggest that STEM students are happy to adopt a ‘satisficing’ approach as far as pay is concerned, but a maximising one for intrinsic job interest and potential job satisfaction.

Their different career aims indicate that by their final year many STEM students understand some features of the graduate labour market. In particular, there seemed to be a good understanding of whether they would need a higher degree or further qualification to pursue particular occupations, some within STEM sectors. Such lessons could have been learned while undertaking degree-related work experience, or in other ways (i.e. from the careers service, graduates, academic staff). The importance of postgraduate qualifications in some subject areas also highlights the benefit of including postgraduates in the survey, and suggests that analysis purely of employment destinations immediately after graduation will only give a partial picture of long-term STEM career intentions.

Some STEM students were put off working in a degree-related area either by the content of their degree course or by their work experience, but far more realised from these experiences that this is what interests them and that they would enjoy working in a degree-related area. Many of these STEM students had few career plans when they first went to university and little career experience, and it is, perhaps, not surprising that they ‘grow up’ to some extent while at university. Although some may have come to realise that they were not interested in a career relating to the degree they have been studying, many more recognise that if their degree course interests them, then degree-related work may also do so. Nonetheless, there is evidence that more of the career-motivated students at entry to university are likely to progress into STEM careers, and the more “decided” they are, in terms of career thinking at any point in time, the more likely they are to pursue a STEM career. The impact of work experience tends to reinforce this trend.

However, other students will realise that they have skills that are attractive to, and in demand from, a wide range of employers in different employment sectors, and so can compete successfully in the wider graduate labour market. Some have this understanding from an early stage; of those citing career-related reasons to choose their degree, as many did so to keep their career options open as to accelerate their path to a particular career.

Additional career support at certain stages might have influenced some students’ career plans. Some would have studied different subjects initially; for some this would have been a course in more strongly vocational subject and might have eased their transition into a STEM career. Some postgraduates on taught courses are undertaking a course in a new subject in order to change career direction. The fact that a quarter would choose a different undergraduate course if they started their university education again indicates that some feel they made the wrong initial choice, although for others this will reflect more on their interests changing while they were at university.

There is little evidence that significant numbers of students are being ‘put off’ STEM careers while they were at university, at least by the time of survey. At the outset, most of those with career plans tend to be STEM focused and, while most change their plans to some extent and some who do change plans will move away from STEM, more broaden the range of options they are considering without necessarily excluding a career in a STEM field. The bigger challenge may be whether they can find jobs in their chosen career; that is to say whether they are actually recruited by STEM employers. This is a major subject treated in the next chapter.

4. STEM graduate career decisions and outcomes

In this chapter, results are reported from the telephone survey and in-depth interviews with working STEM graduates working in STEM and non-STEM employment and occupations. Details of the methodology and overall parameters of the respondents of sample are given in Appendix A. The sample was not intended to be quantitatively representative, but of sufficient size and diversity to obtain information and understanding of a range of individuals' experiences, providing coverage of respondents with different characteristics such as degree subject and gender, as well as occupation and employment sector. Some graduates with non-STEM degrees were included for comparative purposes, selected with broadly similar employment to many of the STEM graduates.

Numerical figures and percentages are reported for certain closed questions within the 485 telephone interviews. However, caution is needed as their statistical significance is limited due to the deliberately purposive – rather than representative – nature of the sample, which was not a complete cross-section of all types of STEM graduate in employment (nor in non-STEM employment). As discussed in Appendix A, the way graduates were recruited for interview meant that many in the sample were rather 'strong' graduates in 'good' jobs, and the sample may not have represented the full range of employment outcomes. Deeper investigation was provided through the 70 face-to-face interviews, but information from both interview methods is principally intended to provide corroborative support for the student survey findings as well as insights into experiences after university.

The chapter focuses first on the graduates' current employment – and reasons they entered it – and how it relates to their career thinking and decision-making at graduation, then considers how their career thinking had developed up to that point and what had influenced it. Thereafter we highlight the skills the graduates actually use in their current job, as well as their expectations in relation to their future careers. These reflections, made with hindsight, on the evolution of career thinking prior to and during higher education offer, an interesting comparison with the data obtained from existing students reported in Chapter 3.

Scattered through the chapter are a series of case studies of STEM graduates now working in STEM Generalist or non-STEM employment, drawn from the in-depth interviews. These are included for illustrative purposes, and are not intended to be representative of the overall sample, but aspects of their stories illuminate the survey findings. However, they also demonstrate the individuality of graduates' career decision-making and the complexity of individuals' actions and subsequent pathways.

4.1 Current employment

The employment sectors within which the graduates now worked, and their occupational functions, are detailed in Appendix A (Tables A.18 and A.19). Due to unavoidable limitations in the recruitment strategies (see Appendix A, section A.3.2), a relatively high proportion of the graduates interviewed were working for larger and 'high quality' employers. Nonetheless the graduates were widely spread across almost the entire the economic spectrum, with examples in all 9 segments of the matrix formed using our employment and occupational classification (see Figure A.1 in Appendix A).

The higher education backgrounds of the graduates are summarised in Table A.23 (in Appendix A), which shows that the sample was dominated by graduates with 'good' (1st or 2.1) degrees, many from the Russell Group and 1994 Group universities on which larger graduate employers tend to focus their recruitment. The class of undergraduate degree obtained is shown in relation to graduates' current employment circumstances in Table 4.1. For these graduates, the pattern was relatively similar between sectors, although with a somewhat higher proportion of 1st and 2.1 degrees, and lower proportion of lower degree classes, in STEM Generalist sectors and STEM-related occupations, than either STEM Specialist or non-STEM work. Notably fewer 1st class degrees were held by those working in non-STEM sectors or jobs, but the proportion with lower degree classes was similar in both specialised STEM and non-STEM work.

Table 4.1 Degree classes obtained by graduates with different employment circumstances, shown as percentages (all STEM graduates interviewed by telephone)

Sector	**1st**	**2:1**	**Other**	**All STEM**	*Number of cases*
STEM Specialist	38	47	15	36	*150*
STEM Generalist	42	50	8	34	*138*
Non-STEM	25	59	16	30	*104*
Function					
STEM Core	34	46	17	41	*170*
STEM-related	38	53	7	37	*148*
Unrelated	30	52	14	22	*74*
All	36	51	13	100	*392*
Count	*141*	*200*	*51*	*392*	

Given the early career stage of the graduates interviewed, most were either in their first 'serious' job after graduation or a role for the same employer that was a direct progression from it. However, a minority had made several job and employer changes since graduation and it was felt important, given the focus of the study on why STEM graduates are (now) working in non-STEM jobs, not to restrict the research entirely to those in their first graduate jobs. For this reason, we obtained information about 'current' employment, which for some was their first graduate job and for others a subsequent post, and for the latter we sought to obtain information about their earlier graduate jobs and choices as well. Information and understanding from those whose current job differed significantly from their first graduate job – and the reasons for the change – are given in a separate section.

4.1.1 Reasons for taking first graduate job

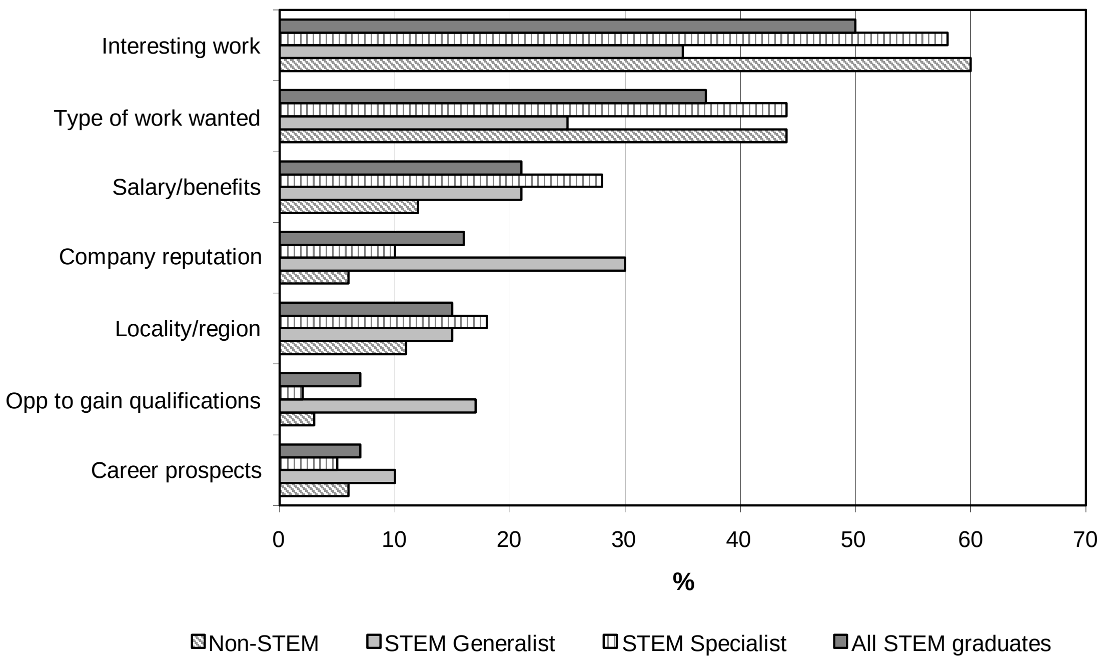
When asked why they had decided to take their current job, half of all STEM graduates interviewed reported that they had been attracted by the prospect of interesting work and for over a third (37%) it had been the type of work they were seeking (i.e. it fitted their career plan). Lower, but significant, proportions cited salary and benefits (21%), the employer's reputation (16%) or the location of the job (15%). These are summarised in Table 4.2. 'Interesting work' was the most frequently cited reason, and the relative ordering of reasons was roughly maintained, irrespective of degree subject.

Table 4.2 Main reasons for taking current job by undergraduate subject (graduates interviewed by telephone). For full data see Appendix B Table B4.1

	Biology and related	Chemistry	Physics	Maths	Computer Science	Eng./Tech.	All STEM	Non-STEM
Type of work wanted	38	39	41	24	50	35	37	31
Salary/benefits	17	22	18	15	46	25	21	14
Locality/region	13	10	16	17	21	21	15	6
Interesting work	48	56	54	41	71	52	50	51
Needed a job	15	22	18	7	0	6	11	8
Graduate scheme	14	10	9	5	38	10	13	16
Company reputation	13	15	23	17	8	12	16	24
Not answered	1	0	2	2	0	3	2	0
Count	*86*	*41*	*56*	*41*	*24*	*99*	*402*	*80*

When STEM graduates' responses were analysed by current employment, there were significant differences. 'Interesting work' and 'type of work wanted' were cited by higher proportions of those working for STEM Specialist employers, and also non-STEM employers, than those working for STEM Generalist employers. Salary and benefits, and also location, were important to more graduates in STEM Specialist employers, than others (Figure 4.1). A similar pattern was seen according to how STEM-focused the job role was.

Figure 4.1 Main reasons for choosing current job, by employment sector (STEM graduates interviewed by telephone). For full data see Appendix B Table B4.2



On the other hand, a higher proportion of those now in STEM Generalist or related employment rated interest in or type of work markedly lower, as reasons, but rated issues like employer reputation much higher, or the opportunity to obtain professional qualifications. Lesser proportions also mentioned the training and development environment, potential variety of work and long-term career prospects. Graduate scheme quality was mentioned by some in non-STEM sectors. These trends partly reflect the significant number of STEM graduates interviewed who were working for large finance and professional services firms (hence the issue of qualifications) and also in the Civil Service ‘Fast Stream’.

None of the graduates reported that they had applied for their current job as a result of a failure to secure degree-related work, although in their additional comments some reported earlier directional changes while at university – particularly several who originally aspired to a career in medicine but obtained insufficient grades and had changed direction as a result.

A somewhat higher proportion of male STEM graduates, than females, cited salary and benefits as an important reason for taking their job, and also the prospect of interesting work. Otherwise there was relatively little difference in the reasons cited by males and females or their relative ranking; see Appendix B Table B4.3. Analysed by HE institution type, the only significant difference appeared to be that a higher proportion (over 50%) of those at “other” institutions reporting that the type of work was important (i.e. fitted with pre-existing career plans) than of Russell or 1994 Group graduates (of whom around a third reported this as important). None of the "other" graduates cited reputation of their employer as important. These variations did not appear to be artefacts of differing sub-populations in the sample, i.e. mostly males in engineering.

Amongst the more detailed individual reasons made, in expansion of "other" category responses, were enjoyment of an internship with the employer, appreciation of a good graduate or training scheme or development environment, and other issues relating to the specific employer rather than the employment sector or occupation. Perceived employer reputation seemed to be particularly important. Although only a small minority of graduates had stated their desire "to make a difference" as a reason, almost entirely from those now working for non-STEM employers and in unrelated roles, this was reinforced as a significant reason in the extended comments, often articulated as desire to "work in the public sector".

The detailed reasons, for choice of current employment, uncovered in the in-depth interviews echoed the reasons stated in the telephone research, tending to exemplify a combination of pragmatic and personal factors and the graduates' more strategic or aspirational career (direction) thinking which they had developed during university. As the graduates had progressed, issues such as their knowledge of the labour market, including reputation of employers, and perceived stability of employment, had become embedded in their practical decision-making, along with other issues relating to their individual personal circumstances.

Rebecca, finance trainee in a Local Authority

Rebecca enjoyed science and maths at school but felt she was weak at the practical aspects of science, so studied maths at Durham, gaining 1st class Maths. She had no real ideas about career and did not succeed with applications for work experience schemes. Having investigated different careers in accountancy, she disliked the commercial aspects of the City and the private sector but wanted to "make a difference". Rather cautious, she worried about making a wrong decision and made no job applications while at university.

Once home she became a purchase ledger clerk for the small music company where her father worked. Gaining some confidence, and comfortable in a role where she "*enabled other people to do the real work*", she made applications for finance jobs in the public sector and started a CIPFA qualification. Rebecca entered the graduate scheme for a county council and enjoyed its placements. Now a trainee accountant, undertaking CIPFA training, she wants to work in the non-profit or third sector eventually, in order to 'fit' personally. Although not unduly ambitious, she aspires to a senior accountant role through which she feels she could contribute her skills of numeracy and analysis to a good cause.

4.1.2 Job changes and reasons

Through the in-depth interviews, it was possible to obtain detailed understanding of the job changes made by those graduates who were not in their first job but had changed employer or direction. This was a minority as most interviewees had worked for the same employer since graduation, although many had experienced progression of job roles for that employer. For a few graduates their first long-term employment after graduation was rather pragmatic (i.e. "getting a foot on the ladder"), enabling them to join a more desirable employer or when an opportunity arose, by which time they could cite relevant experience.

A small number of graduates had taken somewhat unexpected pathways due to particular personal circumstances; for example, due to responsibilities as a carer for a disabled parent, or relating to a family or the relocation of a partner.

Jessica, Policy Adviser in central government

Jessica went to university as a first-generation HE student to study what she loved, zoology, and did not worry about longer-term ideas as she was diagnosed with a serious long-term visual impairment. She worked at a zoo in vacations but felt her shyness would severely restrict her options and made no job applications while at university. She also had caring responsibilities at home for her disabled, single-parent mother, and restricted job-hunting to administrative jobs and a few serious conservation posts locally. Over-qualified for the former, she obtained neither, but found work in an education project with animals and then an animal re-homing unit where she ended up in research.

Her self-confidence grew ("*I could make scary choices*") and she also realised she could have personal impact on conservation research through policy work, which could be a more realistic direction than a research career. As a result Jessica applied for and entered the Civil Service Fast Stream and has since worked in a variety of posts relating to the environment. She uses her analytical skills and keeps abreast of her beloved zoology in her spare time. She now recognises that the personal challenge is as important to her as the field of work itself. Although still hankering to be 'on the ground' in conservation research, she knows that to re-enter that field with any seniority would probably now be impossible.

Now thriving in London, Jessica muses that with her particular circumstances, she would have benefited from expert advice at key career stages, which would have stopped her making unrealistic job applications and potentially given her a smoother path.

Very few of the graduates had changed from a STEM Specialist sector to other sectors, or in other ways between our sector groups. More common was a shift away from corporate graduate schemes, most of were within STEM Generalist sectors. Several graduates had entered the Civil Service Fast Stream after having earlier joined – and disliked – a corporate graduate scheme (for example Debbie, in section 4.2.2). Only for one or two graduates interviewed had these changes been involuntary, due to redundancy, chiefly where they had worked for very small, technical businesses in the IT sector. There were relatively few cases of ‘migration’ from STEM Specialist sector jobs outwards and none in the other direction, i.e. ‘into STEM’.

4.1.3 Summary of reasons

The main reasons graduates chose their jobs, for most therefore, appear to have been individual choices which were quite aspirational, with their potential interest in the work being the dominant reason, supported by some longer-term career-related reasoning. Issues like starting salary or benefits, the potential for training, and especially employer reputation, were also significant, particularly for those not entering STEM jobs, but were not primary reasons for choosing the *direction* of their career. Individual practical reasons, such as location, or ease of getting a job, were displayed by relatively few of these graduates. Extremely few, if any, seemed to have ended up in non-STEM jobs as a result of failed applications for STEM employment.

We now turn our focus to graduates’ career thinking around the time of graduation which, for most of them, determined their career direction and the nature of their first ‘graduate job’.

4.2 Career thinking at graduation and applying for first graduate job

4.2.1 Career readiness and job applications

Just over one third (36%) of the STEM graduates reported that they had a definite career plan by the time they graduated, as shown in Table 4.3 (compared with 16% when they had started university, see subsequent section 4.4). The proportion with only vague ideas or no idea at all was around a quarter (26%, compared with around 60% at the outset). There were marked variations in these proportions by subject of degree, with over half of the Engineering/Technology and Computer Science graduates by that point definite about their career plans but much lower proportions of graduates in some Physical and Biological Sciences (of whom around a third still had only vague ideas or none at all).

Higher proportions of the STEM graduates now working in specialised STEM employment had a definite career idea at graduation (46-43%), compared with those now working outside STEM employers (37% STEM Generalist and 20% non-STEM), as shown in Table 4.4. A similar pattern was seen by occupational function type.

There was no discernible difference in the proportions with or without career ideas by gender, but a significantly higher proportion of those at "other UK" universities (48%) had definite career ideas at graduation compared with those in the Russell Group (32%), more of whom tended to have some ideas. The proportions with only vague or no ideas were similar irrespective of HE institution type (see Appendix B Table B4.5)

Table 4.3 Career situation at graduation by undergraduate subject (all graduates interviewed by telephone), as percentages. Lowermost section only for those who made applications at university. For full results see Appendix B Table B4.4

At graduation, did you have:	Biology and related	Chemistry	Physics	Maths	Computer Science	Eng./Tech.	All STEM
A definite career in mind	31	34	21	38	54	53	36
Some ideas about you might do	31	32	48	43	42	24	37
Only a vague idea	24	24	18	12	4	16	18
No idea at all	13	10	11	7	0	4	8
Not answered	2	0	2	0	0	3	1
Applied for jobs while at university							
Applied for jobs directly related to career	40	54	52	69	88	68	57
Applied for job not related to career	2	7	4	0	4	6	4
Not applied for jobs	58	37	43	29	8	26	38
Not answered	0	2	2	2	0	1	1
Count	*88*	*41*	*56*	*42*	*24*	*99*	*405*
Jobs directly related to degree/subject course							
Yes, all the jobs	38	29	45	69	86	75	57
Yes, some of the jobs	15	17	13	17	5	16	14
No	47	54	42	14	9	9	29
Count	*34*	*24*	*31*	*29*	*22*	*69*	*288*

Over half (57%) the graduates interviewed had made long-term job applications by the time they graduated but 38% had not made any job applications at all, which reflects the trend of many final year students to delay job applications until after finishing university (consistent with our student survey findings). The proportion was highest for Computer Science (88%), Engineering/Technology and Mathematics graduates (68-69%), and lowest for Biological Sciences where over half of graduates had not made any job applications by graduation (Table 4.3).

When the graduates who had engaged in postgraduate training were excluded, the proportion of STEM graduates who had made applications related to long-term career while at university was 68%. This figure probably is a fairer reflection, as it should more closely represent the proportion of those intending to seek employment who had made applications. The equivalent data, by subject, excluding those with postgraduate training, are presented in Appendix B Table B4.6.

Table 4.4 Career situation at graduation by employment sector (STEM graduates interviewed by telephone; lowermost section results only from those who had applied for jobs while at university), as percentages.

At graduation, did you have:	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
A definite career in mind	46	37	20	43	34	22	36
Some ideas about you might do	30	37	44	34	33	47	36
Only a vague idea	16	14	26	14	20	23	18
No idea at all	7	9	9	7	11	6	8
Not answered	1	3	1	1	3	1	1
Applied for jobs while at university							
Applied for jobs directly related to career	62	62	44	67	53	44	57
Applied for job not related to career	5	4	5	3	5	6	4
Not applied for jobs	32	34	50	30	41	48	38
Not answered	2	1	1	1	1	1	1
Count	*153*	*142*	*107*	*174*	*151*	*77*	*402*
Jobs directly related to degree/subject course							
Yes, all the jobs	83	44	28	79	42	21	57
Yes, some of the jobs	5	16	28	9	17	26	14
No	12	40	44	12	42	54	29
Count	*99*	*91*	*50*	*117*	*84*	*39*	*240*

In parallel with their apparent greater ‘decidedness’ about career, higher proportions of the graduates now working in STEM Specialist or STEM Generalist employment had applied for jobs (over 60%) before graduation, than of those now working for non-STEM employers, see Table 4.4. A higher proportion of Russell Group and 1994 Group university graduates (59%) had made job applications by time of graduation than graduates of ‘other’ UK universities (47%), as seen in Appendix B Table B4.5. Whether this reflects enthusiasm to enter ‘prestige’ graduate jobs and employers, or other factors such as early targeting of these institutions by certain major employers, cannot be ascertained from the existing data. There was also some correlation between the more 'decided' about career and those who had undertaken work experience as a student; more of those with work experience had developed a definite career plan by graduation (as also seen in the student surveys), and more wished to enter a career related to their degree, but this did not appear to have much impact on whether they had actually applied for jobs before graduation.

Joanna, Management trainee for national retailer
Having found science A-levels interesting, Joanna chose Physiological Sciences at Oxford although with no ideas about her future career. At university she gained work experience in a genetics centre, and obtained a 2.1, but felt she lacked the necessary passion or commitment for research or medical-related work: "*I'm not the right personality for research – it would be too sterile and quiet*".

With few positive career ideas, encouraged by her parents she went full-time into the little business she had set up during university selling party decorations, which offered her progress and some working experience. A year later she sold the business and temped while making a lot of applications to graduate schemes in different business sectors, to start a management career in business.

The scheme she entered was with a national retailer, although it was general management she was seeking: "*It [retail] wasn't planned*". Joanna loves the retail environment and, though not using any degree knowledge, does make good use of broader skills like her analytical approach and good communications developed at university.

In the longer term Joanna would like to link her continuing interest in science with her career but worries that "*I would have to go right back to the beginning*". She reflects that had she been more aware of different jobs available in STEM at university, she might well "*have been persuaded to stay [in STEM]*".

4.2.2 Were the job applications degree-related?

Of those who had made job applications while at university (240 of the STEM graduates interviewed), over half (57%) reported that all the jobs they had applied for had been related to their degree subject, 14% that some had been, but 29% made applications only for jobs unrelated to their degree (shown in lowermost section of Table 4.3).

High proportions of those now working for STEM Specialist employers (over 80%) had only made applications for degree-related jobs, many but not all of which were within STEM

Specialist sectors (see lowermost section of Table 4.4). A fair proportion (28%) of those now working for non-STEM employers had also only made degree-related job applications while at university, which would seem either to reflect subsequent change in their thinking or that they regarded a wider range of jobs as 'degree-related' than in our definition (exemplifying the complexity of defining STEM). At the same time, less than half (44%) of those graduates now working 'outside' STEM had *only* made applications for non-STEM jobs. This again apparently reflects that many of these graduates had not been fully decided prior to graduation and subsequently changed their career thinking, either for their own reasons or due to factors such as employers' recruitment demands (which could have been significant given the nature of this sample). There was no significant difference by gender.

Debbie, Civil Service Fast Stream in central government

Having no career ideas, Debbie studied maths in her native Glasgow, as she had been very good at it at (and liked her teachers). She took several work experience opportunities, working in a local bank and an internship at a 'big 4' accountancy firm. She quickly realised "*what [she] was learning at university would not be that relevant in 'real' working life*".

By graduation, Debbie had made many applications to finance-related and other graduate schemes, mostly in Scotland, but ruled out what she saw as less interesting work such as actuarial roles or in IT. She felt she aimed high and was rejected from many schemes, including investment banks (also acknowledging she was "*not itching to become a banker*"). Once accepted onto a retail bank's graduate scheme, she felt there that she did not use her maths but rather the wider skills developed around her degree. The experience led her to realise she did not want to work in finance, especially with the pressures of selling, but sought a "fairer environment".

Debbie began to recognise personal interests in politics and re-applied to Civil Service Fast Stream, having earlier failed entry at university, and was now accepted. When interviewed she was an Assistant Private Secretary to a Minister. She makes much use of her logic and rigour in solving problems – and clearly loves it. She expects to progress further in the Civil Service and then forge a wider career.

In retrospect, Debbie thinks she chose the wrong degree, and then the wrong graduate scheme as she lacked any passion for where maths was taking her. Reflecting on that, it was probably no coincidence that her father had been a maths teacher (although he did not overtly advise her). Rather it was not until her mid-twenties that Debbie understood how she could align her career direction with her personal interests.

Although fewer had made firm job applications, a higher proportion of the applications made by graduates of “other UK” universities were only for degree-related jobs, than of the other graduates, and a lower proportion had made no degree-related applications.

The in-depth interviews indicated widely varying approaches to job applications, with some graduates making applications only within a narrow sector but many making applications in parallel across different sectors to test the water. Many had made applications to graduate schemes in sectors such as banking or consultancy, or even law, in addition to applications to specialised STEM employers. The number of applications they made varied but was as high as 50 for a few graduates. The majority of STEM graduates, irrespective of primary career intention at that stage, appeared to have been applying to at least a few ‘mainstream’ graduate schemes (i.e. non-specialist STEM schemes) within their application portfolio.

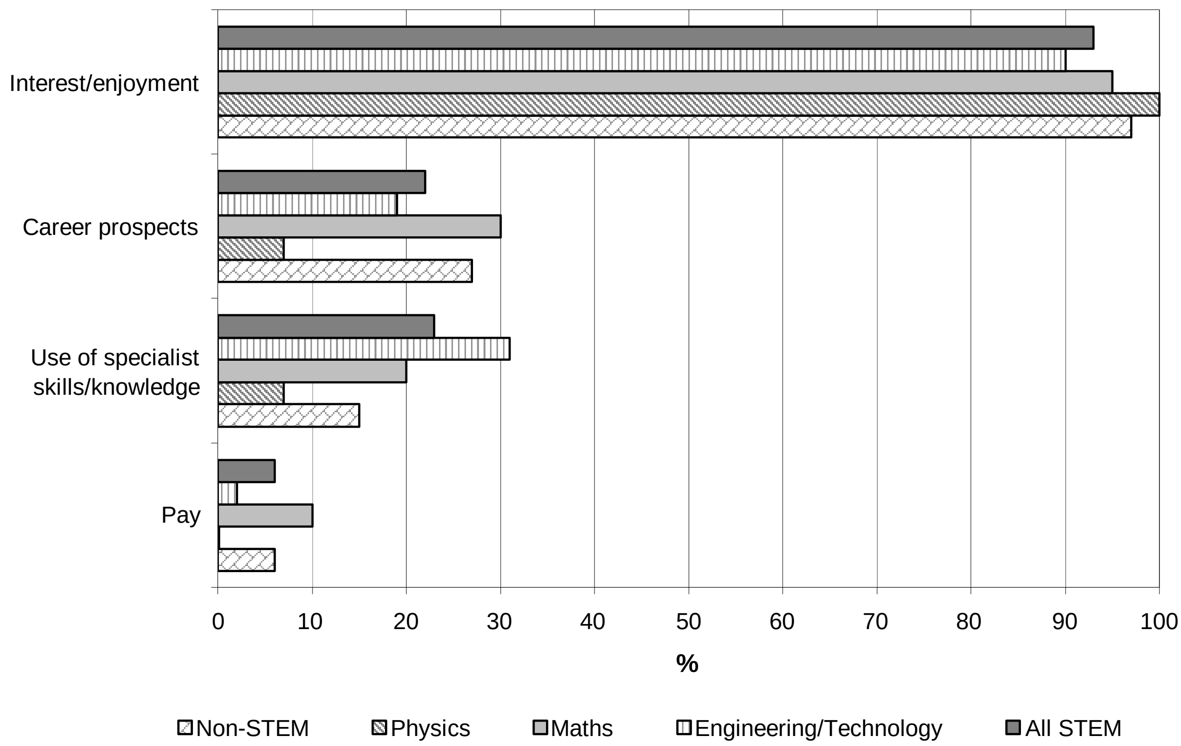
Interestingly, very few graduates reported that they had received rejections from STEM employers in response to their applications. If they did report rejections at all, most of those interviewed in-depth tended to remember rejections from employers’ graduate schemes, mostly not in STEM Specialist sectors, rather than from STEM employers. Their perception was that their rejection was due either to a lack of work experience or poor performance ‘on the day’ rather than any lack of particular skills. However, some caution should probably be exercised in interpreting this as graduates may have made this as a ‘defensive’ response (i.e. “not my fault”) rather than admitting a lack of inherent skills or their overall quality.

4.2.3 Reasons for career direction and related job applications

Reasons for degree-related job applications

The main reasons cited by the STEM graduates who had made ‘early’ job applications (i.e. prior to graduation) for making degree-related applications are summarised in Figure 4.2, while Appendix B Table B4.7 gives full details of their responses. ‘Interest/enjoyment of the work’ was the reason given by almost all graduates, while about a quarter cited the desire to use their specialist skills/knowledge and a similar proportion positive career prospects. The proportions citing salary as a driver or practical issues like ease of finding a job were very small. Figure 4.2 illustrates that there was some variation with STEM degree subject, while non-STEM graduates stated rather similar main reasons.

Figure 4.2 Most frequently cited reasons for graduates applying only for degree-related jobs, for selected undergraduate subjects (graduates interviewed by telephone who had made job applications at university); for full data see Appendix B Table B4.7



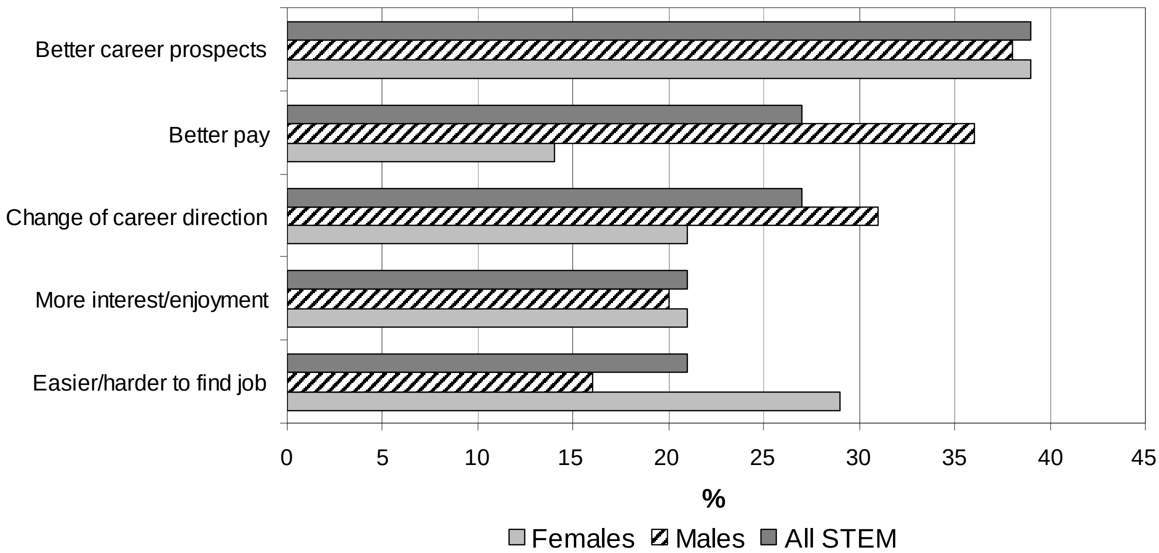
Considering in more detail these graduates who had applied only for degree-related jobs at university, their reasons differed somewhat according to the employment sector in which they now worked. More of those now in STEM Generalist sectors cited career prospects (33%) and the ability to use specialised skills/knowledge (33%) than overall (22% each) for their degree-related job applications at university. None of the graduates who had originally made only degree-related applications but now worked in non-STEM sectors had made those original job applications on the basis of pay or career prospects; rather they were almost entirely driven then by job interest. This seems to suggest that those without career-related reasoning may have been particularly subject to a change in direction after graduation. These results are shown in Appendix B Table B4.7

When analysed by gender, rather more of the male graduates cited more practical issues like career prospects (27%), pay (9%) and location (6%) than did female graduates (16%, 2% and 2% respectively), as reasons for applying for degree-related jobs (also see Appendix B Table B4.8).

Reasons for applications not related to degree subject

Although the number of STEM graduates involved was limited (only 73, most from Biological and Physical Sciences), the reasons that they had applied at university *only* for jobs *not* related to degree were probed. The reasons were much more evenly spread than for those applying for degree-related jobs (Figure 4.3). The most popular reason (for 38%) was better career prospects, followed by pay (27%), and personal desire for a change in direction (also 27%). However, interest/enjoyment of the work was also rated by 21%, and the more pragmatic reasons of ease/difficulty of finding a job by 21%. None of the STEM graduates reported that their decision was due to a lack of opportunities in their preferred location and almost none that they were 'not good enough' for degree-related work. When interviewed in depth, several graduates had 'downgraded' their expectations when they had been predicted or obtained grades lower than a 2.1; however, this mostly triggered a tactical change towards less prestigious employers rather than a change in career direction.

Figure 4.3 Most frequently cited reasons for graduates applying for non-related jobs (STEM graduates interviewed by telephone who had made job applications at university), including variation by gender; for full data see Appendix B Tables B4.9 and B4.10



Some differences in the most frequently reported reasons were seen according to gender, see Figure 4.3 and full results in Appendix B Table B4.10. Better pay was cited by more males than females (36% vs. 14%), more than could be accounted for by gender differences inherent in different subjects. More males also cited desire for change in career direction, while more females considered the ease/difficulty of finding a job (29% vs. 16% of males). It should be cautioned, however, that the sample size for this analysis was very small.

Due to the sample size it was not feasible to undertake robust analysis of the reasons by undergraduate subject. However, from the data in Appendix B Table B4.9 there was some evidence that more of those studying ‘core’ STEM sciences made non-related applications for pay and career reasons rather than their specific interest in a non-STEM job.

When analysed by the graduates’ current employment circumstances, ‘better career prospects’ was cited particularly highly by those who now worked for STEM Generalist employers (47%), and better pay and location-related issues somewhat higher in sectors outside STEM. The detailed data are presented in Appendix B Table B4.10.

By their final year, many of these graduates, at least, seemed very aware of ‘corporate’ graduate schemes, principally in STEM Generalist or non-STEM sectors, and the career opportunities that could be open there, of which very few had been aware when they started university. For many, entry to such graduate schemes was now perceived as the ‘default’ pathway for good STEM graduates, rather than entering STEM Specialist work (see Helen’s case study, in section 4.5, among others). This was the pathway they either consciously decided to join, or avoid, rather than whether or not to enter STEM careers. At the same time, graduates were now recognising practical matters such as earnings, and for a few issues such as location which would impact on their long-term personal relationships. The perceptions of what their peers were doing, feedback from previous graduates now in industry, and the reputations of particular employers were now also in their minds.

Simon, auditor with mid-size accountancy firm

Simon applied for Medicine at Durham but his college grades were insufficient so he ended up taking Biomedical Science there, swept along by the thought of a ‘good’ university and with little understanding of longer term options. He took several temporary jobs during university in both medical and financial roles, much preferring the medical work. However, on track for a 2.2, medicine was firmly closed to him and he decided to avoid a medical-related career altogether; it could be galling to work alongside doctors if he could not be one. With friends working in finance, and a heavy presence on campus by big accountancy firms, Simon applied to all the accountancy companies ranked 5-50 in the UK, believing he was not good enough for the “big 4”.

He received just one offer, joining a mid-sized firm near London. He likes client interactions but finds continued studying hard. His biomedical background helps with a systems approach to his work, and he thinks enhances his presentation skills. In future he would like to leave auditing and is mapping a route towards being Finance Director of a medical charity, through which he could fulfil some of his medical ambitions another way.

Overall, in very simplistic terms, by the time of graduation many graduates' career thinking seemed to be switching from purely aspirational thinking prior to and during university to a combination of aspirational and rational, or more pragmatic, decision-making. However, by no means all graduates felt the same way, as some felt strongly that they wished to focus on their studies until after graduation, and so spent no time at all thinking about careers or jobs, while others had continued on their original STEM-focused pathway, reinforcing their commitment to it by taking opportunities for relevant internships or work placements. There was also evidence from some female graduates, in engineering or science, of their commitment to a STEM pathway appearing to be quite reliant on the 'security' or reassurance provided by a family member or close family friend who was in the industry.

4.3 Choice of degree course

The top reason given by the graduates for choosing their undergraduate degree course was 'interest in the subject matter' (cited by 85% of STEM graduates). The next most commonly cited reasons were 'personal ability' (by 34%) and 'improved job prospects' (23%) of STEM graduates, as shown in Table 4.5. Although 'interest' was by far the most popular reason for graduates of all subjects, 'ability' was rated by nearly as many Mathematics graduates (67%), a much higher proportion than for any other degree subject. Responses from non-STEM graduates were broadly similar to those of STEM graduates overall.

Table 4.5. Most commonly cited reasons for choice of undergraduate course by undergraduate subject (all graduates interviewed by telephone), as percentages. Only reasons cited by over 10% of STEM graduates listed; full results in Appendix B Table B4.11

Reason	Biology and related	Chemistry	Physics	Maths	Computer Science	Eng/Tech	All STEM
Broader skills	5	5	13	12	8	13	11
Improved job prospects	17	12	14	19	29	38	23
Interest	90	80	89	79	79	80	85
Personal ability	28	32	39	67	21	34	34
Other	5	7	5	5	13	5	5
Not answered	5	0	0	0	0	0	1
Count	*88*	*41*	*56*	*42*	*24*	*99*	*405*

'Interest in the subject matter' was cited by an even higher proportion of those STEM graduates who were now not working in STEM degree-related occupations, than of those working in STEM, whereas 'improved job prospects' were cited by fewer than in STEM Specialist work or STEM Core roles (see Table 4.6).

Table 4.6. Most commonly cited reasons for choice of undergraduate course, by employment sector and function (STEM graduates interviewed by telephone), as percentages; for full data see Appendix B Table B4.12

Reason	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Broader skills	12	8	13	10	8	18	11
Improved job prospects	25	22	21	28	17	22	23
Interest	80	87	89	79	88	91	85
Personal ability	24	44	34	28	42	32	34
Other	10	2	2	8	3	4	5
Not answered	1	0	3	2	0	1	1
Count	*153*	*142*	*107*	*174*	*151*	*77*	*402*

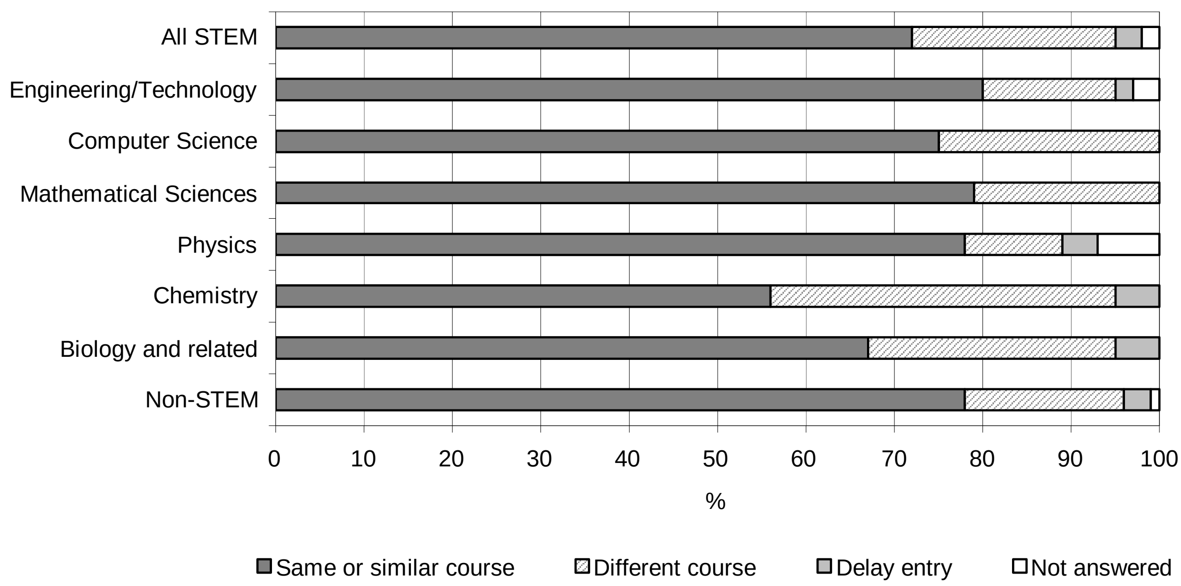
Career-based reasons were cited by fewer of the graduates, although 'improved job prospects' was the third most cited reason (by 23% of STEM graduates and slightly more non-STEM graduates). It was cited by a higher proportion of Engineering/Technology graduates (38%), and also by somewhat higher proportions of those now working in occupations or sectors closely related to their STEM degree, than others. A wide range of other reasons were cited by relatively small numbers of graduates as being important to them, as can be seen in the full tables in Appendix B.

Some deeper insights were obtained from the face-to-face interviews. The primary reasons cited by the majority were interest in or enjoyment of the subject ("*I had always loved science*"), as well as aptitude ("*maths was my best subject*"). A substantial number cited potential career benefit as a secondary reason; interestingly the majority of these recognised that a maths or science degree would "stand them in good stead" in the future, even if they had not at that stage known what career they wanted to follow. Very few seemed actually to have identified a distinct career direction by that time. In addition, several cited parental or family background as a reason to study a STEM course, and more than one that there was some "parental expectation" that they should do so.

When questioned in detail, almost all the face-to-face interviewees reported that they had studied their first choice subject/course as an undergraduate, so there was little evidence that choosing a STEM subject/course was any compromise or a secondary choice. A few graduates had wanted to pursue Medicine but, without strong enough grades, had instead entered subjects like Psychology or other Subjects allied to Medicine. Nearly three-quarters (72%) of the STEM graduates would study the same or a similar course again, were they to have the chance, while 23% said they would study a different course (Figure 4.4); this is almost identical to the result from students in section 3.4. The apparent 'contentment' with course was highest amongst Engineering, Physics and Mathematics (about 80% would study the same course) and lowest for Chemistry (56% would study the same course but 39% would choose a different course).

There was some considerable variation with current employment circumstances, with 31% of those now working for non-STEM employers saying they would do a different course, compared with only 18% in STEM Specialist employment, although this difference was much less strong with occupational function, see Appendix B Table B4.14.

Figure 4.4 Whether graduates would study the same or similar degree course again, for selected undergraduate subjects (graduates interviewed by telephone). For full results see Appendix B Table B4.13



Around 40% of the STEM graduates felt that they would have benefited from more career advice and support prior to university; this was highest (around half) for graduates of the Physical Sciences. For comparison, the figure for students was about 60% (section 3.9). Many of these graduates stated they had lacked advice around how university subject choices linked to longer-term career directions. Many said there had been advice about getting into university, often from subject teachers, but little about longer term career implications (some commenting that their school might have had self-interest in the outcome of the former issue). Several also commented that advisers were more interested in those who were undecided about university, encouraging them to apply almost irrespective of subject, than in those who would apply but were undecided about degree subject. However, at least as many said no careers advice at all was provided to them prior to university.

Some similar observations were evident from the in-depth interviews, with several graduates reporting that there was advice supporting choice of degree subjects at university but rather little about what different subjects would lead to in the long-term. Many more of the interviewees remembered the influence of inspirational subject teachers, who may have also guided them personally, rather than mentioned any support from careers advisers.

In summary, the graduates corroborated our findings from students that most did not choose their degree courses primarily for 'career-related' reasons, but rather on grounds of interest (the vast majority) or personal ability. Career-related reasoning was cited by perhaps a third, but generally because they had thought a STEM degree would keep lots of career options open rather than driving them towards an existing specific STEM career intention.

4.4 Evolution of career thinking

4.4.1 Career plans at entry to university

As can be seen from Table 4.7, only 14% of the STEM graduates reported having a definite career in mind when they started their university course, while around a quarter had some ideas about possible careers, but over half (58%) had only very vague ideas or no career ideas at all. Despite the nature of the sample, these percentages are remarkably similar to those reported for students in section 3.5.

Table 4.7 Evolution of career ideas during university, by undergraduate subject (STEM graduates interviewed by telephone). For full results see Appendix B Table B4.15

When first went to university	Biology and related	Chemistry	Physics	Maths	Computer Science	Eng/Tech	All STEM
Yes, definite career in mind	19	17	5	12	13	18	14
Yes, some ideas about career	23	27	27	31	17	29	26
Very vague idea of career	24	20	27	19	38	29	26
No idea at all	31	34	39	36	33	22	32
Work specified	3	0	2	2	0	1	2
Not answered	0	2	0	0	0	0	1
Career plan change							
Yes, completely	9	10	11	10	4	12	10
Yes, some extent	47	41	48	50	58	48	48
No	32	34	38	29	29	30	32
Not answered	13	15	4	12	8	9	10
Count	*88*	*41*	*56*	*42*	*24*	*99*	*405*

Analysed by subject, higher proportions of graduates in Computer Science and Mathematics (71%) reported that they had only very vague or no career ideas at that time, with the lowest proportion being from Engineering/Technology graduates (but still 51%, meaning that less than half had firm intentions then to become engineers). If anything, the small number of graduates of non-STEM disciplines had rather more career ideas than these STEM graduates. Again, these figures are very similar to those for students in chapter 3, despite the majority of this sample of graduates being those who now work outside STEM.

Rather fewer of the graduates who had studied at Russell Group or 1994 Group universities appeared to have had career plans at this early stage than those who studied at other institutions (although the number of the latter in the sample was rather small). The level of career thinking at this stage did not appear to vary much with gender. However, there was some correlation between those without early career ideas and those who did not go on to secure work experience at university (which is reported in a later section).

There was evidence that more of the STEM graduates now working for STEM Specialist employers or in STEM Core roles had had definite career ideas at university entry, than of those now working outside STEM, but the proportions were still low (16-18%, Table 4.8).

Table 4.8 Career planning at entry to and change during university, by current employment sector and function (STEM graduates interviewed by telephone), as percentages

When first went to university	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Yes, definite career in mind	16	14	11	18	13	9	14
Yes, some ideas about career	19	31	27	22	27	29	25
Very vague idea of career	33	15	30	33	19	26	26
No idea at all	29	38	27	25	40	31	32
Work specified	1	1	3	2	1	3	2
Not answered	1	0	2	1	0	3	1
Career plan change							
Yes, completely	6	11	14	9	9	13	10
Yes, some extent	50	46	48	49	46	51	48
No	38	30	27	37	30	25	32
Not answered	6	13	11	6	14	12	10
Count	*153*	*142*	*107*	*174*	*151*	*77*	*402*

Detailed investigation with the 70 in-depth interviewees revealed a wide range of career understanding when starting university. For most, the level of career thinking was along the lines of "*something in business*", although perhaps 1 in 10 had ideas about research in HE and a significant number knew certain sectors that they did *not* want to work in. Relatively few graduates at all mentioned specific employment sectors like accountancy or consultancy, or for that matter STEM sectors either. A minority expressed very naïve views: from "*I thought I would be able to work for NASA*" to, worryingly, "*I thought once you had a degree they handed you a job*" (the latter from a first-generation HE student).

It seems clear, as from the student data, that few had pre-existing ideas about careers when they entered university. A minority had firm aspirations towards a STEM career and would see those to fruition, while almost none seemed to have forged any firm ideas of careers outside STEM at this early stage.

4.4.2 Changes to career thinking during university and influencing factors

The majority of STEM graduates interviewed had changed their career thinking to some extent while at university, about 10% changing ideas completely and about half changing to some extent. Only about a third did not change their career ideas (see Table 4.7). There appeared to be no systematic variation by degree subject, whether more vocational or less, and if anything fewer of the non-STEM graduates had changed their ideas. Fewer of those graduates now working in STEM Specialist employment or STEM Core job functions had changed their career ideas completely (Table 4.8), compared with others, and higher proportions of them reported no change to their plans. This supports the observation from students (section 3.6) that most changes in career thinking tend to be away from more specialised STEM career directions.

The 'direction' of the changes to career plans during university was investigated in some detail, along with the graduates' recollections of which factors had influenced them the most (they were invited to select the three most important from a list). The top influences on STEM graduates as students were reported to be their university course (for 42%), their work experience (34%, and over 50% of Engineering/Technology graduates), personal interests and values (27%) and relatives and family friends (24%, see Figure 4.5). Other external influences such as employer promotions, industry media, or careers services, were reported as influential by fewer than 20%; see Figure 4.5 and also Appendix B Table B4.16 for the full results. Salary prospects were claimed to have been influential by only 10% of the STEM graduates (and far fewer of the non-STEM graduates).

Figure 4.5 Most common 'top three' influences on career planning while at university, for selected undergraduate subjects (all graduates interviewed by telephone). For full detail of responses see Appendix B Table B4.16

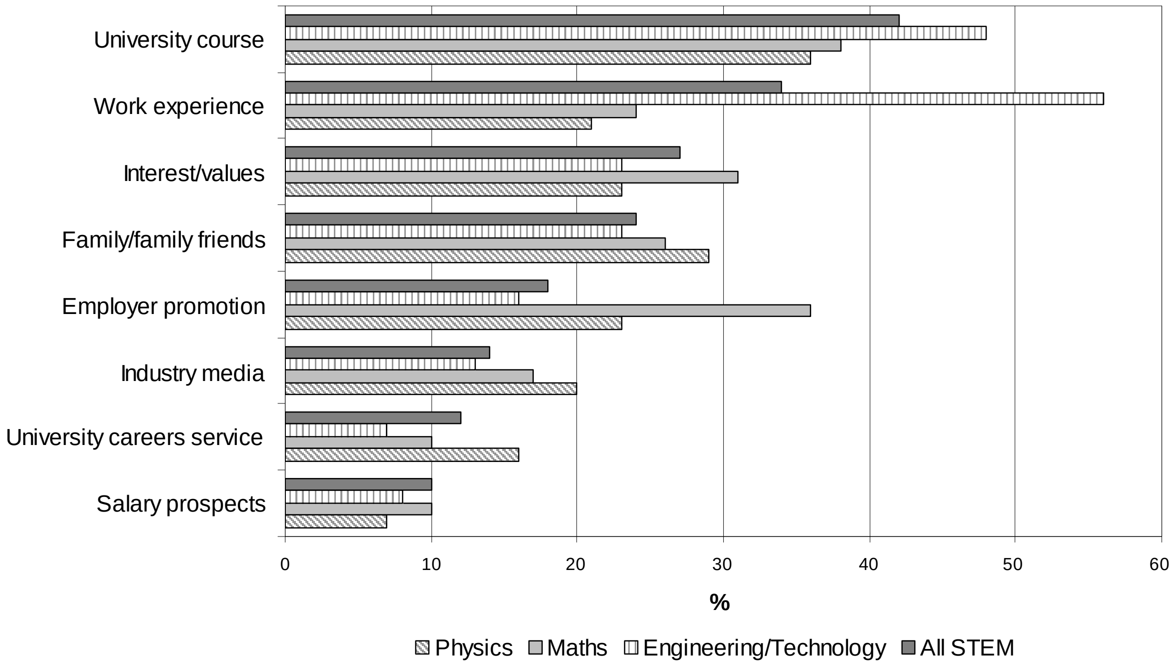
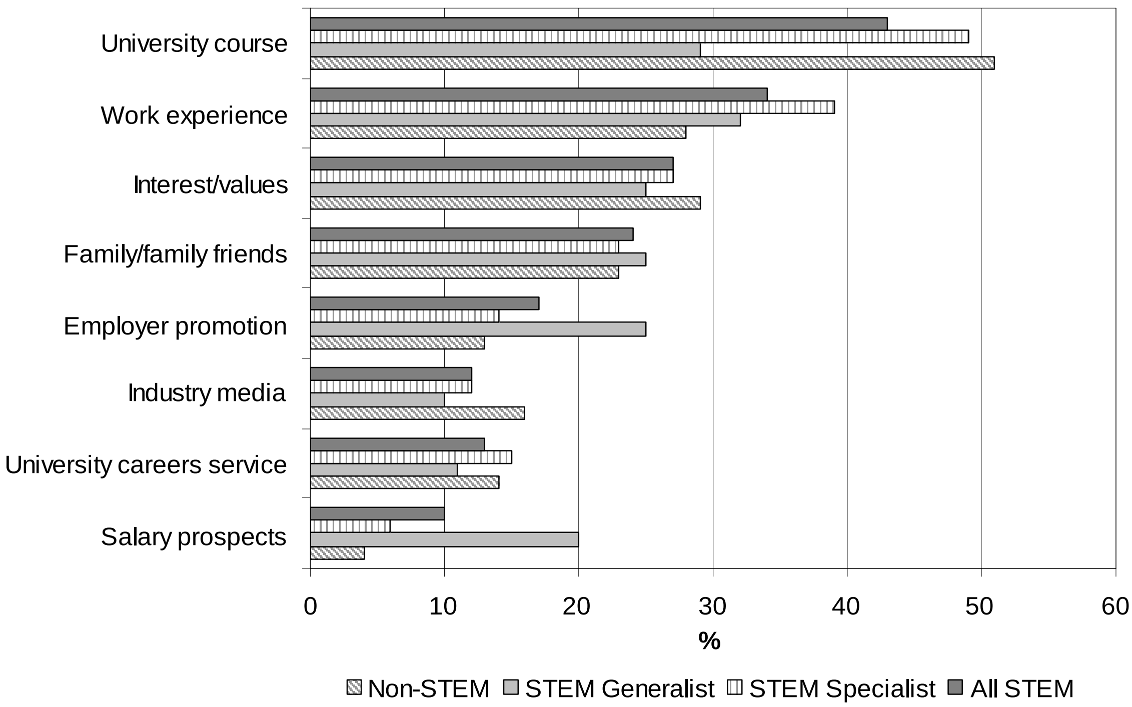


Figure 4.6 Most common 'top three' influences on career planning at university, by current employment (graduates interviewed by telephone). Full results in Appendix B Table B4.17



Analysis by current employment sector showed a roughly consistent relative ordering of influences (Figure 4.6), but with salary prospects and employer presentations being rated influential by many more of those now in STEM Generalist employment (20% for salary, 25% for employer presentations), compared with those in more specialist STEM work (6% for salary, 14% for employer visits). The pattern when split by occupational role was similar.

The in-depth interviews confirmed a growth at this stage in graduates' understanding both of the 'commercial' world and also what it would be like to work within it. New awareness of corporate working environments, partly through the high presence on campus of certain employers, had begun to attract some graduates but had put others off, and some had begun to recognise a personal affinity for working in other sectors, such as in public service. For several there was a clear shift from idealism to pragmatism as they began to recognise their own potential limitations in a competitive labour market, and realised that they might have to make their own impacts on the world in more practical ways: "*I realised you might have more effect on animal welfare through policy than actually practising it*".

Nisha, trainee commercial lawyer

Nisha was a gifted first-generation HE student from east London, where her father ran a restaurant and her mother was a healthcare assistant. Although under family pressure to study medicine, because she potentially could, she loved and instead studied Psychology and gained a 1st at UCL. However, she felt that she needed to enter a professional career in order to maintain the respect of her community and family, rather than pursuing the academic research she dreamed of. Through a combination of her location, and she thinks her ethnic background, she had work experience in top investment banks, but that led her to believe such work was "insufficiently professional". Entering a "proper" profession, in which she could become qualified, in the eye of her community, was critical to her. In addition there was expectation that she would get married and have a family by the age of 30.

While at university she applied to legal firms and secured a graduate place to train with one of London's magic circle. As a trainee commercial solicitor her strong logical and analytical skills are well used and she has progressed fast in the organisation and gained the professional legal qualifications to practice. Nisha's story was relatively unusual in that her perceived requirement to obtain the respect of her community and family, and conform to cultural expectations, overcame her personal passions for a scientific direction. She maintains hope that "the inner academic" within her will at a later stage be able to take a more central position in her working life, when circumstances allow.

The influence of parents, family and peers was significant for some, although by no means all, with some indication that it was more important for female graduates. Some individuals seemed to maintain career pathways or make decisions to please their parents, rather than matching their own personalities or aspirations, and in one case a graduate seemed to be living out his mother's failed career aspiration. In some cases the graduates were aware of this influence, which they generally considered positive or benign, but others had not recognised it until challenged. The influence of the decisions of graduates' peer groups and key friends were as significant, although in some cases this spurred graduates to take different routes ("*everybody else was either going into teaching or accountancy*").

Work experience was the highest rated influence by those who studied Computer Science and Engineering/Technology, at least partly reflecting the much higher proportions of those graduates who had undertaken it. The limited extent of the sample did not allow for deeper differentiation of this issue. From Table 4.9 it can be seen that over three quarters of these Engineering/Technology and Computer Science graduates interviewed had undertaken work experience, well above the proportion of the STEM graduates overall (56%). Two thirds of those who had undertaken work experience thought it was very helpful in developing their skills and experience, somewhat higher than the figure cited by students in section 3.8. Many of those interviewed in detail indicated it had been pivotal in either confirming that they did or did not want to work in a sector – giving them a genuine insight into what, for example, teaching in a school or working in a lab was actually like: ("*lab work just wasn't me*").

Table 4.9 Percentage with work experience, and perceived usefulness of undergraduate work experience for those who had it, for selected undergraduate subjects (all graduates interviewed by telephone). For full results see Appendix B Table B4.18

	Biology and related	Chemistry	Physics	Maths	Computer Science	Eng/Tech	All STEM
Done work experience	48	56	39	40	88	76	56
As an undergraduate	43	54	38	36	88	76	53
As a postgraduate	5	2	5	5	0	1	4
Count	*88*	*41*	*56*	*42*	*24*	*99*	*405*
Undergraduate work experience							
Not at all helpful	0	5	0	0	0	0	0
Not very helpful	5	9	5	0	0	4	5
Quite helpful	38	9	36	31	10	26	28
Very helpful	56	77	59	69	90	70	67
Count	*39*	*22*	*22*	*16*	*20*	*74*	*218*

4.4.3 Impact of career influences

The impact of these chiefly external influences, outlined in the previous section, and the development of the students' and their career thinking at university was also probed. About half of the STEM graduates (52%) decided that they would want to take up degree-related work, but about one third decided to seek work not related to their degree. Up to a quarter had found out about particular employers that they would like to work for, and about 13% had found out about new areas of work they had not considered before.

The proportions reporting these different directions of change varied strongly with the degree subject studied. The majority of Computer Science (83%), Engineering/Technology and Mathematics (69%) graduates confirmed that they wanted degree-related work, but only 34-41% of Chemistry, Biological Sciences and Physics graduates. For the latter, around as many decided to seek work not related to their degree, see Table 4.10.

In the in-depth interviews, many graduates reported that they had changed their thinking 'away' from STEM Specialist employment as their career thinking evolved, although few had been definite at the start. Others did confirm their existing desire to pursue a STEM career as they learned about other options. A significant number abandoned their ideas of pursuing PhD or other scientific research, coming to the realisation that such work was less glamorous than they had imagined, could be very narrow, and that only the very best would obtain funding which could eventually rule them out.

Table 4.10 Main impacts of influences on career plans, for selected undergraduate subjects (graduates interviewed by telephone), by percentage. Full results in Appendix B Table B4.19

	Biology and related	Chemistry	Physics	Maths	Computer Science	Eng/Tech	All STEM
Decided wanted to work in degree-related work	38	34	41	69	83	69	52
Decided not want to work in degree-related work	39	29	39	14	29	29	32
Information about specific work	17	29	9	21	38	23	20
Discovered new areas of work	11	7	13	14	25	13	13
Desirable employer	15	24	25	29	33	22	23
Not answered	3	10	4	5	0	4	4
Count	*88*	*41*	*56*	*42*	*24*	*99*	*405*

When analysed by their current occupation, predictably, much higher proportions of those now working for STEM Specialist employers or in STEM Core job functions (around 70%) reported that they had decided to seek degree-related work than those now working outside STEM (35-48%), see Table 4.11. The inverse was also seen, with twice as many of those now working outside STEM having decided to seek work unrelated to their degrees. However, it was notable that as many as 20% of those now in specialised STEM jobs had in student days apparently decided not to pursue work in STEM, reflecting that individual career decisions and actual paths were by no means simple or predictable. However, of the small proportion that realised that they had to rethink their career plans altogether, the majority were now working outside STEM.

Table 4.11 Main impacts of influences on career plans, by employment sector and function (STEM graduates interviewed by telephone). Full results shown in Appendix B Table B4.20

	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Decided wanted to work in degree-related work	68	39	48	71	40	35	52
Decided not want to work in degree-related work	20	40	36	21	38	43	31
Information about specific work	18	24	20	18	24	19	20
Discovered new areas of work	18	12	7	17	11	9	13
Desirable employer	25	27	14	24	23	19	23
Not answered	5	2	5	5	3	4	4
Count	*153*	*142*	*107*	*174*	*151*	*77*	*402*

The career thinking of these graduates had evolved considerably while they were at university, which was not unsurprising given that few had fixed ideas when they entered HE. The impact of various different influences, external like work experience, or more local such as their degree course learning, was different for different students; for some it confirmed pre-existing intentions (chiefly for those who wanted a STEM career), but for many others – most of whom started undecided – the evolution was ‘away’ from STEM career ideas. It was also clear that the direction in which their career thinking was leading at this time was by no means parallel to the employment which they subsequently gained.

4.4.4 Careers advice and support at university

One of the more significant influences on HE students and their career decision-making was expected to be the careers support available to them from within their university careers advisory service (CAS). Although only cited as a ‘top three’ influence by one in six STEM graduates, nearly two-thirds (61%) of them reported that they had used their careers service in some way at least when they were undergraduates, and the majority described this as either very (31%) or quite (45%) helpful, see Table 4.12. However, within the telephone interviews the manner in which they had used the careers service was not differentiated, i.e. whether they had simply made use of information services or whether they had undertaken personalised guidance sessions.

Table 4.12 Use of university careers service while an undergraduate, and its usefulness, for selected degree subjects (graduates interviewed by telephone), as percentages. For full results see Appendix B Table B4.21

Used Careers Service	Biology and related	Chemistry	Physics	Maths	Computer Science	Eng /Tech	All STEM
Yes	65	49	66	60	63	66	61
No	32	51	32	40	38	34	37
Not answered	3	0	2	0	0	0	1
Count	*88*	*41*	*56*	*42*	*24*	*99*	*405*
Usefulness							
Not at all helpful	4	15	0	0	7	0	2
Not very helpful	11	25	11	24	0	25	19
Quite helpful	37	45	54	28	53	49	45
Very helpful	49	15	30	40	33	26	31
Not answered	0	0	5	8	7	0	2
Count	*57*	*20*	*37*	*25*	*15*	*65*	*249*

When analysed by current employment, there was little variation in the proportion who reported using their university careers service with current employment sector or job role grouping, although somewhat fewer of those in STEM Generalist work had used the service. There was no significant, systematic difference in how helpful they had found it. About 30% of STEM graduates felt that they would have benefited from more career advice and support during their university time. The main area in which these graduates felt they could have done with more support was specialist job information and advice, rather than help in determining their overall career direction. Many commented that they received insufficient support or information in relation to quite specific job ideas or interests.

The in-depth interviews with graduates enabled a more detailed picture to be gained of their experiences of university career advisory services. While the majority had taken some advantage of their CAS, for most this had been limited to using some of its information services, and very few had taken the opportunity of one-to-one guidance sessions. While the support of information about particular employers, and how to make job applications, was welcomed by all, there was less positive feedback about how useful the CAS had been in helping the more 'undecided' graduates. Several graduates reported their perception that the CAS was "*helpful provided you knew what career you wanted*", but less helpful to those who needed assistance in identifying a career direction. This rather contradicts the evidence from graduates in the telephone interviews. Certain graduates also felt that the CAS was more effective in helping STEM graduates who expressed any interest in entering mainstream graduate sectors such as consultancy and financial services, more than those who sought to enter more specialised STEM sectors and less well-known employers. This impression was summed up, in rather binary fashion, by John (see case study in section 4.6): *"Corporate finance was the only real option the CAS suggested if engineering was not an option"*.

Overall, the role of careers advisory services did not appear to be pivotal in terms of influencing the career direction decisions of these STEM graduates – and by its very nature it should be impartial – but there is anecdotal evidence that it was particularly effective in helping ("accelerating") some STEM graduates who were considering mainstream graduate schemes rather than more specialised STEM jobs.

4.5 Use of degree knowledge and related skills

Around half of these STEM graduates felt that they were using and building on their specific degree skills and knowledge to a great (16%) or some (35%) extent within their current work, although this varied quite strongly both by their degree subject and the nature of their employment. The proportion was highest for Computer Science graduates, of whom 75% used their degree skills and knowledge to some or a great extent, and lowest for Chemistry graduates (37%), see Figure 4.7. Not surprisingly, the proportion using their degree skills and knowledge to a great or some extent was highest (about 70%) for those working for STEM Specialist employers, or in STEM Core roles, but was still about 40% for those working in other employment sectors or roles. Graduates in STEM-related roles (or STEM Generalist employers) appeared to use their degree skills/knowledge no more than those in non-STEM work (Figure 4.8).

However, the use of broader or more general skills, ways of thinking and behaving which the graduates had learned as part of their degree, was much higher; around 90% of STEM graduates believed they used these to a great or some extent in their current jobs, and a similar proportion of non-STEM graduates. There was no significant variation of these proportions by either employment sector or by occupational function (Figure 4.8), suggesting that these 'broader' skills were universally useful.

Figure 4.7 Use of degree knowledge and more general skills in current job, for selected undergraduate subjects (graduates interviewed by telephone). Data in Appendix Table B4.22

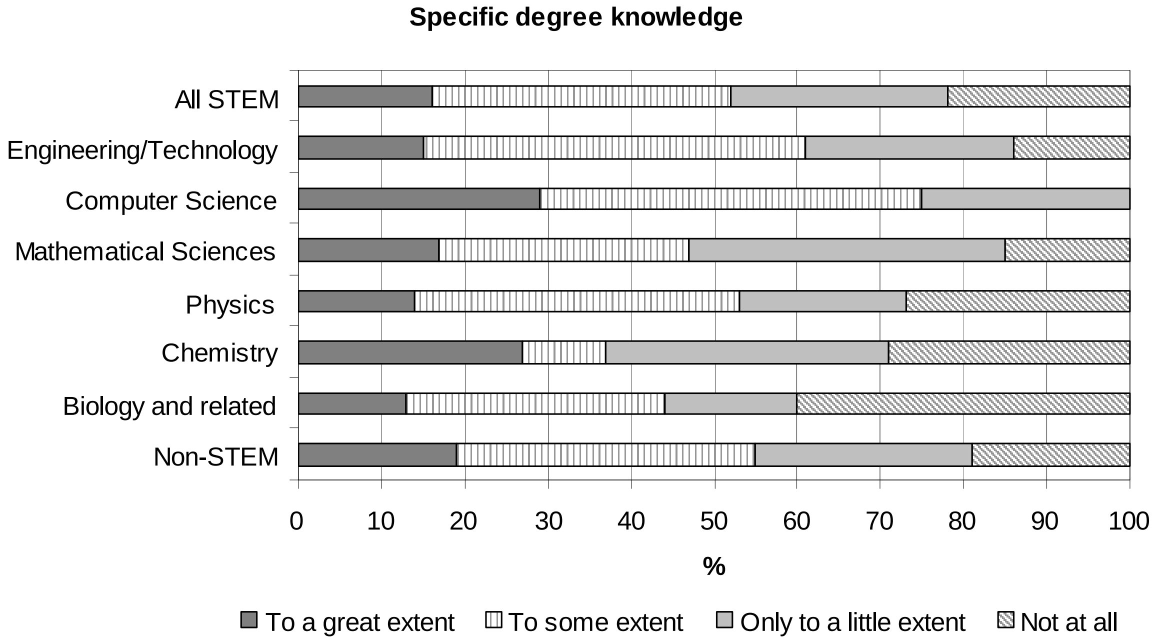
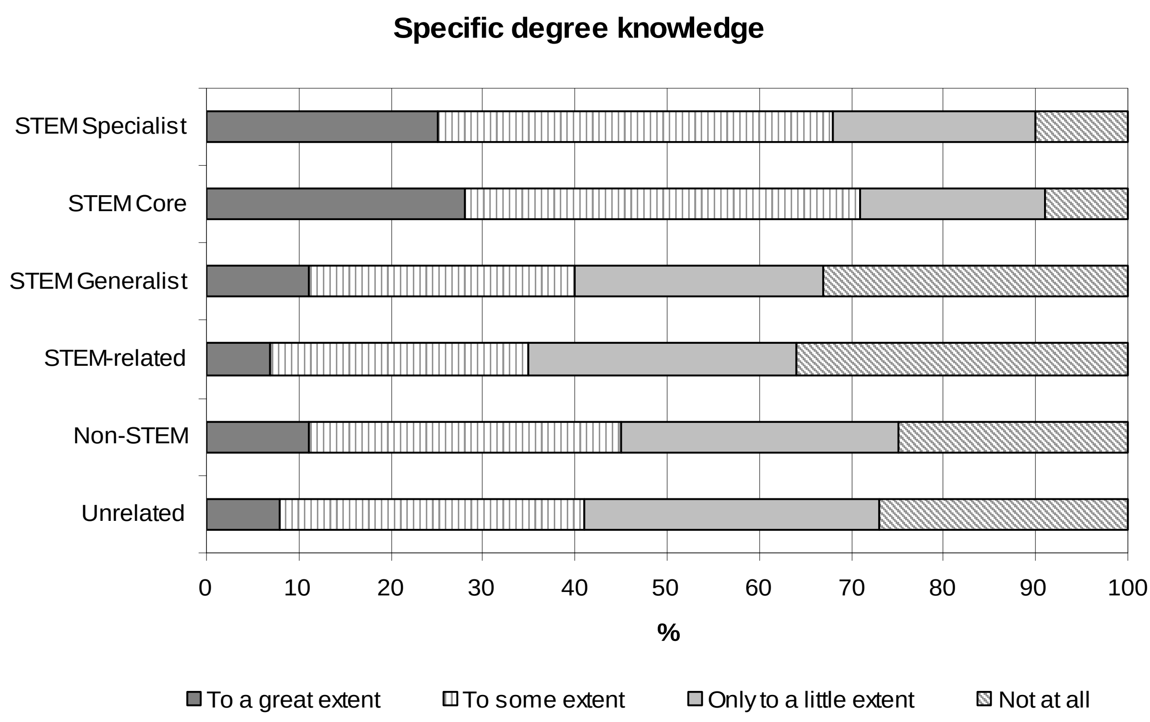
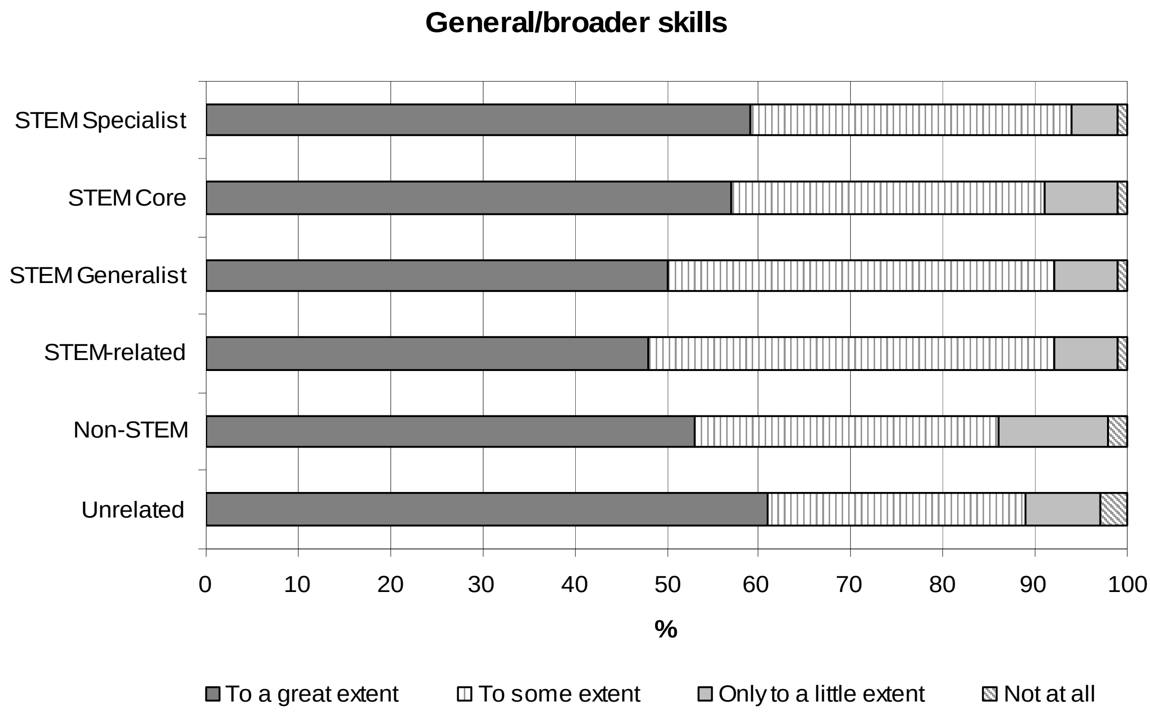


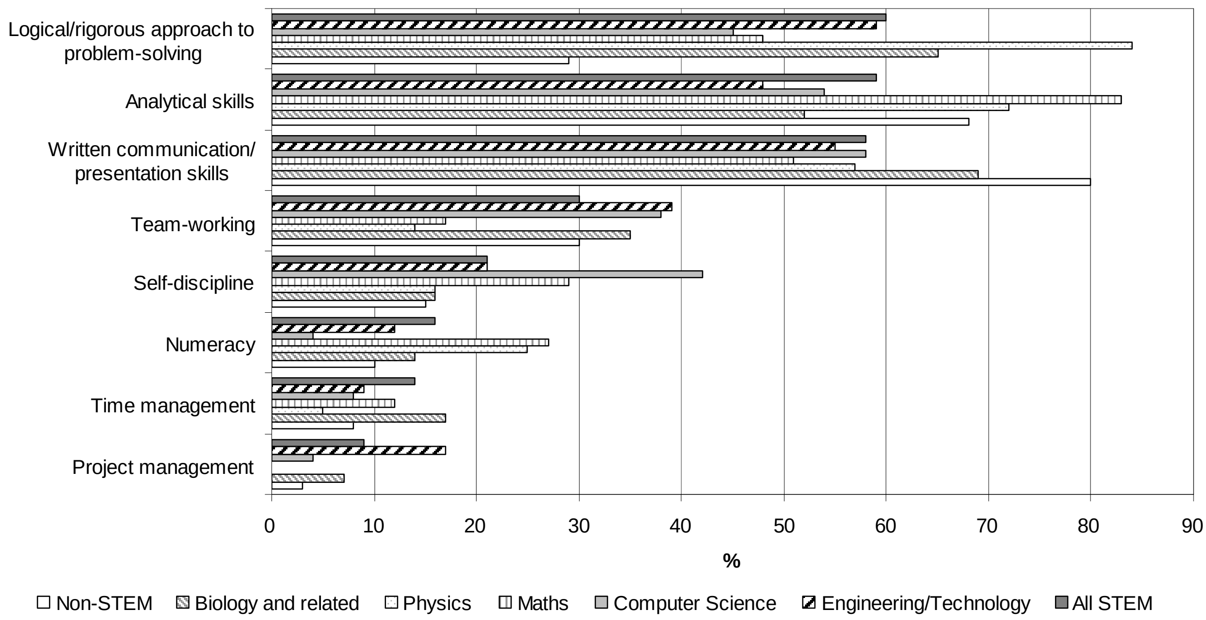
Figure 4.8 Use of degree knowledge and more general skills in current job, by employment sector and function (employed STEM graduates interviewed by telephone)





The graduates were asked to specify which broader or more general skills they believed they had learnt through undertaking their degrees, for which selected results are shown by degree subject in Figure 4.9. Over half of STEM graduates (and 80% of non-STEM graduates) believed they had learnt written communication and presentation skills as a result of their degree. Their analytical approach to problem-solving was also cited over half of the STEM graduates in early telephone interviews, as a result of which the question was then revised to probe this more deeply in the remainder. This revealed that many STEM graduates believed they had learned a particularly logical/rigorous approach to problem-solving, which fewer of the non-STEM graduates recognised, while the non-STEM graduates seemed instead to highlight broader skills of analysis. Amongst the other skills that significant numbers of both STEM and non-STEM graduates thought they had learnt were the more generic skills of team working (30%) and self-discipline (20%). Unsurprisingly, graduates of certain subjects rated particular skills more highly than others, although this was perhaps less pronounced than might have been expected; many of the Physical Sciences and Maths graduates cited numeracy, while some others ranked self-discipline strongly which presumably reflected a particular style of learning within their degree subject.

Figure 4.9 Most popularly cited general skills learnt from degree by undergraduate subject (graduates interviewed by telephone). For full results see Appendix B Table B4.23



This analysis was reinforced by more detailed questioning within the in-depth interviews. Many of the core sciences, and also non-STEM, graduates cited their ability to undertake research, to analyse data/information and to structure an argument or communication, although many felt their communications skills were much stronger in writing than verbally or in presentations. A significant proportion of the STEM graduates felt they brought a particularly rigorous ("scientific") approach to problem-solving in their workplace, which was unique to them as a STEM graduate and also recognised as valuable by their employer.

A higher proportion of graduates interviewed (than in the telephone survey) suggested that their inherent numeracy, as a STEM graduate, and their ability to understand probability and risk, were very valuable in non-STEM work environments especially, where such skills were considered relatively unusual. For those now working in sectors such as Government and publishing, several reported that more quantitative work "tended to come their way" and that they had been strongly welcomed by their employer and team colleagues when they joined the organisation because they introduced these skills. Several believed that they had progressed faster within their organisation as a direct result of having such skills than the majority of their colleagues, who were mostly not STEM graduates and therefore did not.

Some graduates displayed a greater awareness of the transferability of certain STEM skills than others. As one example, a physics graduate now practising law mentioned that his advanced understanding of logic, developed when learning computer programming, was extremely valuable to him when writing commercial legal contracts.

Helen, production team leader for academic publisher

Helen had always been good at maths, and her mother was a clerk in an accounting firm who had really wanted to be an accountant (but did not have the right background), so it was not surprising she did a maths degree at York. She had no ideas about jobs while at university and worried that all her peers were headed for "*either accountancy or teaching, neither of which appealed to me*". She dabbled with graduate scheme applications but without putting her heart into them.

After graduating, she decided to follow her heart, which was the world of books. Despite friends saying that it was impossible to get a career in publishing, she temped in a bookshop and, after a period travelling, enrolled in an MSc in Publishing at Oxford Brookes. There she realised she was very unusual in having a maths background.

A local academic publisher was very keen to hire her – somebody with a talent for spreadsheets and the more numerate aspects of the business. Helen progressed quickly from a lowly administrative role through several editorial jobs to lead a production team in the scientific journals division. More quantitative work "*always seems to come [her] way*", and her particular skillset is clearly of high value to the employer, whose staff is dominated by arts graduates, and has enabled her to progress very quickly in that sector.

There appeared to be some difference between the strength with which the graduates articulated their skills, and the value of them, between the two interview methods, with more of those interviewed face-to-face apparently reporting more skills positively. This could suggest that some STEM graduates tend to underplay the broader skills related to their degree, until more actively probed about them.

While almost all the graduates interviewed believed having some kind of degree had been essential to obtain their job, almost irrespective of their employment sector, 59% of graduates now in STEM Specialist employment believed a degree in their subject had been essential (31%) or very important (28%) in getting their job (Table 4.13). Similar proportions in STEM core jobs felt this way. Much lower proportions of all others, unsurprisingly, believed that the subject of their degree was essential or very important in getting their job; in fact nearly two-thirds of those in STEM Generalist or non-STEM sectors, and related or unrelated roles, thought their degree subject had either not been very or not at all important.

Table 4.13 Importance of degree in subject was in obtaining current job, by employment sector and function (STEM graduates interviewed by telephone), as percentages

How essential	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Not at all important	8	39	36	11	38	39	27
Not very important	12	23	19	10	25	24	18
Important	20	23	22	21	22	22	22
Very important	28	10	10	26	11	8	17
Essential	31	4	12	31	5	7	17
Not applicable	1	0	0	1	0	0	0
Count	*153*	*142*	*105*	*174*	*150*	*76*	*400*

When asked about whether the degree subject was essential in order to *do* the job, rather than to obtain it, about a third overall thought it essential and a third thought it was preferable (Table 4.14). By degree subject studied, the proportion thinking it essential was highest (46-47%) for Engineering/Technology and Computer Science graduates, and lowest for Biological Sciences (27%, and lower still for non-STEM graduates). Nearly 60% of those now in STEM Specialist employment felt their particular degree was essential to do their job. However, interestingly, about 20% of those working in STEM Generalist or non-STEM jobs still believed their particular degree subject to be essential and about 40% preferable to do their job (Table 4.15).

Table 4.14 Importance of degree subject in undertaking current job, for selected degree subjects (graduates interviewed by telephone), as percentages; data in Appendix Table B4.24

How essential	Biology and related	Chemistry	Physics	Maths	Computer Science	Eng /Tech	All STEM
Essential	27	32	32	27	46	47	34
Preferred	23	34	30	54	46	34	35
Not essential	50	34	36	17	8	17	30
Not answered	0	0	2	2	0	1	1
Count	*86*	*41*	*56*	*41*	*24*	*99*	*402*

Table 4.15 Importance of degree subject in undertaking current job, by employment sector and function (graduates interviewed by telephone), as percentages

How essential	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Essential	59	17	21	56	18	17	34
Preferred	24	42	42	27	42	39	35
Not essential	16	39	37	16	39	44	30
Not answered	1	1	0	1	1	0	1
Count	*153*	*142*	*107*	*174*	*151*	*77*	*402*

To summarise, it appears that the broader or more general skills learned by virtue of doing a STEM degree are greatly used by the graduates in their current work, irrespective of their sector of employment. Certain of the ‘broader’ skills they developed seem to be unique to STEM graduates and, along with their inherent numeracy, these seem to be prized by non-STEM employers, enabling STEM graduates in that working arena to be highly valued and perhaps to progress faster in their careers than non-STEM graduates. These ‘broader’ skills are used much more widely than more specific degree knowledge, which is used only by the majority of those in STEM Specialist employment or STEM core roles. This is reflected in the relatively small proportions of graduates who believe their particular degree subject to be essential to do their current job, although considerably higher proportions felt that the degree was necessary to obtain the job in the first place.

4.6 Job satisfaction and future expectations of career

Ninety percent of STEM graduates interviewed described themselves as either very satisfied (53%) or satisfied (37%) with their present job, with only a tiny percentage (<5% overall) dissatisfied, Table 4.16. The proportions for non-STEM graduates were broadly similar and there was little systematic difference with STEM degree subject studied. The least satisfied with their job appeared to be Physics graduates, of whom 11% were dissatisfied or very dissatisfied, compared with 4% for STEM graduates overall; on the other hand more of them (59%) were very satisfied than overall. Table 4.16 shows the overall figures and for selected degree subjects, while full results are in Appendix B Table B4.25.

Table 4.16 Satisfaction with present job and career progress to date, for selected undergraduate subjects (all graduates interviewed by telephone), as percentages. For full results see Appendix B Table B4.25

How satisfied with present job	Biology and related	Chemistry	Physics	Maths	Computer Science	Eng/Tech	All STEM
Very dissatisfied	0	0	2	0	0	1	0
Dissatisfied	3	7	9	2	0	3	4
Neither satisfied nor dissatisfied	8	2	4	10	0	2	5
Satisfied	35	37	27	41	33	43	37
Very satisfied	51	54	59	46	67	51	53
Not answered	2	0	0	0	0	0	0
How satisfied with progress of career							
Dissatisfied	2	0	4	5	8	8	5
Neither satisfied nor dissatisfied	5	10	11	5	0	3	5
Satisfied	38	41	43	34	42	44	43
Very satisfied	51	46	41	56	50	42	46
Not answered	3	2	2	0	0	2	2
Count	*86*	*41*	*56*	*41*	*24*	*99*	*402*

Similar results were obtained in relation to satisfaction with graduates' perceived progress with their career to date (again around 90% were satisfied or very satisfied), although with slightly lower figures for Engineering/Technology graduates; however, those were still only at the level of about 1 in 12 Engineering/Technology or Computer Science graduates expressing dissatisfaction and therefore a small minority.

When analysed according to their current employment circumstances (Table 4.17), there was little difference between the proportions between those working in STEM Core job roles, and/or STEM Specialist employers, and those working in unrelated jobs or non-STEM employment. On the other hand there was some evidence that fewer of those in STEM-related roles, and/or working for STEM Generalist employers, were very satisfied (45%) and a few more of them were dissatisfied (but still only 7%). The proportions very satisfied or satisfied, or dissatisfied, with their career progress to date did not vary significantly by the nature of their current employment.

Table 4.17 Satisfaction with present job and career progress to date, by employment circumstances (STEM graduates interviewed by telephone), as percentages.

How satisfied with present job	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Very dissatisfied	1	1	0	0	1	1	0
Dissatisfied	2	6	4	4	5	1	4
Neither satisfied nor dissatisfied	4	7	3	3	8	1	5
Satisfied	36	41	35	36	39	36	37
Very satisfied	58	45	57	56	47	57	53
Not answered	0	0	2	0	0	3	0
How satisfied with progress of career							
Dissatisfied	6	4	4	6	5	3	5
Neither satisfied nor dissatisfied	4	5	6	5	5	4	5
Satisfied	46	39	43	41	40	52	43
Very satisfied	43	49	45	47	48	39	46
Not answered	1	2	3	1	3	3	2
Count	*153*	*142*	*107*	*174*	*151*	*77*	*402*

These almost uniform, high current job-related satisfaction results may in part result from the nature of the sample, i.e. that many of the graduates interviewed had 'good jobs' and were employed by 'good employers', which might mask any differences between different employment sectors.

Unsurprisingly, given those results, a similarly large majority (around 90%) expected to continue in their current line of work. Only about 6% of STEM graduates anticipated that they would change career direction within the next few years. More substantial proportions expected either to progress in their current job and/or to change job within this timeframe, but only 16% expected to change employer. These apparently 'conservative' figures probably reflect both the early career stage of the majority of interviewees and/or their position working for larger and prestigious employers, with whom they might expect to forge good careers over long periods.

Despite these very positive indications of job satisfaction, about half of the graduates who did not consider that their degree was essential to their current job would, in principle, like their work to be more closely related to their degree. Surprisingly, perhaps, this proportion did not differ substantially with the sector in which they now worked (Table 4.18).

Table 4.18 Whether graduates would like a job that was more degree-related than present job (STEM graduates who did not believe their degree essential to their job), as percentages

	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Like job more degree-related							
Yes	51	52	54	47	54	56	52
No	48	36	36	45	36	38	39
Not answered	2	12	9	8	11	6	9
Count	*61*	*116*	*85*	*75*	*123*	*64*	*262*

Of those who would in principle like work more closely related to their degree, the only two reasons cited by any number were to 'have more interesting or enjoyable work' (by 84%) or 'to use their specialist skills/knowledge more' (by 33%, Table 4.19). Very few graduates cited any other reasons, and only one thought it would lead to better salary or career prospects.

Table 4.19 Main reasons for wanting to have more degree-related work, by current employment circumstances (STEM graduates who did not believe their degree essential to their job and sought more degree-related work). Full data in Appendix B Table B4.26

	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
More interesting/ enjoyable	78	90	82	78	91	79	84
Use specialist skills/ knowledge	38	25	41	31	26	50	33
Count	*32*	*59*	*44*	*36*	*65*	*34*	*135*

The graduates who stated that they would *not*, in principle, seek work that was more closely related to their degree were asked their reasons too, see Table 4.20. These reasons were somewhat more widely varied, with the most commonly cited reason being that such work could be too narrowly focused (by over a third), while over a fifth felt their current work was more interesting and enjoyable and a sixth felt the career prospects were better where they were. Taken together, these reasons seem to support a view that most STEM graduates working outside STEM did not see that a return to working closer to STEM would bring them much career benefit, and a distinct proportion perceived and appreciated that their existing work offered greater variation and/or interest than they would obtain in STEM-focused work.

Table 4.20 Main reasons for not wanting to have more degree-related work, by current employment circumstances (STEM graduates who did not believe their degree essential to their job but did not seek more degree-related work). Full data in Appendix B Table B4.27

	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
More interesting/ enjoyable	38	14	17	41	14	9	22
Change of direction	7	19	30	3	23	35	19
Degree-related too narrow	24	52	27	24	45	39	37
Too competitive	7	10	7	0	14	9	8
Better paid	3	12	3	3	11	4	7
Better career prospects	7	21	17	3	25	17	16
Count	*29*	*42*	*30*	*34*	*44*	*23*	*101*

STEM graduates who were not in STEM Specialist employment or Core roles were asked about how difficult they thought it would now be to get degree-related work. The majority (60-70%) perceived that it would now be difficult or very difficult to do so. Their reasons for this perception were mostly that STEM employers might demand more up-to-date specialist knowledge than they could supply, but also that they could themselves would have practical difficulties in making such a change – such as decreased earnings.

Interviewees were asked if they expected to remain in their current line of work. The vast majority said they were satisfied “for now” and were positive about their career progression to date, and the benefits that would ensue financially or in terms of personal satisfaction. However, a minority of those working in accountancy/professional services felt that they did not want to pursue that career direction, but would soon seek career change (generally once they had qualified professionally). For this small, but distinct, group there was a feeling that they had might have made an error in choosing well-rewarded but uninteresting work instead of what were potentially more interesting STEM-focused occupations. Whether they could actually change sector back, to degree-related work, they realised, might well depend on whether they were prepared to accept a lower salary. Several others had already identified a compromise option, where in the longer term they might find financial work for a STEM Specialist employer, hoping that might maintain some personal interest for them.

When considering their longer term career, however, many more indicated that they did not expect to remain in their current sector. They maintained more ‘aspirational’ thinking for the longer term, which they considered to be 5-10 years hence, and many reported some desire to enter quite different sectors, such as teaching, or research, or the third sector, at a later stage of their career. They felt such moves would give them more interest or satisfaction in the long term. Interestingly, when asked whether they thought there was professional (careers) support available to help them consider such changes, none were aware of any available to them as a working adult.

The very high levels of satisfaction reported, across the range of degree subjects of the graduates and their lines of work, reinforces the interpretation that the sample was predominantly graduates a few years into ‘good’ jobs with ‘good employers’, which they may have appreciated for a variety of reasons. The rather low proportions expecting to change job or employer within a few years reflect this, and are somewhat at odds with overall career trends towards multiple changes within a working life. Certainly there was no evidence in the sample for significant numbers of graduates now working in jobs unrelated to their degrees who sought to change direction back towards degree-related work, other than a minority of those working in finance and professional services (such as accountancy). Many realised that considerable practical difficulties could ensue if they did make such changes, not least that they would expect to return to “the start of the ladder” with much reduced earnings. On the other hand, many did maintain aspirations towards or notions of major career direction changes in the longer term.

John, accountancy with one of the ‘Big 4’

John studied Mechanical Engineering at Edinburgh because it was a “well-respected and well-recognised degree” he thought would keep lots of career options open. Based on his fellow students, he felt he would not fit in with those working in engineering. Financial sector employers were regularly on campus and his careers service suggested that was the sector to enter if you did not want to follow engineering. Accountancy also had the attraction of a good starting salary and training scheme, and the excitement of living in London. This was hard to resist; when he got a “big 4” offer in his second year, he stopped worrying about jobs, focused on his degree and obtained a 1st.

Three years on, as a corporate financial analyst, John finds work rather boring and wishes he had not turned his back on engineering, which he feels he did through ignorance, prejudice and arguably laziness. Several contemporaries who took 4-year engineering courses including work experience – of which he had none – were now in engineering careers; he admits he dismissed engineering without ever knowing what it was really like.

Shortly to qualify, although he does not expect to stay in financial services, he does not think he could get an engineering job without a large salary drop, so the accountancy qualification will enable him to enter business management roles and he hopes eventually to become a senior financial manager of a science-related company.

4.7 Observations and conclusions

4.7.1 Overall observations from graduate interviewed

- STEM graduates were found to be working for a wide range of employers in all sectors of the economy, in both the private and public sector, across a wide range of occupational roles. Many in the sample were working for larger 'good' employers, as a result of the interviewee recruitment strategy, so the results obtained are not representative of all STEM graduates working outside STEM. However, despite the deliberate focus of the sample, there was good correlation with certain results from the student survey.
- There was mixed evidence for differential academic 'quality' (attainment) between the employer and occupational groups within this sample of dominantly highly achieving graduates. The sector with the highest proportion of 1st and 2.1 degrees was the STEM Generalists, and in STEM-related occupations, while fewer 1st class degree-holders were working in non-STEM sectors. Fewest of those with lower degree classes were in STEM-related work, with similar proportions in specialised STEM and non-STEM work.
- The majority chose their current job because it offered the prospect of interesting work and/or work of the type they were seeking. More practical issues such as employer reputation and job location were primary reasons for a minority but of secondary importance for most. Starting salary and prospective earnings were only reported as a main driver for a minority of graduates, almost exclusively male.
- The vast majority had chosen their university degree courses because they were interested in the subject or were good at it, rather than overtly for career-related reasons. Before university most had little idea of how degree subjects related to careers (and felt that advice on this had been lacking). The minority with career plans at this stage tended to be studying more 'vocational' subjects and were seeking STEM careers, but most believed a STEM degree would open up lots of careers.
- Many had still been undecided about career direction when they graduated and delayed job applications until after university. Their actual employment destinations often did not correlate simply with their direction of their career thinking prior to graduation. Significant numbers who had applied only for STEM jobs at university ended up outside STEM employment, while the reverse was also the case (i.e. some who had only applied for non-related jobs ended up in STEM jobs). The majority had applied *both* to STEM Specialist employers and also to graduate schemes that were operated by either STEM Generalist or non-STEM employers.
- The main reasons cited for making STEM degree-related job applications were potential interest at work and to make use of advanced skills, yet there was some perception that degree-related employment could be rather narrow. Salary and career prospects were cited by most as reasons to make applications unrelated to their degree, while most of those with genuine degree-related work experience did make degree-related job applications.

- Although the evolution of STEM graduates' career thinking during university was primarily based on their course and individual personal development, the influence of family and peers was also significant, as were the promotional efforts of major (non-STEM) graduate employers, which many perceived to be the mainstream destination for strong graduates; some careers services appeared to support this as the 'default' option for undecided STEM graduates.
- For a minority of these graduates, their particular individual circumstances were more important than any strategic career-thinking, as they took into account their own personal responsibilities or the impact of personal relationships; complex and somewhat unpredictable career pathways could often result.
- Once in the workplace, the proportion that considered they used their degree knowledge a great deal was small, and only modest even in STEM Specialist work, but almost all the graduates – irrespective of employment sector – used the general and broader skills they had gained from a STEM degree far more. Skills such as their approach to problem-solving were highly valued by non-STEM employers, enabling some STEM graduates to progress faster as a result.
- Although interviewed within a few years of graduation, some graduates had changed jobs already, chiefly due to redundancy or to a similar but higher quality job; a few of such moves resulted in a drift away from STEM employment.
- Levels of satisfaction with current job and career progress to date were very high, in all sectors, although many would like more degree-related work as they expected it to be more interesting, including some in financial/professional services who regretted their career direction. Few considered it feasible to re-enter STEM occupations in the short term even if they wanted to, not least due to the expected resultant drop in earnings, and many did not want to because of a perceived narrowing of their work.

4.7.2 Conclusions

These STEM graduates seemed not to have any construct of a 'STEM degree' but viewed jobs and careers in relation to their own specific degree subject. Hence Mathematics graduates viewed accountancy or banking as closely related to their degree, whereas Engineering graduates did not (within our study this would be classified as 'related' rather than 'Core' work, mostly undertaken for STEM Generalist employers). When considering degree-related jobs and careers, these graduates had perceived STEM degree-related jobs to be somewhat less advantageous in terms of salary and prospects, and rather narrow, compared with jobs unrelated to their degree.

Few of the graduates had gone to university with a specific career-related rationale (such as engineering), and many of those that did realised that even more 'vocational' STEM degrees would open up lots of different career directions. Although this might be expected from a sample of graduates which deliberately focused on those working outside STEM, the low proportions with early career ideas were very similar to those found amongst students in chapter 3. For many in this particular cohort, admittedly mostly high-calibre graduates working for 'good' employers, the mainstream career direction became entry to corporate graduate schemes, mostly outside STEM Specialist sectors, which does differ from the intentions reported by most students. However, this does call into question any expectation that for all STEM graduates the 'default' career direction will be into STEM careers.

The progression of their career thinking seemed to have shifted from purely aspirational early in university to a combination of aspiration and pragmatism by the time of graduation; many did not apply for jobs until after leaving university. During HE some graduates became more aware of certain issues in the labour market, some developing somewhat negative perceptions of STEM employment, while many responded positively to the high profile and promotional efforts of major corporate employers on campus. Issues like employer reputation, and how corporate cultures might conflict with their personal beliefs, entered their thinking, but rarely practical issues such as ease of getting a job or location. The effect of all these influences seemed to be to encourage a higher proportion of them to make job applications unrelated to their degree than we might have expected from the students' career intentions recorded in Chapter 3.

Overall, there was evidence that a higher proportion of those who had been more decided (in terms of career thinking) at an earlier stage progressed into STEM jobs, and conversely that the less decided they had been, the more likely that they would enter non-STEM employment. This seems to corroborate the trend observed in the student data. Factors such as the extremely positive impact of work experience could also be related to this issue of how 'career motivated' the graduates had been as students, although deeper investigation confirmed the pivotal nature of genuine work experience for many individuals in their career decision-making.

Employment sector choice therefore seemed for STEM graduates to have been largely a matter of individual choice, taking into account lots of different and rather personal factors, rather than dominated by one or two key predictable/rational factors such as earning potential, career prospects or the image of industry, or external factors such as inability to obtain STEM employment or a lack of jobs in their desired location.

Once in employment, there was little evidence that many of these STEM graduates would wish to change career direction within the short to medium term, as levels of satisfaction were high (probably partly a function of the sample interviewed) and the employment-related skills they had developed by virtue of studying a STEM degree were greatly valued by their employers, whichever sector they worked in. At the same time, those working outside STEM perceived significant barriers to any 're-entry' to STEM work, which they assumed would have to be at a low level and therefore much more poorly paid. While a minority regretted their career sector choice, and the majority would in principle welcome work more related to their degree subject (as it might be more interesting), they clearly weighed this up against the other benefits of their existing 'good' career progress, and were unlikely to change direction.

5. Employer demand and recruitment strategies in relation to STEM graduates

An employer perspective on STEM graduates and their career choices was sought as part of the research project, which is reported on in this chapter. Its aim was to help provide a better understanding of the wider labour market demand for STEM skills, in particular outside traditional STEM occupations and STEM sectors, and to explore how employers' STEM graduate requirements and recruitment strategies might be an influence upon STEM students' career decisions.

Other research has suggested that there is a mismatch between some STEM employer requirements and STEM graduate applicants' skills, which could be a factor behind the widely reported recruitment difficulties that many STEM employers experience (see earlier discussion in section 2.4 and further details in Appendix A1.4). This could be a reason for some STEM graduates, unable to find suitable STEM employment, deciding to seek employment in other areas. Another suggestion is that some STEM students are put off applying to STEM employers because they perceive them to have higher entry requirements, or because they hold negative views about STEM jobs or careers. Others may feel they have less access to, or are excluded from applying for, jobs with some STEM employers (particularly larger firms) because they are not at universities or courses that are targeted by them in their recruitment strategies. Although the surveys of STEM students and graduates have explored these possibilities, it was felt that an employer perspective would provide an additional valuable contribution to meeting the research objectives. In particular, the question of how much influence employers have on individual career decision-making, especially decisions not to take up a STEM career, could be explored. At the same time, such a perspective could provide further knowledge about employer demand for STEM graduates outside core STEM occupations/functions, an area highlighted as under-researched in the past.

5.1 The employer sample

The research aimed to seek views from employers in a wide range of industrial and business sectors. The sample design was structured around the three main employer groups identified in the scoping of the study (see earlier section 2.2 and also Appendix A, section A.2 and Table A.8 which shows our sector classification). These were:

- **STEM Specialist employers:** those seeking to recruit graduates (or postgraduates) for roles where a STEM subject degree (at Bachelor, Masters or Doctoral level) is a core competence. They are typically within the biotech/pharmaceuticals, engineering, IT and telecoms, construction, energy and utilities, processing, transport and health sectors.

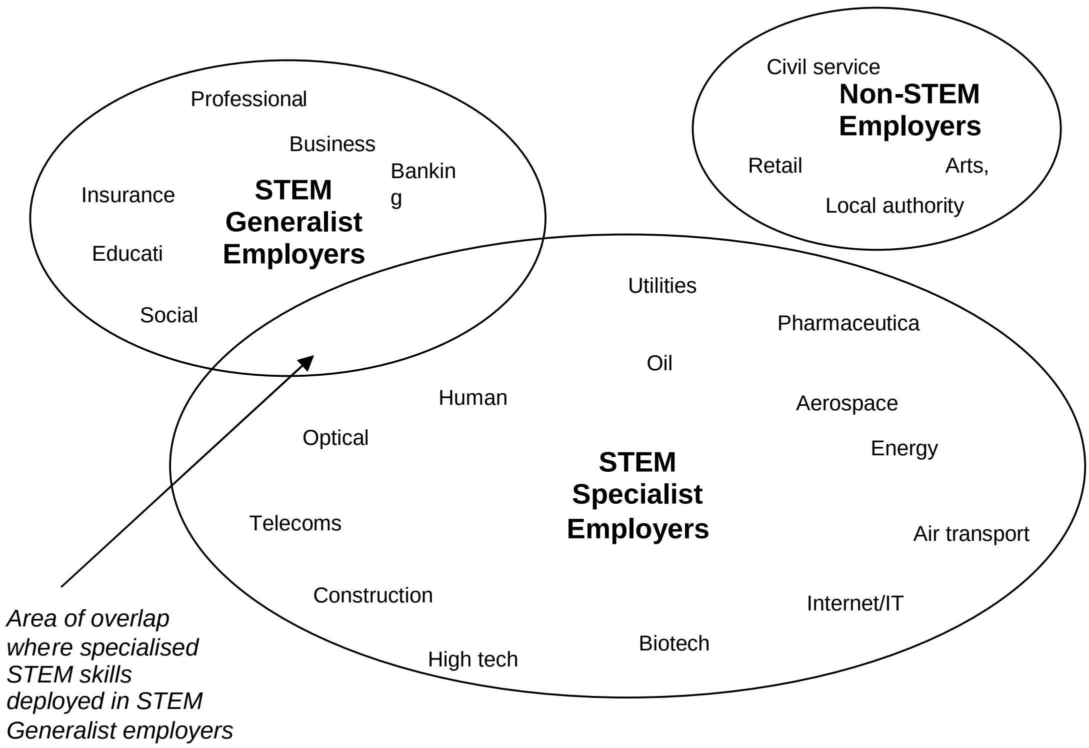
- **STEM Generalist employers:** those seeking to recruit STEM graduates where the skills or subject knowledge gained through studying a STEM subject is seen as an advantage. These job opportunities can also be open to other graduates and a STEM degree is not usually specified as an entry requirement (although it may be stated as a preference). These employers apply STEM skills in a range of sectors, for example financial services, business consultancy, the public sector, and cultural and media services.
- **Non-STEM employers:** those not making any distinction by degree subject during graduate recruitment; some of these do not see any need for STEM graduates (although they may be recruiting them into general graduate programmes or jobs).

Thirty interviews and 2 discussion groups were undertaken with a total of 51 employing organisations, which were mostly of large size. These included 15 STEM Specialists and 36 STEM Generalist or non-STEM employers covering the range of sectors in Figure 5.1. Although we focused on private sector employers, we also included some in the public sector but were unable to include an employer in the education/teaching sector, which is an important STEM Generalist employment sector for STEM graduates[6].

In the interviews, we found that this sector classification worked reasonably well though the boundaries between the three groups turned out to be harder to define, and more fluid, than expected. We found an overlap between STEM Generalists and STEM Specialists (as shown in Figure 5.1). Those categorised as STEM Generalist employers could be seeking a variety of specialised STEM skills or subject knowledge for certain roles, often in very niche areas. Also, although we did not specifically seek out non-STEM employers for interview, some we initially identified as possible STEM Generalist employers could as easily be seen as non-STEM employers: they had occasional STEM needs, in very niche areas, but did not seek to recruit STEM graduates otherwise.

[6] There was a representative from TeachFirst in one of our discussion groups

Figure 5.1 Employment sectors typically recruiting STEM graduates



5.2 Research questions for employers

Views were sought on the following:

- Where are STEM graduates being sought, both in and outside science and engineering firms, and for what jobs?
- Why are they recruited, and exactly what is being sought? Are STEM graduates recruited for their subject knowledge or for their broader skills? How closely aligned are STEM degree disciplines, or other aspects of qualification, with criteria to enter certain jobs or career paths?
- Where, and to what extent, are STEM graduate recruitment difficulties being experienced by employers? What are the reasons behind them? Is it because of a numerical shortage of STEM graduate applicants or because applicants do not meet requirements? Are there perceived deficiencies in STEM graduates? If so, what are they? Do weaknesses lie more in the quality of their subject knowledge from degree study than technical abilities? Or is there a lack of other capabilities, in terms of broader personal skills or work experience?

- What are the recruitment strategies of STEM graduate recruiters, both in STEM Specialist and Generalist sectors? Is there a filtering-out of some STEM graduates from the potential STEM workforce in the way employers target their recruitment?
- And why do employers think that some STEM graduates do not want to work in occupations related to their STEM degree discipline?

The findings that follow are structured in a way that provides responses to each of the questions posed above. However, it is first worth noting that although the discussions with employers focused on STEM graduates, there was not a clear or consistent view among employers as to what the term 'STEM' meant. While the acronym was widely recognised, some interviewees were much less familiar with it than others. The STEM Specialist employers were, not surprisingly, the most familiar with the term, and more of them identified correctly the disciplines it covered than within the STEM Generalist and non-STEM group. STEM is not a term used commonly within many of these organisations, including some STEM Specialists. Rather, there is a preference for using terms like 'scientist and technologist' (S&Ts) or 'engineering or technical [staff]', and STEM can be seen as somewhat 'jargonistic'. Focusing on certain disciplines within the STEM umbrella was seen by some interviewees as more helpful for their specific requirements (e.g. Computer Science, Engineering graduates) than using the more generic term 'STEM graduates'.

5.3 Research findings

5.3.1 Where are STEM graduates being sought, and for what jobs?

Our interviews confirmed that a large number and wide range of employers recruit STEM graduates. Not all of the employers were actively seeking to recruit STEM graduates. Some recruited them into specific engineering or technical training programmes, others to general graduate entry programmes or directly into jobs. It was clear that STEM graduates could be recruited by almost any employer in any sector. We found the following practices in the three main groups of employers (identified above):

In the **STEM Specialists:**

- A STEM degree was a specified requirement for graduate development programmes or specific vacancies; these would almost all be STEM Core jobs in our definition scheme (see section 2.2 and Appendix A, Table A.9). Specific STEM disciplines tended to be targeted by employers in their links with universities. All employers in this group had sought to recruit STEM graduates both last and this year (2010), but some were reducing their current year's intake. Two were cutting back severely; partly they said a result of the recession and partly due to restructuring in their global operations. But most employers were aiming to keep recruitment numbers at a similar level to the previous year despite their more difficult business trading conditions.

- Planned recruitment intakes among STEM Specialists ranged from a handful to up to 200 STEM graduates annually (see Table 5.1); most of those we interviewed had fairly modest intakes, in the 20-50 range, annually.
- Most STEM graduates were recruited into graduate development programmes rather than directly into STEM jobs, mostly technical or engineering streams but also some towards engineering management or business leadership. Most graduate recruits were destined for early careers as scientists or engineers. It was recognised, however, by many of the employers that some STEM graduates would in the future move into other roles in the company, and so become non-specialists, as in the examples below.

> A pharmaceutical company has traditionally sought large numbers of chemists. Most follow a chemist career in the company, but some move into other roles, in patenting, project management or commercial development after a few years as ‘working chemists’.
>
> A R&D /defence systems services business found that some of their STEM graduate recruits who had initially been taken into technical development programmes (for core STEM jobs) migrated into roles in commercial functions after a few years. Their strong technical background and understanding of the business made them very useful on the commercial side of their business.
>
> A global oil company recruits STEM graduates into a 2-4 year development programme within a particular discipline or specialist engineering group. On completion, the STEM graduates have the choice of moving into commercial functions or non-discipline groups (like trading, or logistics) or staying in their specialist technical group.

- Many of the STEM Specialist employers also recruited STEM graduates into STEM-related or unrelated job roles, within their commercial and business functions (and so behaved like STEM Generalists in this respect). For example, a pharmaceuticals group had a separate recruitment programme where it took STEM graduates into marketing and supply functions, health outcomes and drugs regulation; and an energy company took STEM graduates into leadership/management development programmes where no degree subject was specified as an entry qualification. One such employer said it tested STEM graduate applicants on their motivation for moving away from STEM work. Another (an energy business) might encourage a STEM graduate who applied to their commercial function to consider a STEM entry programme but he/she would not be rejected if they could demonstrate well their commercial interest and other more general competences being sought. In addition, there were several examples of STEM graduates being preferred for some non-STEM functions, discussed further in the next section.

In the **STEM Generalists:**

- A STEM degree was seen of value to certain areas of their business. STEM graduates might be targeted specifically, such as for a few roles in investment banking, but generally they were not targeted for their specific degree knowledge in the way that a STEM Specialist employer would (as above). A STEM degree could be an advantage, and would be welcomed, but it was not usually specified as an entry requirement. Nonetheless, they might well give a steer in their on-campus presentations or applicant information, or take STEM graduate employees to those campus visits, to encourage students from STEM disciplines to apply. Job roles or areas where STEM graduates were needed ranged widely; some examples are described here:

> In large financial organisations, providing technical support to the trading desks or to the branch networks or in business projects, as business analysts, support to relationship managers, project support or specialised computing support.
>
> In investment banking, on trading desks or in quantitative research and strategy roles.
>
> In retail organisations, providing technical support in customer services, marketing or development of new business projects, waste or environmental management.

> In Government organisations, for roles in scientific research policy, management of research projects with a technical focus, inspection functions (e.g. for nuclear or safety industry) and in IT roles.
>
> In business and management consultancy firms, in graduate training programmes in tax, audit and advisory/consultancy services.
>
> In museums, as 'public educators', researchers or contemporary science exhibition managers.
>
> By TeachFirst, where STEM graduates are targeted for STEM subject teaching roles and other secondary teaching.

However, it is worth emphasising that many of these roles can also be open to other graduates (from non-STEM disciplines) who can be equally successful in gaining employment provided they have some technical or scientific background or expertise (but not necessarily qualified at degree level in a specific STEM subject). Only in a few cases was there a more specific focus on a STEM degree qualification (and here the overlap with STEM Specialists was more pronounced).

- Intakes of STEM-qualified graduate recruits varied from a handful to several hundred per organisation. Several STEM Generalist employers had higher STEM graduate intakes than most of the STEM Specialist employers in our sample, for example:

> A large business consultancy firm took 200 STEM graduates (a third of their total graduate intake) per year.
>
> An investment bank took 90 annually, comprising 40-50% of their total graduate intake.
>
> The technology division of a retail bank aimed to recruit around 50-70 graduates per year, of which 80% were STEM graduates.

An estimate from a discussion group comprising financial services organisations indicated that STEM graduates represented on average around 20 to 25% of total graduate intakes. However, this ranged from 100% at one firm to almost zero at several others. Nonetheless, the very large annual graduate intakes of some of these organisations makes them very significant in this arena.

While we obtained numbers from some of our interviewees, many we spoke with could not provide figures on the percentage of recruits who were STEM qualified – '*it's not a piece of data of value to us'* as one commented.

In **Non-STEM** employers:

- Whilst STEM graduates could be recruited, sometimes in large numbers (although no specific data were available to check this), such as in retail businesses or public sector organisations, little or no effort was put into attracting them or targeting them at universities. Degree discipline was not a criterion of relevance to these employers. Rather a 'good degree' was sought, usually at least a 2.1, and in a few cases we found a minimum of 360 UCAS points also being required. Other attributes and capabilities of a more generic kind, relating to intelligence, attitude, analytical skills, communication and so on, were of more importance for most of their job vacancies. The exception might be in their IT functions where an IT degree might (although not always) be required, or an occasional STEM graduate might be sought for a technical role (depending on the respective proportions of these roles, in some cases they could alternatively be classified as STEM Generalist). Another example of this was in a local authority where STEM graduates were recruited into finance jobs (although not sought specifically) but it also liked to have some graduates with STEM backgrounds enter its management stream to provide a balance of skills/approaches. But in general, focusing graduate recruitment on specific disciplines (STEM or otherwise) was seen as of little value. In fact some saw it as counter-productive if it narrowed the potential pool of applicants or went against the openness of the organisation's resourcing policy. A large media organisation commented: "S*ome of the competencies used in recruitment may avail themselves to STEM skills but the process deliberately focuses on a range of skills, experiences and attitude, and thus subject preference is not that relevant. There can be a preference for people with good maths and technical ability but also well rounded and a broad perspective"*

- We found a similar attitude in a public organisation engaged in audit and tax, where there was not seen to be a need to target STEM disciplines. It sought high levels of numeracy skills in graduates and attracted many STEM graduates, especially in mathematics, for that reason. Equally, many STEM graduates were likely to be successful in getting through its selection processes. However, a wide range of other skills were tested for – verbal, logical as well as numerical reasoning, communication and behavioural skills – and STEM graduates often did not have any particular advantage with these.

Thus, the interviews confirmed that STEM graduates can be recruited by a wide range of sectors to an equally wide range of jobs. A distinguishing feature is that some enter jobs where a degree discipline is seen as *a core competence*, where their STEM core knowledge and skills are crucial (and fundamental). These are mainly in STEM Specialists but could also be niche occupational positions in STEM Generalists or even non-STEM employers. Others are recruited to jobs where their STEM knowledge and skills can *be applied more broadly along with their other (employability) skills*. The latter are typically STEM Generalists where the capabilities which have been developed in their degree study such as problem-solving and analytical skills are strongly valued. In the third group, the non-STEM employers, in the vast majority of cases the degree discipline is of little relevance at recruitment but STEM graduates may have the general competences (employability skills) to be successful

Table 5.1 Employer annual graduate recruitment requirements, and examples of disciplines

Sector	Number of recruits	STEM disciplines
Utilities	15	12 Mechanical, Electrical or Chemical Engineering; 3 Design Engineering
Energy generation and distribution	34	20 Engineering to engineering management programme, 2 IT graduates and 12 Engineers, mainly PhDs/masters, to R&D centre
Air transport	20-30 annually	5-10 Engineering graduates 15-20 IT graduates
Internet/IT services supplier	40 -50	Approx 40 Computer Science graduates plus a few Mathematics graduates
Plant sciences	15	15 postgraduate chemists
High tech R&D services	100	Computer Engineering, Mathematics, Physics, Statistics; Electronic, Aeronautical and Electrical Engineering
Construction	150	Mainly Civil, Mechanical and Building Engineering graduates, and a few scientists
Telecomms	150	Computer Science and IT-related degrees
Optical technology	1-2	Very relevant discipline (in optics)
Oil	150	Engineering and science, including a few in very specialist disciplines like petro-physics
Pharmaceuticals	200	Mainly Chemistry graduates
Financial services	50-70	80% in STEM
Business services	650	approx 200 STEM

5.3.2 Why are they recruited and what is being sought?

In STEM Specialist employers and for core STEM jobs, the reasons for recruitment of STEM graduates were clear and obvious. They were sought for their higher level engineering, IT or scientific knowledge and skills. Often recruited into graduate technical development programmes, they are generally seen as part of the future talent pipeline of their organisation, destined for careers as technical specialists or technical or general managers.

In the other employers, the reasons for taking STEM graduates were less clear and more varied. Two main groups were identified – one where their degree (subject knowledge) was seen as useful, the second where it was their skills that were – and for some employers it was both. So, there are some job roles or functions where a background in engineering, IT or science is required, such as in the technology unit of an international consultancy, or in defence procurement in Government, or an engineering team within a local authority; and a relevant science or technical degree is needed for these. But in others, the degree subject matters less or not at all, rather it is the skills of the individuals which are of value, for example in business consultancy or general management. A STEM degree can indicate to employers that they have skills being sought, in particular their numeracy and analytical skills. However, having good numeracy skills is often not sufficient. We heard from several employers about weaknesses of graduates generally in personal and behavioural skills (confirming points highlighted in other graduate research, see Appendix A, section A1.4), and this seemed to apply equally to STEM and non-STEM graduates. One exception was a quarrying/mining firm where STEM graduate applicants were often seen as weaker than others in communication skills, and such skills were important in their commercial or management development programmes.

5.3.3 How much do STEM disciplines align with job needs?

We found a varied set of views, mainly from STEM Specialist employers, when asked if a specific STEM degree subject was specified or preferred. Some specified particular degrees in their recruitment information, such as Mechanical, Electrical or Chemical Engineering, Physics, analytical Chemistry or Mathematics for particular jobs/roles. In those cases a fairly tight match existed (e.g. in aircraft engineering, or electricity generation). But we also found examples of broader or more flexible requirements, where degree discipline was less closely aligned with job role. In these, applicants from any engineering discipline or a range of science and engineering subjects could apply for the vacancies. Some examples of disciplines sought, mainly by STEM Specialist employers, are shown in Table 5.1.

In one particular case, an IT company, the match between degree and job to be filled was seen as very tight: only graduates from particular degree courses where core IT and computing competencies were known to be developed were considered. Similarly, an energy company had identified a number of courses which provided specific content that they were increasingly interested in, so would be only recruiting from there in the future. More often though, there were preferences for recruits in specific disciplines or from certain courses but employers would be prepared to recruit from other relevant subjects/courses, for example:

An energy company preferred Electronic or Electrical Engineering but almost any Engineering course would be considered depending on how much it had an electricity/energy focus.

An oil company recruited from a range of STEM disciplines but with a bias towards Engineering for many of their recruits. Some Physics or Mathematics graduates could enter some of the more specialist areas like petroleum engineering or drilling. It had 17 sub-disciplines in engineering and four science specialisms, so a huge variety of jobs were open to STEM graduates from a range of subjects.

A city bank preferred Mathematics, Physics, Computer Science or Management Information Systems (MIS) but considered others (provided that they had a 2.1 or better).

A pharmaceutical company recruited STEM graduates into its commercial functions where some jobs needed degrees in specific science disciplines, for example in Chemistry process development, Chemo-metrics, Physical Chemistry (particles), Bio-engineering, Pharmacology, and Statistics. But alongside these were other jobs in functions open to any science-based graduate.

Many industrial firms had an expectation that Engineering graduates would become chartered and so they recruited only from courses recognised by the relevant professional body (this did not seem to apply as much to science degrees).

We found far fewer examples of very specific STEM degree subjects being sought by STEM Generalist employers.

Disappointingly for our research objectives, very few employers could give numbers of recruits from individual STEM degree disciplines (unlike for STEM as a whole, where most of the STEM Specialists could give numbers, though few other employers could). Only a few employers, mostly STEM Specialists, kept details of degree disciplines of their graduate recruits, and usually this was where they targeted specific disciplines. A few larger employers with good management information infrastructures kept degree discipline details for monitoring purposes (of their graduate recruitment processes and policies), including a public services agency and a large business consultancy, but they could not provide us with the data for individual STEM disciplines.

5.3.4 Skills being sought

When asked about the skills sought, again views varied between employers:

- The importance of academic excellence in engineering and science fields was stressed by most STEM Specialist recruiters; having a sound grasp of the fundamentals of Engineering and Physics was seen as very important. This was tested for quite carefully in selection processes.
- Academic and technical excellence was seen by some STEM Specialist employers as more important than having good 'soft' (or employability) skills. Equally there were others which stressed the importance of graduates having a range of such broader capabilities *alongside* a strong technical academic record. Many of our interviewees, both STEM Specialist and other employers, used corporate skills and behavioural lists in graduate selection (in assessment centres), and applied this testing to STEM graduate applicants as well as others. Their 'skills' priorities varied, but tended to include: team-working, applying their technical knowledge, drive and resilience, ability to deliver results, business focus, interpersonal skills and future leadership potential.
- One employer in the science education sector had communications skills as its priority – '*they have to be able to talk about science but not in too detailed a way and also understand what communicating science to the general public means*". A number of others valued numeracy, analytical and problem-solving skills, which tended to be harder to find in graduate recruits generally. STEM graduates were thought more likely to have strengths in this area and so could be at an advantage over others in getting through selection processes. However, this seemed to apply mainly to STEM graduates from the 'top' universities or certain courses where employers said that they were more likely to find what they considered to be better applicants.
- Some roles into which STEM graduates were recruited are highly quantitative ones (such as financial modelling in global banking) so those who have very strong mathematical skills are especially sought for them, but this did not mean they had to have a Mathematics degree in all instances.
- One STEM Generalist employer commented on how some STEM degree courses developed a structured way of studying which was beneficial when applying for business consultancy posts. Another with a similar view (a global investment section of a bank) targeted Engineering and Mathematics graduates '*because of the* way *they are used to studying; they think in structured ways, are familiar with the kind of complex models we use, are analytical and used to the language we use (some Economics graduates would be too*)'.

- Some of the public sector employers felt that STEM graduates brought '*an enquiring mind*, *the ability to spot trends and to highlight issues'* or had an '*organised mind'* which helped contribute to round-table policy discussions.
- For a number of employers (STEM Specialists and others) intellectual capability was an important requirement, and they specified a minimum of a 2.1 and high A-level results to try to achieve this in their recruitment, rejecting any lower qualified candidates at initial stages of selection. Several STEM Specialists asked for Mathematics and Physics at A or B grade at A-level.
- Several STEM Specialist employers also sought knowledge of particular specialisms, or very specific skills and knowledge (in, say, Software Engineering, or Mathematics). Overall, however, there was generally less interest in graduates who had taken very specialised STEM degrees.
- Postgraduates were thought often to bring more independent thinking than first degree graduates, and the 'latest thinking' or contacts in fast-developing areas or new practical techniques, so were highly valued generally by many employers.

5.3.5 Preferences for particular qualifications or institutions

As well as having a preference for specific STEM disciplines for certain job roles (although in others there can be some flexibility), we found also a growing preference among some employers, especially STEM Specialists, for Masters graduates (MEng or BEng with Masters). This appeared to be because of higher skill needs and their search for high quality and higher capabilities in graduate recruits.

Focusing recruitment towards M-level graduates was a trend seen more in Engineering than in sciences where intakes were generally still fairly mixed between BSc and MSc qualifications. Several 'scientific' firms had always had specialist roles to fill, where a Masters or PhD qualification in a specific scientific area was required (and definitely seen as an advantage) but also some where there has been a shift towards higher qualifications. For example – *'We have moved significantly away from graduate recruitment and now recruit more PhD students than other graduates or postgraduates …the industry [pharmaceuticals] has moved radically, and the challenge is now to ensure that universities recognise this and keep pace'*

We also found examples where boundaries between graduate and postgraduate qualifications were becoming increasingly blurred – "*we recruit the best we can get".* For some, however, this did mean a trend towards recruiting more at postgraduate level; while others were recruiting across the spectrum of skills from technician to postgraduate. Several had developed a strong focus of 'growing their own talent', such as investing in technician and foundation engineer programmes to fill short- and long-term skill gaps and encouraging progression to chartered status.

Most employers (both STEM Specialists and others), and especially all the larger firms, had preferences for particular universities and courses. Although they had such preferences, and also targeting strategies on particular universities, this did not preclude students from other universities applying to them, usually via their websites (all had online recruitment). Most had multiple recruitment methods – their own website, agencies, advertising in careers magazines, Facebook, targeted recruitment activities, via alumni networks, research partnerships, work placements and so on. Placements were seen by several as the best way to recruit future graduates as they provided exposure of the industry to students and the company could identify potential recruits. One large pharmaceuticals company also spoke about placements being '*an excellent investment opportunity for upskilling in SMEs in the pharma supply chain'.* Another (in utilities) used their placement schemes also to encourage first degree graduates to consider MSc programmes and also to encourage A-level students into their field.

A greater amount of marketing effort is generally put into employers' 'target' universities and, in some cases, senior executives get involved in events and sponsorship programmes to increase the company's profile. The 'target' universities are chosen usually for a number of reasons, including 'quality' (as measured by UCAS entry points, research ratings, league tables and accredited courses), overall size, and quality of previous recruits. Location could be an added factor for some national firms with a branch network where they experienced local recruitment difficulties. Some of the large scientific and engineering companies have developed strategic relationships with a few universities to foster both recruitment and research links.

STEM Specialist firms invested much more in targeting certain STEM departments or courses to encourage applicants than did other employers. They also tended to use their academic contact networks and alumni to undertake more informal marketing and identify potential applicants (though some STEM Generalists did so too, to fill particular niche roles, e.g. in investment banking). In smaller organisations, STEM graduate recruitment might be more by chance rather than specifically sought, through agencies or by job advertisement.

5.3.6 Where are the STEM graduate recruitment difficulties and why?

Employers' difficulties in filling their vacancies for STEM graduates from UK universities, with some increasingly looking overseas even in the current recessionary times, have been widely reported (BIS, 2009a; CBI, 2010; HEFCE, 2010, see also Appendix A1.4). So, it was not surprising to find confirmation of STEM graduate recruitment difficulties in our research, though this came almost exclusively from STEM Specialists. Few such problems affected STEM Generalists.

For many employers, the root of the problem was a perceived lack of supply of STEM graduates from UK universities *of the calibre they required*. It was therefore not so much a problem of numerical shortages per se but more a quality problem that many experienced. They felt that there was too much variation in the quality of STEM degree output and insufficient numbers of

STEM graduates applying with the required level of skills and knowledge. Often it was too few applicants from (what they viewed as) the 'right' kinds of STEM courses or with the subject knowledge that was required. Others put more emphasis on how courses at many universities were not sufficiently relevant to their business (the latter particularly for IT employers). Yet others spoke more generally about wanting more of the 'better' graduates.

Weaknesses of many graduates in their core disciplines along with their lack of fundamental scientific and technical knowledge, relevant to their business, was highlighted as an issue, for example:

An oil company interviewee spoke about its interest being in core engineering and science disciplines, not in the very specific undergraduate courses in, for example, emerging technologies or with a sustainability focus, which are very popular with potential students and some universities.

An IT employer commented similarly, saying that too much was being driven by student demand and not employer demand – '*courses in UK are offered to students as enjoyable experiences – to be fun at the expense of hard graft of learning the core, quantitative subject that employers want. Other countries produce better graduates because they concentrate on more traditional teaching of fundamentals of these hard technical subjects.'*

A computer games industry interviewee commented on there being over 40 degree subjects offered in the games area, while it, and similar employers: '*needed Software Engineering, Computer Science and perhaps Mathematics – traditional STEM courses, and not 'games' courses.'*

An engineering business spoke about how crucial it was that universities taught Mathematics and Physics fundamentals – academic excellence was the first benchmark in their recruitment, employability skills came second (though they saw them as necessary to distinguish between candidates beyond their technical competence).

Having a degree programme approved by a professional body was a necessity for most engineering companies and some scientific roles, for example – '*about half the students graduating in chemistry do not have their programmes accredited by the Royal Society of Chemistry – this halves the talent pool from which we recruit'* commented a major pharmaceuticals company director; while an energy supply company said: '*we want Engineers for chartership so they need to be from courses recognised for that by professional bodies'.*

Perceptions by students that an industry sector is relatively unattractive to work in was an added problem for several employers, for example *'The oil and gas industry has an unattractive image, off-putting, not glamorous. It is a problem despite us paying high salaries (though not as high as some investment banks)',* while another commented: '*students that come out with Engineering degrees are not interested in engineering; it's really difficult to attract them into our sector (energy supply and distribution). Those that apply often want to take our corporate programmes. This is because they don't know enough about the engineering opportunities that we have and our industry - our own research has told us that they want to go broader. We are at the cutting edge (e.g. in environmental work, climate change) but they don't seem to know this… we can't get it across that it is an exciting business'.*

The apparent, relative ignorance about STEM jobs and lack of industrial experience of many STEM students was a recurring theme in comments from employers. Many felt STEM students often did not have a clear view of what working in an engineering or technology company would be like and so they had to spend more resources on raising awareness of the opportunities available. Student expectations could be unrealistic, for example: '*many students do not have a clear view of what their working life will be like, have really no idea, they don't realise that working in marketing is not all about PR but business analysis; these careers are seen as more glamorous than they really are'* and (from a health sciences employer) *'they expect exciting jobs but much of research is not, a lot is automated and is hard work'.*

STEM Generalist employers were likely to experience STEM graduate recruitment problems only where supply was relatively 'thin', for example in a very specialist area, or where a combination of high calibre (intellectually and technically) and the ability to apply degree learning in the business was needed, or where location was a problem (e.g. in some regional offices of a large consultancy organisation). One bank found that IT graduates did not perceive them as a *'challenging assignment'* and found such graduates preferred to apply to IT companies rather than take up their opportunities in technology roles in trading desks, platforms etc. '*Students do not understand that banks offer these types of positions – and the recession has left many thinking there are no jobs in banking or little job security'*. Although STEM Generalist and non-STEM employers had few or no problems relating to the number of STEM graduate applicants they received, several said they would like more, especially Engineering, STEM graduates in financial and business services (for their problem-solving skills).

5.3.7 Are there perceived deficiencies in STEM graduates?

As highlighted above, some employers (mainly STEM Specialists) identified deficiencies in the skills of STEM graduate applicants as a reason for their recruitment problems. These tended to be similar to those raised by other research (reported in Appendix A1.4) but more emphasis was put on deficiencies of a technical and academic nature than behavioural (though some perceived that both existed) in our research. In the main, STEM Specialists spoke of weaknesses in the core discipline knowledge of many STEM graduate applicants and a lack of fundamental knowledge of engineering and science. As highlighted above, several had concerns about the relevance of some of the courses being run at some universities, relating to Computer Science in particular.

While technical competencies dominated the discussion about deficiencies in the supply of skills, there were also concerns expressed about STEM students lacking broader skills, although such deficiencies were less significant for most. Communications, team-working, time management and organisational skills were most frequently mentioned (as being lacking in many applicants with first degrees in STEM, and more so at PhD level). An engineering company, for example, mentioned the challenges of today's industrial research which needs an integrated skills set that is both multi-disciplinary and multi-natured – a project could involve graduates from conception through to design, testing, manufacture, delivery and support. They found that PhDs with a narrow range of capabilities were not suitable, but Eng Docs often had the right combinations of technical capabilities and industry 'know how'. Another said that he did not expect commercial and business experience as much as good communications skills in graduate entrants (as they could train for commercial capabilities), but this comment was more an exception to the general rule.

A few spoke about specific deficiencies, for example, a lack of mathematical expertise among chemists – '*something like 50% of Chemistry graduates do not have A level Maths yet it is a must to get top grades in Chemistry at university...there is a serious divide between those students with both the capabilities and the right qualifications and those who really struggle on courses not accredited by the RSC which do not require Maths A level',* a major pharmaceuticals recruiter had observed.

The STEM Generalist employers, when asked, tended to put more emphasis on deficiencies in 'soft' skills of STEM graduates than did STEM Specialists. This seemed to apply to IT graduates more than others. For example, a major IT company said – '*technical qualifications are a given, what we seek is cultural fit'.* The consensus of our discussion group with public sector employers was that STEM graduates needed to work on developing their communication skills. Other STEM Generalist employers also highlighted deficiencies here and many felt that they were greater in STEM than other graduates. However, there was a general criticism of *all* graduates' broader employability skills in general, and some employers felt that STEM graduates were no different from others in this respect.

5.3.8 How do employer recruitment strategies affect students' career decisions?

Most graduate recruiters, and especially the large ones, have a range of recruitment methods in place including a targeting strategy on particular courses, universities and/or types of students. But this does not preclude other students (not in the targeted coverage) from applying as they generally run on-line recruitment via their websites.

Criteria used to select their core or 'target' university/department/course list usually included university performance, size, and the performance of previous graduates recruited, but could also include other specific requirements. The 'select' group of universities would then be the ones where more resources are put into attracting and recruiting students through campus presentations, sponsorship or other activities, or where the employer might focus its work placement offers (see above). The tendency in most of our interviewees was to have universities with high A-level entry requirements on targeted lists, including most of the Russell Group, but some included also certain other universities with particular STEM specialisms, centres of excellence or research links. The number of institutions targeted tended to be between 8 and 20; a few had more where particular courses at the universities were targeted. Both STEM Specialist and Generalist employers targeted STEM graduates but such targeting was most actively pursued by STEM Specialist employers.

All employers we spoke with saw clear benefits in targeting in this way as part of their recruitment strategies. Although some were aware they might be seen as 'elitist' in their choice of target universities, they did not feel they that they were excluding other potentially appropriate candidates from applying through their open application system. They aimed to get more, stronger applicants by their targeting strategies, and this was backed up by their own research. So although large numbers of STEM graduates are being produced by non-targeted universities, there was no evidence from the employers we interviewed that they thought their recruitment methods might be filtering-out appropriate candidates.

5.3.9 Why do some STEM graduates not want to work in their STEM degree discipline?

Finally, we present views of employers as to why some STEM graduates are not seeking to follow careers in STEM.

It is worth saying first that several employers, in IT and engineering in particular, did not see the question as relevant – 'losses' at the graduation stage were not a significant problem as they expected most graduates in these disciplines to enter a STEM job. Rather, their key concern was at earlier educational stages: they wanted more young people to choose to study IT or Engineering degrees so as to increase the first degree output and also improve the feedstock of people potentially interested in higher STEM qualifications.

However, the majority of employers acknowledged the 'losses' of highly able STEM students into other employment sectors and non-STEM work after they graduate and, for STEM Specialists in particular, this did negatively impact on their own recruitment. Nevertheless, there were some, mainly STEM Generalists and non-STEM employers, who saw benefits in a wider recruitment of STEM graduates across the economy and society as they brought valuable skills – for example '*a client of an IT firm with a good technical grasp can lead to a more profitable and productive relationship for the IT supplier'*.

The employers perceived two main reasons for STEM graduates moving away from their degree discipline:

- The greater attractiveness of working in other sectors, due mainly to higher salaries that students expected to get (especially in financial and business services), especially early in careers, and also due to the perceived 'glamour' of City businesses (the attraction of being a trader, for instance*)*; and.
- A lack of knowledge amongst many STEM undergraduates about what engineers or scientists really do and what their career progression might be like (in contrast to other professions such as lawyers or doctors where they felt a lot more is known).

These two reasons were cited almost equally by STEM Specialist and other employers, though there was some speculation about the current strength of the first as there were doubts that the City would have a continuing strong 'pull' due to the recent banking crisis and 'fall-out' from the recession. Several STEM Specialist employers commented on increases in applications they were receiving this year as an indicator of this, backed up by their own research among students. However, the lure of 'making a lot of money very quickly' in the City, was still perceived to feature, albeit by fewer possibly than in the past.

Some of the STEM Specialists were taking steps to address the first issue (and the second too, as they are seen as linked) by improving their own sector's acknowledged poor image. This was being attempted through increasing their presence on campuses, attending specific engineering and science events, or engaging more directly with academic staff to educate them on the opportunities open to undergraduates and postgraduates. Accessing students at an earlier age to inform them of the career options they have as STEM graduates was seen as an important activity to help with the second reason – *'once we get to the stage where we are recruiting graduates we can only be reactive due to the fact that the choices around education have already been made…our graduate community have supported some of the events to engage with younger students …I have spoken to many candidates in the past who don't know how their academic choices align with our opportunities and as such don't apply',* commented a recruiter in the energy sector*.*

Some other reasons were suggested by a few employers for STEM graduates not seeking to enter careers within STEM industries:

- A desire to develop a career within a broader field of opportunity and not be restricted to their initial choice of their degree. For example, an investment bank had noted '*some of the brighter STEM graduates can see that a spell in financial services can involve them in developing other valuable non-technical skills for future career development';*
- Possible disillusionment with their STEM subject;
- The attractiveness of a more structured CPD system, leading to a further qualification, being offered in other sectors (such as accountancy);

- Greater job security or a feeling of 'doing something for the common good' in the public sector;
- Better conditions of employment, such as more flexible working hours, or a specific location – '*money isn't the only determinant as to where they apply for jobs'* commented a director of a technology division of a financial company.

There was no support from employers for the view that work experience placements might put people off a STEM career if they found out about the 'more boring' bits of being an engineer or scientist.

5.4 Summary and conclusions

The research confirmed that a wide range of employers recruit STEM graduates. Our categorisation of employers into three groups worked reasonably well in helping to distinguish different kinds of employer demand for STEM skills but the boundaries between the groups can be 'fuzzy' in places and there is overlap between STEM Specialist and STEM Generalist employers relating to certain needs and job roles.

Those employers that are more targeted in their approaches to securing the skills they need tend to be the STEM Specialist employers which recruit graduates for STEM Core jobs (usually into a graduate development programme). After a period of time, some of these graduates would move to STEM-related or unrelated jobs as their careers progress. Many STEM Specialists also recruit STEM graduates directly into STEM-related or unrelated job functions.

A range of job roles or functions were identified as likely to be filled by STEM graduates in STEM Generalist employers, from investment banking to education, and from commercial functions to public policy and administration. Many of these were also open to other graduates; although STEM degrees were frequently welcomed, in only a few places was there an apparent specific need for a STEM degree qualification. Additionally, STEM graduates were recruited by other employers (non-STEM) where the subject of degree qualification is of little relevance.

Reasons why STEM Generalist and non-STEM employers recruited STEM graduates varied and were sometimes rather vague (in contrast to the STEM Specialists). For some, the relevance of degree subject was important for certain job roles, while in others STEM graduates' skills were valued more, especially their expected numeracy and analytical skills. As a general rule, it was the ability to apply STEM knowledge and skills more broadly, along with other (employability) skills, which was most highly valued. This is in contrast to STEM Specialist employers where it is generally the STEM core competences that are required and valued most.

The 'tightness' of match between STEM degree discipline and jobs to be filled varied; some (mostly STEM Specialists) have preferences for graduates from particular degree courses or types of courses to fill certain STEM Core jobs, while others have STEM Core and related jobs open to graduates from a range of STEM disciplines (both STEM Specialist and Generalist employers).

Academic excellence in science and engineering was seen as a key requirement by most STEM Specialist recruiters. Equally, it was important for some specialised functions of STEM Generalist and other employers. Some STEM Specialists considered this a more important requirement than having good broader behavioural skills, but others felt both were required. There was some evidence that STEM Generalist and non-STEM employers were more likely to find numeracy, problem-solving and analytical skills in STEM graduates than in other graduates. These are skills increasingly being sought generally and are seen as ‘harder to find’ in new graduates. This would give a STEM graduate an advantage in a competitive employment market.

The interviews confirmed much of the existing research evidence on STEM recruitment problems. They were mainly being experienced by STEM Specialists which perceived deficiencies in some STEM graduates’ technical ability and subject knowledge, and in some cases also in their lack of business awareness. STEM Specialist employers were more critical of weaknesses in STEM graduates’ core discipline knowledge and lack of relevance to their business than STEM Generalists, many of which seemed not to have graduate recruitment problems. Some STEM graduates were seen though, by all types of employers, to lack the broader behavioural skills being sought by all graduate employers, in particular team-working, communications and time management/organisational skills. An additional problem for some STEM Specialists is their relatively unattractive image as an employer or working environment. In some cases, this perception arose from a lack of up-to-date knowledge about STEM jobs and workplaces among many STEM graduates.

We did not identify many specific problems associated only, or more with, certain individual STEM disciplines. However, there were clearly some differences between disciplines where some issues were more relevant or significant. It is not easy to generalise from our sample as we found a diverse range of views, often contrasting, among employers. However, on the whole, IT employers had greater concerns about the relevance of university Computer Science courses, while engineering and scientific employers were concerned more with simply getting adequate numbers of high-calibre graduates.

Targeting certain institutions or degree courses is part of most large firms’ graduate recruitment strategies. Though it may appear as potentially narrowing the pool of STEM-qualified applicants, employers did not see that this had a significant effect on outcomes. Rather, it helped them to focus better on the kinds of graduates they wanted to attract, and compete with other recruiters (often in non-STEM) and they were content that their on-line recruitment processes provided graduates from other institutions with access to vacancy information and their application system. However, it is almost inevitable that such graduates would not be as fully informed about job opportunities, or how to present their application to the company, as those in the targeted institutions or courses.

Employers were actively working with schools and selected universities to try to improve STEM students' and potential STEM students' knowledge of STEM careers, and some STEM Specialists in particular were increasingly doing so at earlier education stages, well before decisions about university entry were taken.

The majority of STEM Specialist employers were concerned about potential losses of STEM graduates from STEM Core functions to other employers and unrelated jobs, and its negative effect on their ability to satisfy their recruitment requirements; the STEM Generalist and other employers were more likely to see economic benefits in the wider dispersion of STEM graduates. Two main reasons seen by employers as reasons why STEM graduates did not stay in STEM were the perceived greater attractiveness of careers outside STEM, mainly in terms of expected higher salaries, and the graduates' lack of knowledge about careers in STEM Core functions.

Thus, in conclusion, the employer strand of the research has provided some new insights into the demand for STEM graduates, especially in areas outside STEM Specialist employment which is the focus of much of the existing evidence on STEM demand. It has also confirmed that deficiencies in some STEM graduate applicants are seen as a key problem, especially for STEM Specialists seeking to fill core STEM jobs, as it has the effect of reducing markedly the pool of potentially 'recruitable' STEM graduates. This could well be an additional reason why STEM graduates might apply to enter non-STEM jobs instead (as has been suggested, see section 2.1), either failing to succeed in recruitment processes or filtering themselves out beforehand on the basis of a job specification.

The STEM Generalist sector offers a range of employment opportunities for STEM graduates, including work for some large and very prestigious employers, some of which are seen by students as being more attractive than the work or environment that STEM Specialist employers can offer. Some, though not all, are likely to pay more. This is another factor affecting recruitment to STEM Core jobs. Additionally, many STEM graduates have higher levels of certain skills, in numeracy and problem-solving, which are generally in high demand across the economy. STEM graduates can add value to many businesses so are in demand in many areas.

These are clearly strong 'pull' factors away from core STEM work. However, it seems that many STEM graduates lack awareness of the range of career opportunities that exist within the STEM world, in today's fast-moving, fast-changing high-tech engineering and science environment, both in the STEM Specialist sector and in STEM core roles within STEM Generalist employers. This is something that many of the large STEM Specialist employers are increasingly addressing, especially in earlier education stages and through their careers work in schools, but wider efforts are needed. Our interviews have focused mainly on the larger recruiters who have the resources to compete in the graduate market and to get their message over to graduates and students about the jobs and careers they offer. Despite their size, many struggle to do so. It is inevitably much more difficult for the myriad of smaller firms, which form a large part of the STEM demand, to get their message to market, and also to show potential recruits that they have worthwhile jobs for which to apply.

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Appendix A. Research context, methodology and samples

A.1 Context for the research

Over the last few years, a body of evidence has been accumulated through high level STEM reviews and research, by Government and various other organisations, on the demand for STEM graduates and the extent to which the supply of STEM graduates may not be meeting employer needs in the UK. Much of it is familiar to many but it forms an important context for our research study. In particular, it contains the background evidence for questioning why some STEM graduates are not found in STEM occupations or STEM-related work and seeking explanations, and so the origins of our research. It has also helped in developing our research methodologies, especially how we decided to define 'STEM' and 'non-STEM' (discussed in section A.2).

A.1.1 Importance of STEM to the UK economy

There is a general consensus that the future UK economy is dependent on a sufficient supply of STEM skills. Numerous reports have pointed to the increasing importance of STEM disciplines in underpinning knowledge- and technology-based industries and also more generally in promoting innovation and enterprise across society (see most recently CBI, 2009a; BIS, 2009b; BIS, 2009c; UKCES, 2010,). For example, the CBI HE Taskforce report (CBI, 2009a) stated '*The UK has longstanding strengths in business sectors which need scientific, technical, engineering and maths graduates'.* It also emphasised '*value-adding arising from knowledge-intensive services';* while the *National Strategic Skills Audit for England: Skills for Jobs, today and tomorrow* (UKCES, 2010) identified technology as one of the key drivers of future change, and whose impact will be widespread but especially in medical and life sciences, use of e-commerce and developments towards a low-carbon economy.

A 1.2 Demand for STEM skills and qualifications

Alongside these has been a range of other reports emphasising the importance of people as a key asset and the need for an increasingly qualified workforce in the UK. A key message of the 2010 UKCES Strategic Skills Audit is that '*there is significant demand for highly skilled workers in the labour market, with the largest number employed now and in the future as managers, professionals, associate professionals and in technical roles with associated requirements for higher level skills'.* Professional skills in the computing and software sectors, in pharmaceuticals and medical technology, in manufacturing, and in teaching and research, and especially STEM skills, are highlighted as important skill areas (among others) which need to be increased in order to achieve economic growth.

The BIS (then DIUS) review of the UK's future needs for STEM skills concluded from an extensive analysis of available data that the continued shift towards a knowledge-intensive economy would increase demand for higher level STEM qualifications (BIS, 2009a).The share of the workforce with a STEM level 4 (NQF) qualification (equivalent to degree level) was projected to increase from 8.2% in 2007 to 9.8% by 2017. Though there were recognised to be some difficulties making projections of future demand for STEM qualifications due to uncertainties over future business prospects, and in particular projecting demand in different STEM disciplines, the general conclusion was that some limited growth in demand for STEM qualifications in the next decade was expected under most plausible future scenarios.

Further work by the Institute of Employment Research (IER) for CIHE and UKCES in 2009 updated these forecasts (see CIHE, 2009). Demand for STEM graduates was forecast to grow faster than the average (i.e. for all graduates) over the next decade (2007-2017). At an individual STEM discipline level, the fastest rate of growth in demand at both postgraduate and first degree equivalent (NQF4) level would be in agricultural and biological sciences, while the slowest would be in medicine at postgraduate level and in medicine, physical sciences and engineering at first degree level.

A number of other reports covering a range of sectors – from IT to health sciences - have also suggested mid- to long-term growth in demand for STEM graduates, though growth rates vary between sectors and disciplines and there are some uncertainties surrounding them, especially those based on data from employer surveys.

The recent recession is likely to have had an effect on some growth forecasts. For instance, the Association of Graduate Recruiters reported that graduate recruitment forecasts were revised downwards considerably in 2009. All sectors, except utilities, reported a fall in graduate vacancies, with some such as IT employers reporting a fall of as much as 40%. Recent reports suggest some recovery in 2010 though how much is uncertain: some suggest that most leading employers will either increase vacancies or hold them steady this year (High Fliers Research, 2010), while others report continuing short-term reductions, although not as severe as in 2009 (AGR, 2010). The CBI reported increased demand for highly skilled people as the economy partially recovers, with half of employers surveyed in spring 2010 experiencing difficulties filling posts where STEM skills are needed, and even more expecting to have difficulties continuing in the next three years (CBI, 2010).

Thus, the general consensus appears to be one of continuing overall growth in demand for STEM graduates in the longer term, despite the recent dip in graduate recruitment due to the recession, although forecasts vary between STEM disciplines and occupations/areas of work.

A.1.3 STEM graduate output

There is a substantial supply of STEM graduates from UK universities each year. Over 130,000 people obtained first degrees in STEM subjects in 2007, with an additional 37,000 qualifiers at masters level and 12,000 at PhD. STEM subjects (as shown in Table A.1) in aggregate represent approximately 42% of the total first degree output.

Table A.1. First degree qualifiers in STEM subjects from UK HE institutions, 2007 (excluding Open University). Source: HESA (2008)

Subject of study	Qualifiers	Percentage
Medicine, Dentistry, Veterinary Science.	8,905	6.8
Subjects allied to Medicine	30,460	23.3
Biology	4,670	3.6
Sports Science	6,325	4.8
other STEM (other sciences, Agriculture, Psychology)	25,230	19.3
Chemistry	2,665	2.0
Physics	2,255	1.7
Forensic and Archaeological Science	1,445	0.5
Mathematics	5,385	4.1
Computer Science	16,255	12.4
Engineering	17,120	13.1
Technology	2,380	1.8
Architecture, Building and Planning	7,615	5.8
Total STEM	**130,710**	**100**
Total others	179,960	
Total all subjects	310,665	
STEM as % of total	42%	

- Table A.1 shows how the size of the first degree output varies between STEM subjects. The largest STEM subject group is 'Subjects allied to Medicine' (30,000) followed by Engineering (17,000) and Computer Science (16,000); whilst Chemistry, Physics and Technology (each just over 2,000) are much smaller. The 'newer' STEM subject of Sports Science, which has been fast-growing, produces almost as many (at 6,000) as these three subjects combined.
- Amongst the 37,000 Masters graduates in STEM subjects (in 2007), a quarter were in Engineering and Technology and almost a sixth each in Biological Sciences and Computer Science. By comparison, the numbers graduating with masters degrees in Chemistry (400), Physics (350) or Mathematics (1200) were relatively small.
- The 12,000 STEM PhD graduates produced annually include some 2,500 in Biological Sciences, 2,100 in Engineering and 1,000 in Chemistry. STEM PhD graduates outnumber non-STEM PhDs by a ratio of two to one.
- Women and men are roughly equally represented in STEM overall, but considerably under-represented in certain individual STEM subjects. In Physics, the female percentage is just 21%, Computer Science 18% and Engineering 15%. By contrast, in Biological Sciences and Medicine, women make up the majority, with 62% and 59% of all first degree entrants respectively; while in Mathematics and Chemistry, women are slightly in the minority (40% and 42%, respectively, female). There is also some gender bias in A-level qualifications, which feeds through to the HE situation: girls are less likely to gain A-levels in science subjects than boys, though more likely than boys to achieve A-level qualifications in general.
- STEM graduates qualify from a large number and wide range of institutions. The extent to which STEM subjects are represented in different kinds of universities varies. Physical sciences and Mathematics courses are more concentrated in the older universities (in the Russell and 1994 groups), while Biological Science and Engineering are more evenly balanced across different types of universities. Computer Science degrees tend to be offered more at the newer and more vocational universities (many of whom are in the Million+ group). This pattern is affected by institutional admissions policies (some are more dominated by A-level qualifications than others) as well as a range of historical and other factors.

A.1.4 STEM graduate supply trends

Past trends show a lack of consistent growth in STEM graduate output from UK universities in recent years, in contrast to the overall growth trend in graduate output. This is despite efforts (following the Roberts Review in 2002) to encourage more young people to study STEM subjects (see reports from the DTI, Royal Society, Engineering UK, CIHE and others). STEM graduate output fell in the earlier part of the last decade for most STEM disciplines, although some fared better than others, but there has been an upturn generally in the last few years (probably at least partly a consequence of the increased 'Roberts' investment). Particular points of relevance to our research are:

- A-levels are still the most common route into STEM degree study, though IT-based and Engineering courses have a broader qualification entry profile than most other STEM subjects.
- Between 2003 and 2006, applications for degree study in Mathematics and Computer Science dropped more than others subjects, while there were small rises for Physical and Biological sciences and Engineering. All STEM disciplines showed an increase in applicants between 2007 and 2008, but Engineering and 'Subjects allied to Medicine' increased the most. The picture in some subjects varies with student domicile, with growth in Engineering, for example, principally due to non-UK students.
- Excluding Medicine and Veterinary Science, STEM students at UK HE institutions increased by almost 3% from 2003/04 to 2007/08, compared with almost 5% growth for all subjects (HESA, 2009a). However, students in Biological Sciences grew by 13%, Physical Sciences by 17% and Engineering by 8%, while Computer Science fell by 29% and the large subject group 'Subjects allied to Medicine' remained almost static over this period. There has also been strong growth in some of the smaller, 'newer' STEM disciplines, such as Sports Science and Forensic Science.
- First degree qualifiers in STEM increased by 11% between 2003 and 2007, but this compares with a 15% increase in non-STEM subjects. Masters qualifiers in STEM subjects rose at a faster rate (by 35%), similar to non-STEM, while PhD-level STEM qualifiers rose by 18% (also similar to non-STEM).

A.1.5 STEM skill shortages and employer recruitment concerns

Although we have seen growth in output in many STEM disciplines in the last few years, debates about the widespread existence of STEM skills shortages, and whether the UK is producing sufficient STEM-qualified personnel, continue, particularly if much of the growth in some subjects is non-UK students. Several organisations have reported on the situation in their own sector or discipline, highlighting the extent of recruitment difficulties being experienced by employers seeking to recruit STEM graduates, especially into specialist areas or in very specific roles. There is a considerable body of evidence on skill shortages reported in the BIS report (2009a), and many of them are likely still to be an issue. We have not replicated this here, but aimed to summarise the more significant areas of concern relevant to our study, including more recent evidence. It is worth highlighting, however, that data on 'shortages' are produced in different ways and often the evidence is inconsistent between sectors or STEM occupations making it difficult to draw overall conclusions about the extent of STEM skill shortages. The key evidence on STEM skill shortages comes from:

- The Migration Advisory Committee (MAC), which listed a number of 'shortage occupations' (where employment of migrant workers is allowed) in its March 2009 report.

It concluded that, generally speaking, supply and demand in STEM occupations are broadly in balance, though it included some STEM areas of work in its 'shortage' list. This list , updated in December 2009 , identified a number of specific jobs where STEM degree qualifications were likely to be required: *certain* (not all) jobs as civil engineers, physicists, geologists, meteorologists, chemical engineers, mechanical engineers, electrical engineers, design and development engineers, production engineers, biological scientists and biochemists (in particular health-related), mathematics and science secondary school teachers and some engineering and science technicians. EngineeringUK commented in its annual report (2009) that these identified 'shortage occupations' were tied to very specific roles and the needs of employers for specific qualifications, skills, competencies and experiences for the job.

- The BIS (2009a) report showed that recruitment difficulties for employers were greatest in particular areas of biosciences, engineering and IT. The concerns were mainly a lack of candidates of the quality sought. To some extent, these related to applicants not having specific STEM knowledge and qualifications, but to a greater extent employers were concerned about a lack of well-rounded candidates with technical skills and broader competencies, especially mathematical skills and practical work experience.
- The *Insights* report (e-skills, 2008) found that around one in five employers in the IT and telecoms sector – and a similar proportion in other sectors – both large and small in size, reported difficulties in trying to attract applicants with the right skills for IT jobs. There was a reported mismatch between applicants' abilities and company needs in terms of technical and business skill needs. In some cases, recruits who did not fully meet skills specifications were being hired. A separate survey of employers by e-skills found that around 40% of employers experienced mismatches in the business needs and interpersonal skills of new recruits.
- The CBI reported in its 2009 Education and Skills Survey (CBI, 2009b) that a third of businesses recruiting STEM-skilled employees at graduate and postgraduate level were having difficulties, and this rose to 50% in manufacturing and 74% in the energy and water sectors. Over half of employers cited STEM graduates lacking employability skills as a barrier to recruitment, and a similar proportion cited lack of relevant work experience. In the 2010 CBI survey report, 45% said they were having difficulties recruiting staff with STEM skills, with science and manufacturing-based companies having the most difficulties.
- A 2008 review of skills needs in the biomedical sector by the Association of British Pharmaceutical Industries (ABPI) concluded that '*the UK has substantive skills deficiencies in biomedical sciences, many of which are at the heart of translational medicine key to the commercialisation of research'*. Skills gaps in new recruits which had been identified in an earlier 2005 survey were still problematical and in only a few instances had skills improved. Of major concern were graduates' lack of practical experience and application of scientific knowledge and, to a somewhat lesser extent, high-level mathematical and scientific knowledge.

- Research on chemical sciences graduates (IER Warwick, 2008) for the Royal Society of Chemistry highlighted weaknesses in some soft skills of graduates but of more concern to employers was a shortage of specialist chemistry skills, e.g. in physical chemistry, analytical chemistry, and handling of hazardous materials. Of particular concern was graduates' ability to work on large-scale chemistry, at the interface between chemical engineering and chemistry (where UK graduates are seen to be weaker than those of other European countries). There was also a difficulty in finding graduates with sufficient chemical science knowledge to work in sales roles.
- Most recently, a HEFCE commissioned review of evidence on the demand for certain strategically important and vulnerable subjects (undertaken by WM Enterprises in 2009) confirmed other studies' findings that many employers were facing difficulties recruiting graduates in Sciences, Technology, Engineering and Mathematics. But it concluded that there was insufficient evidence of actual widespread shortages. Some specific absolute or near shortages were identified, but these were in highly specialised academic areas where numbers needed were very small. Rather the main problem for recruiters was a quality issue – many vacancies were difficult to fill because not enough candidates came forward to match the standards set by the employers. The employers wanted to see more graduates emerging from universities who were better prepared for the world of work in terms of team-working and related skills. With respect to science graduates, they wanted them better able to handle uncertainty, ambiguity and complexity, to be better trained mathematically, to have more understanding of over-arching scientific principles (i.e. less modular learning), and in some cases better basic skills such as laboratory techniques. However, this research also pointed to employers becoming more demanding, and so it was not just weaknesses on the part of candidates, and so in part their university education, that was being criticised.

Most of the evidence on skill shortages focuses on the traditional STEM sectors and it is not clear how much it relates to other sectors requiring STEM skills and which are more likely to do so in the future, for example the business and service sectors. Furthermore, it is unknown how growth in STEM skills demand in some new and emerging sectors, and/or for specific expertise, is contributing to the reported STEM graduate recruitment problems. This is partly because the evidence is rather piecemeal, brought together from a number of sources, and also because different STEM definitions have been used by organisations depending on the scope of their interest. It is also worth noting that many of the concerns of employers on the perceived quality of STEM graduates are not new but have been cited in many reports over the last decade or so (see, for example Mason, 1999).

A.1.6 Employment outcomes of STEM graduates

Employment outcomes of graduates vary according to their STEM discipline. STEM graduates in aggregate (taking a wide definition of STEM[7]) are slightly more likely to be in work or further study than other graduates (87.5% v. 85.1%), at the six month stage after completing degree study (according to the DLHE survey, HESA 2009). But this definition of STEM includes Medicine and Nursing whose graduate employment rates are very high. Focusing only on the core STEM subject group[8], which is of primary interest in our research, the percentage in work or further study is slightly lower, 85.5%, but very similar to that of the other (non-STEM) graduates. It varies by individual STEM disciplines, being much lower for computer science (80.9%) and higher for life sciences (88.5%).

Additionally, there are significant variations between STEM subjects in the proportions going on to further study after full-time first degrees (mostly postgraduate study) as shown in Table A.2. Over a third of graduates in life sciences and Physics do so, compared with just 11.5% in Engineering and 10.5% in Mathematics. This may be because graduates in some disciplines see more value in entering employment than taking a higher qualification or that higher qualifications are more in demand by employers in some disciplines than the others.

[7] This wide STEM coverage includes: Medicine, Nursing, Psychology, Geography, Architecture and Agricultural Science as part of science and engineering, while our study's STEM definition excludes Medicine, Veterinary Science and Nursing (see section A.2)

[8] Those we call 'core' STEM subjects are life sciences (which is the combination of Biological Science and Subjects allied to Medicine, excluding Nursing), Physics, Mathematics, Chemistry, Computer Science and Engineering and Technology.

Table A.2 Destinations of UK domiciled first degree leavers who studied full-time by STEM subject of study 2007/08

	Work	Further study	Unemployed	Other	*N* (100%)
Life sciences	70.3%	18.2%	7.1%	4.3%	17,265
Physics	47.4%	36.8%	9.3%	6.5%	1,605
Chemistry	49.1%	36.7%	8.9%	5.2%	1,905
Mathematics	61.4%	23.6%	8.6%	6.4%	3,585
Computer Science	70.0%	10.9%	14.6%	4.5%	7,975
Engineering and Technology	72.6%	11.5%	10.5%	5.4%	9,530
Total of above (core STEM)	68.2%	17.3%	9.6%	4.9%	41,865
Total STEM (wide)	72.5%	15.0%	7.8%	4.8%	81,975
Total other (non-STEM)	69.3%	15.8%	9.0%	5.9%	109,765
Total all subjects	70.6%	15.5%	8.5%	5.4%	191,740

Source: HESA DLHE survey (HESA, 2009)

The HESA DLHE survey gives an indication of the initial outcomes of graduates (at the six month stage) but it is increasingly the case that graduates are taking a longer time to settle into employment than in the past, with more taking time off to travel after completing first degrees or only starting to apply for jobs after graduating. HESA's 'longitudinal' destinations survey (L-DLHE) undertaken three and a half years after graduation is arguably a better measure of graduate outcomes. This shows very high percentages in employment or further study (96.6%) for all first degree graduates qualifying in 2004/05, surveyed in 2008. It is a very similar figure for STEM graduates (whether considered as 'wide' subject coverage of STEM or the narrower 'core' STEM discipline group). STEM graduates in aggregate are as likely as non-STEM graduates to be in full-time work (both around 76%). It is also worth noting that around a quarter of Physics and Chemistry graduates are in further study, compared to the average of 11% for the core STEM subject group and just 4% for Engineers.

These data show that early career paths vary markedly between STEM subjects. They also suggest that demand from employers varies according to STEM discipline, as indicated by initial graduate unemployment figures.

We now turn to the employment distribution of STEM graduates and, in particular, evidence showing the extent to which STEM graduates are found in non-STEM areas of work. Historically, the manufacturing sector has been the main employer of STEM graduates but this pattern has shifted over time and there is now a much broader spread of STEM graduates across industrial, business and services sectors. The number of STEM graduates (excluding medicine from the STEM subject group) employed in the 'business and other services' sector now exceeds the number in the 'manufacturing' sector (see IER's analysis of Labour Force Survey data in CIHE, 2009). STEM graduates represent a higher share of total employment in the 'business and other services' sector than in 'manufacturing'.

This change is a reflection of industrial structural and organisational change over the last few decades:

'..*the continuing trends towards specialisation and lengthening of supply chains, with roles in research and development being separated out from traditional activities and being re-classified as services to business rather than core manufacturing activities*' (CIHE, 2009)

Another factor is that today's high-tech manufacturing sector is much less labour-intensive than it was in the past, so many of its employers require relatively small numbers of highly qualified people with specialist STEM skills. It is also worth noting that a range of different types of businesses are included in the coverage of the 'business and other services' sector, from highly specialised technical and research organisations to those providing financial and consumer services. Their needs for STEM graduates are likely to be different but some are likely to employ STEM graduates in scientific and engineering occupations.

The CIHE report (2009) also shows how STEM graduates and postgraduates are employed across a number of different occupational categories, though its analysis was limited to broad occupational categories:

- The largest numbers of STEM graduates (NVQ4 level, and excluding medicine from STEM subject group) are in two occupational areas – Science or Technical Professional and Corporate Manager – while smaller but still significant numbers are employed in several others: Health Professional, Teaching or Research Professional, and Scientific or Technical Associate Professional;

- STEM postgraduates (i.e. NVQ5) are more concentrated in Science and Technical Professional, and Teaching or Research Professional, occupations, with a third slightly smaller occupation, Corporate Manager, also of importance;
- A small number of both STEM graduates and postgraduates are spread across other occupational categories, including some lower level occupations.

There are limitations in using the LFS to distinguish between STEM and non-STEM work[9]. One attempt (in the BIS analysis, 2009a) was to group the SOC codes used in the LFS into a ‘science’ occupational category. Using this approach and LFS data, just under half of STEM-qualified graduates[10] were working in a ‘science’ occupation[11]. This overall figure, however, masks significant differences between STEM subjects, from over 60% of graduates in ‘Subjects allied to Medicine’ to 50% in Engineering, about a third in Mathematics and Physical sciences, to just 21% in Biology, considered to be working in ‘science’ occupations.

Other evidence on the types of jobs entered by STEM graduates can be seen in the HESA DLHE survey on initial graduate destinations, though it also uses broad occupational categories (see Table A.3). Points of note are:

- Chemistry graduates are the most likely of all STEM graduates to enter Scientific Professional occupations. Engineering graduates, especially Civil and Mechanical Engineering, are clustered in Engineering Professional occupations. For other STEM subjects, these two occupational areas are entered by relatively fewer graduates.
- IT and Computing graduates are clustered in IT Professional occupations. Mathematics and Sports Science graduates are the most likely to enter Education Professional jobs. Mathematics graduates, and also but to a lesser extent Physics graduates, are the most likely to enter Business Professional roles.
- Architecture and Building graduates are clustered in Other Professional, Associate and Technical jobs (including, for example, architectural assistants, quantity surveyors, planning officers). Biological, Environmental, Physical, Geographical and Terrestrial Sciences, and IT and Computing, graduates have the next highest percentages entering this group of jobs.
- Architecture and Building, and Environmental, Physical, Geographical and Terrestrial science graduates are slightly more likely than other STEM graduates to enter management jobs (industrial, commercial, public sector).
- Physics graduates have the widest occupational spread.

[9] Discussed further in section A 2 on STEM definitions
[10] includes medicine and dentistry in STEM scope
[11] As shown later in section A2 on the different definitions of STEM occupations, this covered a number of jobs closely associated to science or technology (e.g. chemists, engineers, scientific researchers, statisticians, technicians etc.), but did not include science teaching

Table A.3. Type of work (Job groups) of 2008 first degree graduates in STEM subjects, six months after graduation, shown as percentages (only most common job groups are shown).								
	Number employed	Managers	Science Prof	Eng Prof	IT Prof	Education Prof	Business Prof	Other Prof, Assoc. Tech
Biology *	1945	6.7	12.4	0.7	0..9	4.4	5.0	16.3
Chemistry	1000	6.0	23.5	4.0	2.1	5.1	9.9	8.1
Env., phys., geog. & earth science.	1470	12.0	2.1	2.7	1.6	2.5	8.1	17.9
Physics	735	8.9	9.9	7.2	9.5	5.9	18.3	6.9
Sports science*	3815	8.4	0.6	0.4	0.4	12.5	4.3	1.6
Mathematics	2120	7.8	1.1	1.8	6.4	9.5	37.4	3.4
IT and computing*	6310	9.1	0.1	1.9	43.7	3.0	5.1	10.4
Arch. and building	3820	13.3	0.1	4.5	0.4	0.4	2.9	59.6
Civil eng.	1290	4.7	0.2	74.5	0.5	0.2	2.5	7.9
Elect+elect-ronic Eng. *	1635	7.9	0.3	33.8	21.3	1.0	2.8	4.0
Mechanical Eng.	1520	7.1	0.1	62.9	2.1	0.8	4.2	5.8
All subjects	**148,800**	**9.3**	**1.2**	**3.2**	**3.2**	**7.1**	**7.5**	**5.2**

* omitted due to lack of space in table are columns for: Health professional and associate professional roles - 3.9% of Biologists (but <1% for other STEM subjects); Arts, design, cultural, sports professional roles - 5.2% of IT and Computing, 7.2% of Electrical and Electronic Engineering, and 23.6 % of Sports Science graduates.

Source HECSU, 2009.

This seems to indicate that the type of work entered by certain STEM graduates, such as engineers and computer scientists, is more likely to be associated with their discipline area than is the case with others (such as Physics or Mathematics graduates).

A number of organisations have analysed the DLHE survey data in more detail for specific groups of STEM graduates of relevance to their own sector or discipline. These include some which have reworked the occupational data to focus better on STEM and non-STEM types of work.

- Engineering UK stated that 71% of Engineering and Technology (E&T) graduates in 2008 entered an E&T occupation, including 46% as engineering professionals, while only 19% went to non-E&T jobs (Engineering UK, 2009). Civil Engineers were the most likely to be working as engineering professionals and the least likely to be in non-E&T jobs (just 8%), while Electrical and Electronic Engineers were the most likely to be in non-E&T jobs (21%). In terms of employment sector, 63% of E&T graduates were recruited to firms whose primary activity is E&T and 11% to firms whose primary activity is associated with E&T. Only 3% joined firms in the financial sector, but around one in six of them were doing E&T work there, mainly in IT. The manufacturing sector was the main recruiter of E&T graduates.

- Cogent (the SSC for the energy and process-related industries) has undertaken analysis of DLHE data for Cogent-relevant disciplines (defined as Chemistry, Biology and Mechanical, Electrical and Electronic, Chemical, Process and Energy Engineering). Graduates in these STEM subjects enter a range of employers: 20% to manufacturing, 25% to business and research services, 9% to education and 7% to the public administration and defence sectors.
- The Royal Society's 2006 report showed that manufacturing remains a significant destination for STEM graduates, though its share of employment has been falling – 27% of all Chemistry and 22% of all Engineering and Technology graduates who entered employment in 2004 joined manufacturing firms. By contrast, just 7% of Physics graduates did so. These percentages were higher for graduates with enhanced or integrated Masters (i.e. 4 year) degrees in Chemistry, Engineering and Physics. It also showed that 43% of Mathematics and 30% of Physics graduates entered financial and business activities sectors (including accountancy, management consultancy and PR/marketing), compared with 23% of Engineering, 20% of IT and 18% of Biology graduates. In relation to Masters graduates, the Royal Society's 2008 report showed that the proportions who enter Science or Research Professional occupations varied from almost 40% in Chemistry to under 8% in Engineering and Technology, Computer Science and Mathematics. Business and Statistical Professionals jobs are taken predominantly by Mathematics rather than other Masters graduates. With regard to Doctoral graduates, the report showed that a sizeable proportion in all STEM subjects enter Research Professional jobs, with the highest proportion in Physics (almost 50%), and lowest in Engineering and Technology (20%).
- A HECSU study for DIUS in 2008 concluded that employment outcomes for postgraduates matched their subject studied to a large extent. It highlighted the higher proportion of biosciences, compared to Physical sciences, postgraduates entering scientific, research, analysis and development professional occupations, and a corresponding lower proportion entering business, IT or financial professional jobs.
- Analysis by Vitae (2009; 2010a) of the employment destinations of UK doctoral graduates has also showed variations in outcomes by STEM discipline. Of particular note is the extent to which Physical sciences and Engineering Doctoral graduates enter employment in the business, finance and IT sectors (around 20%), compared to much lower numbers from Biological Sciences (5-7%). In certain disciplines within the Physical science and Engineering grouping, this proportion was higher still: Mathematics 34%, Civil Engineering 31% and Computer Science 26%.

The latest L-DLHE survey (HESA, 2009) provides further evidence relating to outcomes three and a half years on. STEM graduates in some disciplines are more likely than others to be working outside manufacturing or other industries, in particular:

- 22% of first degree Mathematics and 10% of IT graduates were in the finance sector, but very few from other STEM subjects (under 5%);
- The public sector (administration, defence, social security) employed approximately 15% of Biological and Physical sciences graduates;
- Education employed 21% of Biological Sciences, 18% of Mathematical Sciences and 16% of Physical Sciences graduates.

We also can draw from the interim results of a 5 year follow-up study of Physics graduates (by the Institute of Physics, due to be completed in 2010) which showed that 30% were employed in industry with the remainder in a wide range of other sectors, including Government (9%), Services (21%) and Education (13%). The Physics graduates were carrying out a variety of roles, the most commonly mentioned being technical support and consultancy (each 12%), teaching and development (each 11%) and applied research (8%). A broad range of other jobs were given including work mainly unrelated or loosely associated with their degree, such as auditing, legal, policy and IT work. Interestingly, 59% stated that their current occupation was either not at all related or not particularly related to physics. However, three quarters stated that they found their Physics background either very or quite useful in their current occupation.

A.1.7 Influences on career choice

We finish this contextual section by summarising what is known from the literature about career choice in relation to STEM graduates. While it is apparent that labour market factors, such as earnings and relative demand from employers, affect the employment outcomes of STEM graduates and their likelihood of entering different types of work, other factors are likely also to be relevant, including individual career choice. These in turn are affected by a myriad of factors, and chance events, as a wide range of literature has shown.

Many of the influences have impact at an earlier stage than the focus of our study (which is the transition from higher education to work). For some students, the decision to enter a STEM occupation – or not – is likely to be part of a long-term process of career decision-making with earlier influences at school and home interplaying with subsequent experiences at university or during work experience and in job search. These earlier and more general influences can include curriculum content, subject options, careers advice, parental attitudes, popular images and so on, and they impact differentially on people of different gender, ethnicity and social class. They have been documented in a number of published literature reviews for various organisations (most recently the BIS Science and Society Expert Group), and in research, for example by Pollard et al (2003), Donnelly and Jenkins (2006) and Vitae (2009). There is also wider research which includes reference to STEM subjects, for example, the first stage report of the *Futuretrack* study (HECSU, 2008a).

None of these influences acts alone, and some are more important at certain educational stages. Frequently it is a mixture of factors relating to perceptions about careers, school and personal experiences (acting together and interacting with each other) which motivates a young person to choose to study a STEM subject at university (see BIS, 2009e). For many young people the focus is on the immediate 'decision' (such as subject choice, or degree choice) rather than the broader context of a 'career decision'.

A weakness of much research undertaken to date is that much of it focuses on career-related decisions at particular times, rather than on students' career decision-making processes taken over time, or on how known factors actually operate individually or together to determine long-term outcomes. Some researchers suggest that students seem to appear more decided in survey results than they actually are, and that there may be more capriciousness in student decision-making than is acknowledged in research reports (this is highlighted in research by Lichtenstein et al. 2009 in the USA). Nevertheless, it is still worth highlighting the more significant issues identified from previous research relevant to STEM study or STEM career choices:

- Gender, social class and ethnicity: A main focus of much of the academic research in this area has been around gendered occupational stereotypes and the influence of gender on career choice (Pollard et al., 2003). Studies have emphasised the pervasive nature of stereotypes which can have an influence from a very early age and how women and girls prefer certain types of work and aspects of work, while boys and men prefer others. Other personal factors, such as social class and ethnicity, can also have an influence and interact with gender (as shown in The Royal Society report, 2008). Recent research on attitudes towards participation in higher education (BIS, 2009e), and the *Futuretrack* study (HECSU, 2008) found variations in subject choice were strongly associated with gender, ethnicity and class differences. Milner (2009) showed how those most likely to aspire to and achieve a professional job had a parent who was a professional.
- Public image of STEM: A second group of influences identified in research is the public image of STEM and public opinions on science and technology careers. Public awareness about engineering as a profession, for example, is recognised as being poor (see surveys for ETB and the Royal Academy of Engineering, in ETB, 2008, and recently, the BIS Science and Society Expert Group reports, March 2010). Differences have been identified between social class groups, gender and age, with the less well-informed tending to be young people, women and those in lower social class groups. One particular issue repeatedly highlighted has been that relatively few people know what engineers actually do, while another is confusion between the different types of engineers. Further, the contribution that engineering makes to wealth and human/social

wellbeing is not widely recognised, especially amongst young people. However, some recent research has found somewhat more positive views (reported in Engineering UK 2009).

- Levels of well-being in a country: These negative views about science and technology are not restricted the UK but shared by young people in many other countries. An international comparative study (the ROSE project) found that young people's desire to choose a career in science and technology was related to a country's HDI index (a measure of well-being combining health, education, GDP, life expectancy, etc), see Sjøberg and Schreiner, 2007. This has been linked to the view in most developed countries, like the UK, that engineering's role was crucial at the time of industrialisation but is less so now. This change in our values may explain the low image and reputation of science and engineering careers among today's youth.
- Subject choices at school: Another key set of issues identified in research is around choices of subjects of study at school**.** The Roberts review (2002) and others commented on the way that many pupils view the choice of science and technology as narrowing their future career options (which is an incorrect view, many current careers experts would say) rather than broadening them. The Roberts review reported that a lack of knowledge of, or background in, science amongst careers advisers meant that they could be unwilling or unable to advise on future options, or at least could not do so in an informed manner.
- Ability and subject difficulty: Several reports have highlighted how STEM subjects are perceived to be more difficult to study, and in which to attain high grades, which could be seen as disadvantageous to students seeking high A-level grades for entry to university (see CEM, 2008 and ETB, 2006). There appears to be insufficient evidence to show how perceptions of difficulty of STEM subjects actually change degree application choices, while the link between perceived ability and subject choice is well-established.
- Careers 'interventions': Numerous research studies have shown that children develop opinions about STEM subjects at an early age and, as a consequence, there is now a large range of interventions and activities supported by and engaged in by the engineering and science communities, at various stages within and outside the school curriculum. Many of these promote young people's interest in science, mathematics or engineering rather than necessarily their interest in or the benefit of pursuing careers in STEM.
- Careers advice and guidance: Lastly, a volume of evidence exists on the impact and quality of careers advice and guidance. Much of the research has been on subject and career choices in general rather than specifically relating to STEM, but some key points highlighted in the ETB literature review by Pollard et al. (2003) were:
    - how material designed to inform young people about STEM study can be 'filtered out' by parents and individuals, and also by institutions and careers advisers themselves, where few have STEM backgrounds or direct experience;
    - much careers support, especially by employers, was being targeted at older children where attitudes had already hardened against STEM options;

- o there were concerns about the effectiveness of careers advice and information relating to STEM subjects at a time when science study was decreasing in popularity and also when economic factors often affected STEM graduates' job prospects, albeit temporarily.

Turning to career intentions at the stage of applying to HE, Purcell and Elias, in the first stage report of the *Futuretrack* study (HECSU, 2008), comment on the importance of subject choice in their choice of university which can affect subsequent career trajectory. There is a more restricted range of subjects in certain universities (including some STEM subjects, like Chemistry, and particular STEM courses of study). The research showed also that applicants to Mathematics, Computing and Physical sciences were more likely to say they applied to university to get a good job than applicants to other subjects (other than law). Careers advice was seen as more influential in this decision by those opting for Engineering and Technology than for most other subjects. Among the reasons for choosing their degree subject, enjoyment of subject was most likely to be the main reason given by applicants to STEM degree subjects (over 70% .and even higher 89% to Physical sciences). Other reasons included their attainment (they had obtained good grades). Employment- or career-related reasons were mentioned much less often.

This is similar to findings in an earlier survey (Purcell and Picher, 1996) where graduates from natural sciences were much more likely to have chosen their HE course for 'hedonistic' reasons (primarily related to interest or enjoyment of the subject) than for 'pragmatic' reasons (related to longer term career plans). These two reasons were equally rated by Engineering and Technology students in that survey, while Mathematics and Computing students had similar results to those in the natural sciences.

The *Futuretrack* stage 2 survey (of first year HE students in 2006) continued this theme. It showed that enjoyment of the subject was rated more highly as a reason for taking their course among Biology, Veterinary and Agriculture Sciences, Physical Sciences, Mathematics and Computing students than for the sample as a whole (i.e. all subjects). Other research, however, has produced slightly different results. Students interviewed in 2008 in a BIS study, 2009e, who were intending to take STEM subjects in HE were more likely to do so for economic reasons, including seeing them as being in demand by employers and expecting to get a better paid job, than those taking non-STEM subjects. This is more recent research than the literature cited above and may reflect some change in views by potential students as a consequence of changes in the cost of HE study, or it could be due simply to methodological differences.

A 1.8 Career intentions of HE students

There have been only a small number of studies which have explored career intentions of students while on STEM subject degree courses at university and their reasons for pursuing, or not, a career related to the subject of their degree course. Evidence from a CRAC survey of

Engineering undergraduates in 2007 (covering all years) showed that most (82%) were happy about their choice of Engineering as a degree to study (in that they would make the same choice again) and most did want to pursue engineering as a career. A number of intrinsic reasons were given for choosing engineering as a career, the top three being: the chance to work on exciting projects, an opportunity to put learning into practice, and the chance to shape the world around them. Women were more interested than men in the latter. The main reason for not pursuing a career in engineering was that it did not fit with their self-image (over half cited this), along with extrinsic reasons such as that salaries were uncompetitive, and that employers in other sectors were more assertive with career messages. Women tended to be more put-off than men by image-related factors and less by salary (although sample numbers were rather small for conclusions on gender differences).

An interesting finding from this CRAC research is how work experience seemed to be a major factor of influence on the career choices of Engineering students, as were employer presentations/information, the latter especially for final year students. Other influences, such as parents, faculty, peers and the careers service, appeared to have some, although lesser, impact on career decision-making. CRAC also noted different levels of commitment to engineering as a potential career between students in different years, with evidence for a decline in commitment in later years, which was particularly marked for female students.

A small research study in the US (Lichtenstein et al., 2009) on Engineering undergraduates' career decision-making also showed commitment to pursuing engineering careers, but less so than in the UK study above, with only 42% definitely intending to do so, with 44% showing some uncertainty and 24% definitely not committed. This research covered only two universities, one a state-funded technical institution and the other a private university with a more comprehensive subject coverage. Engineering students at the technical university reported greater likelihood of pursuing engineering careers. Other interesting findings from this US study were '*the fluid and quixotic nature of students' decision-making*', which was highlighted in their interviews; and that single experiences and events during their undergraduate programmes – such as an internship, advice from a mentor or interaction with faculty staff – could sway their career options, in some cases it seemed disproportionately. This work also found, as others have (see, for example, ETB studies in the UK, cited earlier, and Stevens et al., 2008 in the US), that students' perceptions of engineering are very limited at the time they are making career decisions. External influences, such as family and career websites and career campus centres (careers services), also have an influence, more so it seems (in that study) than any support from within their Engineering departments.

In a survey on attitudes to careers and work in the IT sector, among computing/IT and also other undergraduates (also by CRAC, 2008), a high proportion of computing/IT students were satisfied with their degree choice (80%), and similarly a very high proportion (90%) were seeking a career in IT, over half with a definite intention to do so. Like the Engineering students surveyed, the overwhelming majority had chosen computing/IT at university due to a personal interest or aptitude in IT (and more men gave this reason than women); and around a half had enjoyed the subject at A-level. Most had positive views about a future in the IT sector (80% believed it had a bright future and many job vacancies, and 78% agreed that it provided lots of opportunities to earn a high salary). Those who intended to seek a career in IT gave a variety of reasons, the most popular being related to applying their specialist knowledge, working on exciting projects and expecting to be suited to the technical work involved. However, some negative views were also expressed, pertaining to the image of the industry and of being an IT professional. The main reason for not intending to work in IT, expressed by undergraduates of other subjects, was that work was expected to be boring; while amongst the computing/IT students it was an active preference for something new or where rewards were better (although those numbers were very small).

Stage 2 of *Futuretrack* surveyed students in their first year and asked them about their career expectations. There is some analysis available on Chemical Science students (reported in RSC, 2008) which shows that a little over two thirds of students definitely hoped to use their chemistry or other scientific knowledge in their jobs, and only a small proportion (16%) wanted to change to a different area of work. The biggest change was in the branch of chemical sciences they wanted to work in, reflecting perhaps their exposure to a wider range of options since starting their degrees. The two sectors of preference were healthcare manufacturing (including pharmaceuticals and biotechnology) and fine chemicals (including oil and paint).

It is perhaps interesting to note that prospective MChem students in that study had chosen this option over a BSc course because they expected the additional knowledge and qualification to help their employment opportunities. A number of enhanced four-year degree programmes (MEng, MChem, MPhys) are being provided by universities; they offer additional modules, work experience and take some topics to greater depth than can be accommodated in the three-year bachelor degree. Some are geared specifically for careers in STEM (as engineers or research chemists) and universities often market them with this emphasis. However, there does not seem to be much research yet undertaken specifically on the views and experiences in the labour market of M-level STEM graduates.

Another source of data on aspirations and behaviour of final year students is provided annually by a large-scale commercial survey undertaken by High Fliers Research (with a sample of 16,000 focused on the UK's leading universities, mainly Russell group) to which many business organisations subscribe. It is a 'high calibre' sample, with most students having at least three A-levels at A or B grade, and is not representative of the whole final year UK university population. However, some interesting and relevant points from the report of students surveyed in February 2009 were that, overall:

- Of those categorised as 'job hunters', almost 10% wanted to work in each of advertising/marketing, law and education, with slightly fewer in accountancy (7%) or professional services (7%), and very few wanted to work in engineering or R&D;

- Being challenged (54%), genuine responsibility (42%) and gaining a professional qualification (33%) were the key elements being sought in a first job;

For STEM subjects shown in the report:

- 50-59% of Engineering, science and Computing students wanted to work for a major employer, a slightly higher proportions than for the whole sample (all subjects);
- Engineering and Computing students were more likely to be looking for or expecting to start a graduate job after university (57% and 55% respectively) than science students (35%);
- Twice as many science students intended doing a postgraduate course (36%) than Engineering and Computing students (18% and 15% respectively);
- Of the Engineering students, 70% had applied to employers in engineering, and a further 11% to R&D, 10% to consultancy and 7% to IT, while 37% had applied to teaching. Relatively small numbers had applied to employers in accountancy (5%) and investment banking (8%);
- Computing students also had a core employer group, in this case the IT sector where 70% of students had applied. The next most popular sector was consulting (15%) and investment banking (14%), while 9% had applied to employers in R&D, 7% to media and 6% to engineering**;**
- The pattern was different amongst science students where a broader set of employers was chosen. The main employer group was R&D (34%), a further 14% had applied to teaching, and 11% and 10 % to accountancy and investment banking employers respectively.

Finally, a few studies have focused on the career intentions of postgraduate students, mostly at doctoral level rather than Masters students:

- Research by the Royal Society of Chemistry in 2006 with Chemistry PhD students showed that the vast majority wanted a career that required their scientific background. However, it also showed that women were more likely to be put off Chemistry research during their PhD study than men, and more likely than men to be re-thinking their intentions to pursue an academic career during their PhD study.
- Two follow-up studies focusing on female retention in Chemistry and Molecular Biosciences (reported in HECSU/Prospects summary reports, summer 2009) suggested that experiences were different in the two disciplines. In contrast to the Chemistry PhDs, the female Molecular Bioscience PhDs did not change their minds about a research career. It was suggested that a contributing factor was the standard and availability of careers advice which can be variable across HE; for example, there was more awareness of career opportunities outside academia among Chemistry than Molecular Biology PhDs, while more Chemistry graduates were aware of the general skills they possessed which are attractive to other employers. Cultural differences within the

research communities of the two disciplines were possibly another factor affecting women's career decisions.

In conclusion, there is some evidence from the research literature which provides indications of undergraduate student career intentions and but this is limited in scope to students of certain STEM subjects, mainly in engineering, IT and some sciences. There is a much larger body of research which has explored more generally factors likely to affect decisions to pursue a STEM career, or not, and in particular those that seem more significant in choosing a STEM subject in undergraduate study. However, this has not explored in any depth the reasons for pursuing a STEM occupation or career as opposed to other directions, nor has there been much differentiation between students of different STEM subjects. Our own research survey work is specified to inform this.

A.2 Study definitions – STEM and 'non-STEM'

Although the term STEM is used widely, there is no uniform agreement on what it covers exactly and some policy and review documents give no definition at all. Some refer to STEM in terms of academic disciplines, others to occupations or sectors. Further, many 'non-STEM' jobs actually require technology skills or knowledge.

The research specification for this project referred to STEM as 'Science, Technology, Engineering and Mathematics' with additional guidance as to what should be included in terms of degree subject disciplines. It was important at the outset to reach agreement with BIS on the scope of the research in terms of STEM disciplines, STEM sectors, STEM jobs and 'non-STEM' jobs. Crucially, we needed to find a simple way to defining different aspects of STEM which we could use consistently in our research instruments and analysis in order to come up with clear findings.

We reviewed a number of different approaches, to defining STEM, previously taken by other organisations, and the issues these raised, before agreeing definitions for this study.

A.2.1 Previous work on defining and using 'STEM'

It is apparent from the literature that STEM has become the term used most widely today to refer to a range of subjects (in Science, Technology, Engineering and Mathematics). In recent years, the term STEM has become widely adopted across Government in policy and delivery; including the former DCSF's national STEM strategy, the STEM High Level Skills Strategy group, HEFCE's National HE STEM programme, STEMNET etc. The acronym STEM is also used internationally, for example in the USA, to refer to more or less the same subjects as in the UK.

However, in the past, these subjects have sometimes been referred to as SET or STM, rather than STEM; for example, the ‘Roberts Review’ in 2002 defined SET as ‘Science, Engineering and Technology (including the mathematical sciences)’; while STM was used by The Royal Society in its 2006 report on degrees in Science, Technology and Mathematics, although engineering subjects were within its scope.

Although STEM (and previously SET/STM) usually refers to a range of subjects or disciplines, it can also be used to refer to skills – for example, by the CBI (2009a and 2010) and HEFCE (2010). The DTI (in its 2006 report on the demand and supply of people with SET skills) defined SET skills in terms of people holding qualifications in SET. Although holding particular qualifications is often used as a proxy for ‘skills’, it has some flaws as people may have developed capabilities and competencies outside their study for qualifications. However, this proxy is frequently used in the STEM literature and terms like ‘STEM skills’ and ‘STEM subjects/qualifications’ tend to be used interchangeably.

A.2.2 STEM as subject of qualification

A number of educational and qualification classifications are currently in use in the UK and these identify STEM areas of study and/or students. They are generally based on internationally agreed definitions of science and technology[12]. At higher education level, STEM is defined *by qualification* most commonly by reference to certain JACS[13] subject codes (as used in HESA, UCAS and Labour Force Survey data, see Table A.4).

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[12] see EUROSTAT and OECD reports in the 1990s which sought ways of classifying occupations and activities related to science and technology

[13] Joint Academic Coding System (HESA)

Table A.4. JACS subject groups relating to STEM	
(A)	Medicine & Dentistry
(B)	Subjects allied to Medicine
(C)	Biological Sciences
(D1, D2)	Veterinary Science
(D0, D3-9)	Agriculture & related subjects
(F1-3, 9)	Physical sciences
(G0-3,9,91)	Mathematical Sciences
(G4-7,92)	Computer Science
(H, J)	Engineering & Technology
(K)	Architecture, Building & Planning

Although the JACS classification is in common usage for identifying subjects, the definition of STEM can vary depending on which JACS subjects are included. Some users have preferred a broad definition for STEM, taking in a wider range of subjects; for example, CIHE included medicine and medicine-related subjects within STEM in its 2009 report on STEM demand. The BIS report on the demand for STEM skills (BIS 2009a) also included medicine (as well as nursing) within its scope.

Meanwhile others have narrower definitions, depending on the focus of their interest, for example:

- COGENT (the Sector Skills Council for the chemicals, pharmaceuticals and polymer processing and oil-related industries) used the term ‘science and engineering’ graduates to cover those with degrees in Chemistry, Biology, and Mechanical, Chemical/Process/Energy and Electrical/Electronic Engineering;
- EngineeringUK (previously the Engineering & Technology Board, ETB) used the term ‘Engineering and Technology’ for the subject disciplines in JACS codes H and J (see Table A.4) and excluded the sciences and computing from the group of subjects defined by CIHE, above;

- SEMTA, the Sector Skills Council for the science, engineering and manufacturing technologies sectors, considers relevant STEM subjects to include only Physical Sciences (JACS codes F1, F2, F3 and F9), Mathematical Sciences (G0 – G7, G9) and Engineering and Technology (H0-H9).

A.2.3 STEM as an industrial sector

The JACS subject codes above are very helpful in underpinning a common agreement of STEM in terms of disciplines and therefore a common understanding of STEM graduate qualifications. However, there is no such simple classification in common use which captures well the range of STEM employment activities or industrial/business sectors.

While it is clear that STEM qualifications and skills are likely to be needed more in certain industrial and business sectors than others, it is not clear what might comprise a ‘STEM sector’. London Development Agency research on STEM skills in 2007 found little agreement on what might be STEM core sectors. One difficulty relates to IT – used in almost all sectors, so IT professionals are found in all those sectors as well as in the specialist IT sector itself (Royal Academy of Engineering, 2009). According to the CBI (2009b), nine out of ten businesses employ STEM-skilled people, *‘valuing their analytical capabilities and problem solving skills’*. The Science Council has recently highlighted the vast array of settings and professions where scientists work, from pharmaceuticals and diagnostics to teaching and public policy (Science Council, 2010). It therefore seems unlikely that there are many business sectors which do *not* require some ‘STEM skills’ to some degree, so trying to define a specific subset of business sectors as ‘STEM’ may be neither useful or realistic.

There have been attempts, though, to identify specific employment sectors which are more likely to have significant STEM skills needs, and group those into ‘STEM core sectors’. SIC (Standard Industrial Classification) categories at different levels are used to make sector groupings but there are difficulties aligning sectors which have significant STEM skill needs with SIC categories. For example:

- EngineeringUK identified a ‘STEM footprint’ (see ETB, 2008), defined as the sectors covered by seven Sector Skills Councils (SSCs), each of which has a SIC 2-digit code coverage (as shown in Table A.5). While this captures clearly some key sectors likely to be employing STEM subject graduates, it almost certainly underplays the prevalence of STEM skill requirements across the wider economy, such as in digital media, transport, and parts of Government, which are included in other SSCs.

Table A.5. STEM Footprint' as defined by SIC codes (2003) within SSC coverages		
Sector Skills Council	**Sectors covered**	**SIC code**
Cogent SSC	Chemicals, pharmaceuticals, nuclear, oil , gas, petroleum, polymers and signmaking	11, 23-25 (excl 24.3, 24.64, 24.7, 25.11, 25.12) 50.5
Construction Skills	Construction	45.1, 52.2, 45.32, 45.34, 45.4, 45.5, 74.2
e-skills	IT, telecoms, contact centres	22.333, 64.2,72,74.86
Energy &Utilities	Electricity, gas, waste management and water	37, 40.1,40.2, 41, 60.,3, 90.01, 90.02
Proskills	Process and manufacturing of extractives, coke, refractories, building products, paper and print	10, 12-14, 21.24, 22,2, 24.3, 26.1, 26.26, 23.4 - 26.8
SEMTA	Science, engineering and manufacturing technologies	25.11, 25.12, 27-35, 51.52, 51.57, 73.10
Summitskills	Building services engineering	31.1, 31.62, 33.3, 45.31, 45.33, 52.72

Source: ETB, 2008, Appendix 3

- The Royal Society in its report on STM graduates (2006) identified six key sectors for their employment – R&D, manufacturing, financial activities, education, health and social work, public administration/defence, and other sectors (based on SIC codes).
- The DTI 2006 report identified 20 categories using SIC 2-digit level codes as being the most significant for employment of SET graduates. It defined this as being where SET graduates represented at least 5% of that sector's employment. These included R&D, computer-related activities, health/social work, education, and chemicals.

A.2.4 STEM as an occupation or activity

The relatively few reports or documents from organisations that refer specifically to 'STEM occupations' or 'STEM jobs' define them, in the main, using clusters of Standard Occupational Codes (SOCs). As with using SIC codes to try to identify STEM employment sectors, this approach also suffers (arguably more so) from problems of ‘fitting’ certain identifiably ‘STEM’ jobs into categories of SOC, especially in new and emerging employment fields. Additionally, it is recognised there is often some arbitrariness in allocating some jobs to specific occupation codes from the information available (for example, by respondents in the LFS or HESA surveys on graduates) leading to concerns about reliability of data on STEM jobs which are defined by SOCs.

SOC codes have been used to define STEM occupations, at different levels of detail, for example, by:

- IER in its projections of demand for STEM graduates (in CIHE, 2009a, and also in *Working Futures*, UKCES) where it identified a select group of occupations at 2-digit SOC level (see Table A.6);
- EngineeringUK which identified a selection of SOC code groups to be engineering and technology (E&T) occupations, using a more detailed, 4-digit level (2009);
- The DTI which used 3-digit level SOC codes to define SET occupations, shown in Table A.6 (although no SOC codes were actually specified in its report (DTI, 2006);
- HECSU which publishes data on the type of work graduates enter in its annual ‘*What do Graduates do?’* reports (based on HESA DLHE survey data) which it analyses at 3-digit SOC level (HECSU, 2009a);
- BIS which defined a group of ‘STEM’ jobs by combining SOC codes at a 4-digit level, see Table A.6. Rather than calling them ‘STEM jobs’, it referred to them as a ‘scientific’ occupation group (although it included engineering and IT jobs).

Table A.6 Examples of SOC categories used to define STEM jobs
Selected occupations and SOC codes used by IER (in CIHE, 2009b)
11. Corporate managers 21. Science/tech professionals 22. Health professionals 23. Teaching/research professionals 31. Scientific/Technology associate professionals 32. Health Associate professionals 33. Protective services occupations 34. Culture/media/sport occupations 35. Business/public services associate professionals
SET occupations as defined within DTI report (DTI, 2006)
Science professionals Engineering professionals Scientific researchers ICT professionals Health professionals Architects, town planners and surveyors Science and engineering technicians Draughtspersons and building inspectors IT service delivery occupations Health associate professionals and therapists
SOC 4-digit codes comprising 'scientific occupation' group (BIS, 2009e)
Managers in construction (1122), mining and energy (1123), IT (1136), R&D (1137), health services (1181), pharmacy (1182), healthcare practice (1183), farming (1211), natural environment (1212); Chemists (2111), biologists (2112), physicists/mathematicians (2113), engineers (2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129), IT professionals (2131), software professionals (2132), medical occupations (2211), other medical professionals (2212), pharmacists (2213), opticians (2214), dentists (2215), veterinarians (2216), scientific researchers (2321), statisticians (24234), actuaries (24235), architects (24310) Technicians (3111, 3112, 3113, 3114, 3115, 3119, 3121), draughtspersons (3113), other medical associate professionals (3214, 3215, 3216, 3217, 3218, 3221, 3222, 3223, 32290, 32292, 32293)

Additionally, a few reports have defined STEM jobs in other ways, such as:

- *by job role*: for example, IT professionals are defined in roles such as programming, systems design, systems analysis, web design/development, project management (by e-skills, 2009) and Chartered Scientists are identified by the Science Council in ten types of jobs, from research scientists to roles in communication and policy (Science Council 2010); or
- *by discipline area*: for example, scientists are defined as clinical pharmacologists, biochemists, molecular biologists, analytical chemists, chemical engineers, statisticians (ABPI, 2008).

This serves to illustrate the range of ways in which STEM jobs can be defined, and also the difficulties in trying to closely define them.

A.2.5 Our approach to definitions of STEM and non-STEM

We built on the experiences outlined above to decide how to define STEM and non-STEM in a way that could be used easily and consistently across the three strands of the research and to structure our findings clearly. Our proposed approaches were discussed with BIS and the following definitions were agreed.

A.2.5.1 STEM as a subject of qualification

We used JACS broad subject code groups as our primary means of defining the scope of STEM degree subjects for the research; a detailed list of subjects within these groups is shown in Table A.7. A graduate (with a first or higher degree) in any of these subjects listed above would be eligible and thereby included in our survey samples and within scope of the discussions with employers. We deliberately excluded certain very vocational subjects, which have been included in the scope of some previous STEM research, like Medicine and Dentistry, Veterinary Science and Nursing, since graduates from these subjects are known to go predominantly into directly related STEM occupations (e.g. doctors, dentists, vets and nurses, respectively).

The question of whether to include students and/or graduates on combined courses (i.e. STEM and non-STEM disciplines, such as computing and business) was considered. We decided to include them partly on the grounds that it might be difficult to exclude them completely from the survey samples.

Table A.7 Degree subject disciplines within project scope, using JACS subject classification scheme; individual key subjects in bold were considered to be key focus for study

JACS SUBJECT AREA	JACS PRINCIPAL SUBJECT
Subjects allied to Medicine	(B0) Broadly-based programmes within Subjects allied to Medicine (B1) Anatomy, physiology & pathology (B2) Pharmacology, toxicology & pharmacy (B3) Complementary medicine (B4) Nutrition (B5) Ophthalmic (B6) Aural & oral sciences (B8) Medical technology (B9) Others in Subjects allied to Medicine
Biological Sciences	(C0) Broadly-based programmes within biological sciences **(C1) Biology** (C2) Botany (C3) Zoology (C4) Genetics (C5) Microbiology **(C6) Sports science** (C7) Molecular biology, biophysics & biochemistry **(C8) Psychology** (C9) Others in Biological Sciences
Agriculture & related subjects	(D0) Broadly-based programmes within agriculture & related subjects (D3) Animal science (D4) Agriculture (D5) Forestry (D6) Food & beverage studies (D7) Agricultural sciences (D9) Others in Veterinary sciences, agriculture & related subjects
Physical Sciences	(F0) Broadly-based programmes within physical sciences **(F1) Chemistry** (F2) Materials science **(F3) Physics** (F4) Forensic & Archaeological science (F5) Astronomy (F6) Geology (F7) Ocean sciences (F8) Physical & terrestrial geographical & env. sciences (F9) Others in Physical Sciences

Continued…Table A.7 Degree subject disciplines within project scope, using JACS subject classification scheme; individual key subjects in bold were considered to be key focus for study	
Mathematical Sciences	(G0) Broadly-based programmes within mathematical sciences **(G1) Mathematics** (G2) Operational research (G3) Statistics (G9) Others in Mathematical & Computing Sciences (G91) Others in Mathematical Sciences
Computer Science	(G4) Computer Science (G5) Information systems (G6) Software engineering (G7) Artificial intelligence (G92) Others in Computing Sciences
Engineering & Technology	(H0) Broadly-based programmes within engineering & technology (H1) General engineering (H2) Civil engineering (H3) Mechanical engineering (H4) Aerospace engineering (H5) Naval architecture (H6) Electronic & electrical engineering (H7) Production & manufacturing engineering (H8) Chemical, process & energy engineering (H9) Others in Engineering (J1) Minerals technology (J2) Metallurgy (J3) Ceramics & glasses (J4) Polymers & textiles (J5) Materials technology not otherwise specified (J6) Maritime technology (J7) Industrial biotechnology (J9) Others in technology
Architecture, Building & Planning	(K0) Broadly-based programmes within architecture, building & planning (K1) Architecture (K2) Building (K3) Landscape design (K4) Planning (urban, rural & regional) (K9) Others in architecture, building & planning

After consultation with BIS, we agreed to identify certain individual target subjects, within and in addition to the broad subject codes proposed above, including: Biology, Sports Science, Forensic science, Chemistry, Physics, Mathematics, Computer Science, and Engineering. It was agreed that we would specifically include students of Psychology, Geography and Archaeological sciences – subjects which are within the JACS groups above but for which there is a spectrum of more and less 'scientific' courses and study, although it would not be feasible to sub-divide within these subjects.

A.2.5.2 STEM as an employment sector

In the employer strand of the research, we considered a number of ways of classifying industrial/business sectors as STEM or non-STEM. We started with a list of 'core' STEM sectors (based on SIC categories), identified from previous studies and our own preliminary discussions with key organisations, where there seemed to be significant labour need for STEM graduates. We divided the remainder of sectors into two groups – those which we believed were likely to be employers of STEM graduates but to a more limited extent and those which we believed were unlikely to be. We used early employer interviews to explore the demand for STEM graduates in these three groups, and used this information to refine our initial rough sector categorisation. A key interview question was whether an employer had *specific* needs for STEM subjects in its graduate recruits, that is to say whether they sought to recruit graduates with specific STEM degrees to fill certain posts. If not, did they have more general needs for STEM subject knowledge or STEM skills, and so recruited STEM graduates for other reasons?
We identified three clusters and named them 'STEM Specialist', 'STEM Generalist' and 'Non-STEM' employers, defined in the following way:

- *'STEM Specialist'* employers which recruit graduates for roles where a degree in a certain STEM subject or group of STEM subjects is required for entry to a graduate programme or direct to appropriate jobs;
- *'STEM Generalist'* employers which recruit STEM graduates or consider them to be potentially suitable candidates within graduate programmes or roles which are open to holders of a range of degree subjects. Although they do not list a STEM subject as a requirement for entry, they see the skills or knowledge gained from study of STEM courses as an advantage for the jobs being filled.
- *'Non-STEM'* employers which make no distinction by degree subject at recruitment (at least in relation to STEM subjects) and have no specific demand for STEM graduates, although they may still recruit them into graduate programmes or directly to jobs.

These groups were used to structure the employer sample in the research. In the student and graduate surveys, however, we used these clusters as a guide to developing a simpler coding structure, shown in Table A.8. This was used in the analysis of employment sectors, which appeared as 'dropdown' options within our survey questionnaires. Many are narrower than the SIC group or groups in which they fall, but we found them to be more meaningful sectors for respondents than pure SIC-based groups or sectors.

Table A.8 STEM employer classification

Table A.8 STEM employer classification

Employment sector	SIC 2007 group	SIC code	STEM Specialist	STEM Generalist	Non-STEM
Accountancy and business services	M, K	66,69,70		G	
Advertising, marketing and PR	M	70,72			N
Armed forces, defence and emergency services	O	84			N
Banking – investment	K	64		G	
Banking – retail	K	64		G	
Building and construction	F	41,42,43	S		
Catering and hospitality	I	56			N
Charity and development work	S	94?			N
Chemical/pharmaceutical/ biotech	M, C	72,20	S		
Creative arts and cultural	R	90,91			N
Education and training	P	85		G	
Energy and utilities	D,E	35,36	S		
Engineering	C,M	26-33,71	S		
Environment and agriculture	A	1,2,3	S		
Fashion and design	C,M	13-15,74			N
Government/public administration	O	84			N
Health	Q	86	S		
Human resources and recruitment	N	78			N
Insurance	K	65		G	
IT and communications	J	61,62,63	S		
Legal services	M	69			N
Manufacturing	C	VARIOUS	S		
Media	J	58,59,60			N
Property	L	68,77,81			N
Publishing	J	58			N
Retail	G	45,47			N
Science	M	72,74	S		
Social care	Q	87,88		G	
Sport and leisure	R	92,93	S		
Tourism	I,N	55,79			N
Transport and logistics	H	49-53	S		

A.2.5.3 STEM as an occupation

There was no clear model available from previous research for us to use or adapt to classify the occupations (i.e. types of work or job functions) that STEM graduates hold or students seek. Drawing from the experiences of others, our review of previous research and our initial interviews with employers, we proposed three categories: 'STEM core' jobs, 'STEM-related' jobs and 'Unrelated' (to STEM) jobs.

'STEM core' jobs are the easiest to identify, and are likely to include roles such as:

- scientific, research, analysis and development professionals (such as research chemists, geologists, pharmacists);
- engineering professionals (such as electrical, chemical or design engineers);
- IT professionals (such as computer systems managers, IT consultants, software engineers);
- other associate scientific professional and technical jobs (such as lab technicians, surveyors, ophthalmic opticians, etc).

'*STEM-related'* jobs are more difficult to identify clearly but we found it useful to try to separate those that are more loosely related to STEM disciplines from those that are clearly 'STEM core'. They are likely to include:

- certain business professionals (such as auditors, financial consultants, underwriters, also some marketing, sales and legal roles relating to STEM Specialist businesses);
- certain education professionals (secondary-level science teachers, lecturers);
- business managers in relevant sectors (healthcare, conservation);
- associate health professionals (psychologists, therapists);
- science administrators, policy advisers, etc.

The final category of '*Unrelated*' jobs covers the remainder of jobs and occupational functions which are not within the first two categories.

It is no easy task to map these groups onto SOC codes, as there is some arbitrariness in classification and some jobs are on the boundaries between the groups. Also, some jobs are seen as more relevant for certain STEM subjects than others – Mathematics graduates entering finance jobs, for example. We developed coding for the surveys using this classification and SOC codes at 3-digit level to allocate a respondent's job function (given on a dropdown list in the questionnaire) to one of these three STEM groups, as listed in Table A.9.

Table A.9 Classification of STEM job functions

Table A.9 Classification of STEM job functions

Job function	SOC codes			STEM core	STEM-related*	Unrelated
Accountancy/finance	113,115	242	353		R*	
Administration/clerical	111,114,115	244, 356	41, 42			N
Building construction/skilled trades	212,312	243	53	S		
Business strategy/analysis	113,	353				N
Business/org. management	111,113				R*	
Consulting	242,212			S		
Creative/design	342					N
Customer support/client care	114	72				N
Editorial/writing	341	343			R	
Education/teaching	231				R	
Engineering/technology	212, 213, 311			S		
Environmental management	121	311	355	S		
Food services/hospitality	122	621				N
Health and social care	221, 118	321,322 ,323	244	S		
Human resources	113,356,					N
Equipment installation/maint/repair	311,313,524			S		
Insurance	353				R	
ICT management/development	113, 213, 313			S		
Legal	241	352				N
Logistics/distribution/transport	116	351	821	S		
Marketing/market research	113,	354				N
Production/operations	112, 212,			S		
Project management	113,212			S		
Public relations/advertising	354,					N
Purchasing/procurement	354	113				N
Quality assurance/safety	356, 311			S		
Research and development	211, 212, 232	311		S		
Retailing	116, 354	123	71			N
Sales/business development	71, 113	354				N
Security/protective services	117	331				N

Note: * in the R column refers to it being R for some STEM graduates only

A.2.5.4 Resulting classification of jobs: STEM and non-STEM

When our classifications of employment sector (STEM Specialist, STEM Generalist and Non-STEM) and occupational role/function (STEM core, STEM-related, Unrelated) are combined, individual jobs could be plotted in a ‘matrix’, see Figure A.1. Although the boundaries between categories are somewhat fuzzy, and there may be some subjectivity in the positioning of a particular job, the resulting matrix is useful practically in illustrating whether a job is a “STEM job” or a “non-STEM job”. Although no specific boundary can be drawn between the two, what we regard as “STEM jobs” will be towards the lower left of the matrix, while “non-STEM jobs” will be those towards the upper right corner. In Figure A.1 we have plotted, as examples, some illustrative job roles.

Figure A.1 ‘Matrix’ plot of illustrative jobs using both employment sector and occupational role classifications

Occupational				
Unrelated	HR manager for engineering firm Sport/fitness equipment sales	Social care manager IP/patent lawyer Management consultant	Retail manager Policy adviser Commercial lawyer	
STEM related	Pharma marketing manager Finance manager for telecom company	Accountant Investment banker Secondary science teacher	Scientific publisher Museum explainer Science policy adviser	
STEM core	Pharma lab chemist Software engineer Electronics designer Environmental consultant	IT manager for bank Actuary	IT manager in local authority (LA) LA highway engineer LA fitness instructor	
	STEM	STEM Generalist	Non-STEM	**Employment sector**

A.3 Research methodology and samples

A.3.1 Quantitative surveys of STEM student career intentions

In order to obtain information on the career thinking and decision-making of students studying STEM degree subjects in Higher Education, and their career intentions in particular, a quantitative online survey approach was devised. Final-year undergraduates were considered to be the core target, but it was decided to extend this to include Masters-level students, since many STEM undergraduates study directly for M-level degrees (e.g. MSc or MEng) and a significant proportion of others undertake separate taught Masters courses. For the fullest possible view of those studying STEM in Higher Education, a parallel survey was devised for PhD students.

The online questionnaire created for undergraduates and taught postgraduate students contained 30 questions, of which a small number were open-ended. The questionnaire underwent two phases of cognitive piloting by a handful of relevant students (in a range of subjects and universities), some of which was observed. The final questionnaire was open for responses between 12 January and 11 March 2010. The online questionnaire for doctoral postgraduate students, hereafter referred to as PhD students for brevity, was open for responses from 24 March until 29 April 2010.

A.3.1.1 Attraction strategies

For the online survey of STEM undergraduates and taught postgraduate students, an e-mail campaign invited relevant students to participate. Outbound e-mails contained a hyperlink to the online survey site and offered entry to a prize draw as an incentive for participation.

An e-mail was issued by Milkround Online, a commercial recruitment database of HE students, and repeated two weeks later, to c.28,000 contacts held of final-year and Masters students in relevant subjects. Concurrently, bespoke e-mails were circulated to a series of organisations and groups with contacts within HE institutions for many of the target subject disciplines, whose assistance had been sought in advance. The individuals contacted were asked to forward an embedded e-mail to their students inviting them to participate in the online survey. A separate e-mail inviting PhD students to participate was issued to contact lists held by CRAC and the Vitae Programme (on behalf of Research Councils UK).

The attraction strategy using the co-operation of numerous individuals and third parties to pass on invitations had an inherent drawback in that there was no control over the number of students actually invited to participate. As a result, it was not possible to calculate a response rate. On the other hand, there were two major benefits (in comparison with use purely of a single e-mail list of a known quantity). First, it enabled a much wider number of relevant students to be invited than was available through any single contact list. Second, the coverage obtained would be somewhat randomised, due to the wide but varying participation of individuals who forwarded e-mails to entire groups of students. This more random coverage would avoid any potential bias introduced by reliance on a single list of contacts from a provider with whom, for example, students would need to have registered (which might therefore not be representative of all relevant students).

A.3.1.2 Survey responses and sample dimensions: undergraduates and masters

A total of 7,568 students responded to the undergraduate and taught postgraduate survey, of whom 91.5% had been recruited via the cooperative 'referral' e-mail campaign. In terms of completion rate, 96% of those who started the survey completed all compulsory questions and reached the end. Even among those who did not complete the whole survey, many completed sufficient questions to be included in most analyses.

A number of responses were excluded from the survey analysis; duplicate responses, respondents who had only completed the first section of the questionnaire, and 26 respondents from non-UK universities (some of whom could have been studying in the UK as part of their degree). This left 7,294 respondents as the main undergraduate and taught postgraduate student sample.

Some of the respondents were not in their final year and others were not from the UK or EU/EEA, which was inevitable given the attraction strategy used (Table A.10). Overall, 4,298 (59%) of respondents were from the UK/EU/EEA *and* were in their final year or were postgraduate (masters) students, considered to be the core of the sample. Rather than exclude all 'non-core' respondents from analysis, it was considered helpful to include them in certain analyses for comparison purposes.

Just over half (52%) of the UK respondents were male, but rather more (59%) of EU/EEA students were male and of students from the rest of the world (67%). For comparison, for the range of STEM subject disciplines under investigation, the proportion of male full-time UK undergraduates was 56% in 2008/09 (derived from HESA, 2009). 38% of the UK taught postgraduate respondents were studying part-time but only a very small proportion (4%) of UK undergraduates. Students studying part-time were coded to the nearest equivalent full-time year for analysis purposes.

Over a third (36%) of the UK taught postgraduates had gone straight on from their undergraduate degree to postgraduate study and a further 5% had not worked since graduating, while 34% had been employed in a permanent job. Considerably more (52%) of UK postgraduates on full-time taught courses had entered directly after being undergraduate students, while a further 7% had not worked since graduating. However, most (71%) of those studying part-time had been employed in a permanent job (and 8% were still employed), while only 10% had come straight from being an undergraduate student.

Responses were received from students at 115 Higher Education institutions (see Appendix B, Table B.1 for full listing). Of these 42% students were at Russell Group universities, 23% at 1994 group institutions and 36% at other UK universities (see Table A.11).

Table A.10. Year of study, by nationality (undergraduates and taught postgraduates)

Year of Study	UK		EU/EEA		Rest of world		Not answered		All respondents	
Undergrad	Number	%	Number	%	Number	%	Number	%	Number	%
First/Second/ Foundation	692	13	69	12	87	8	69	15	917	13
Placement/ Penultimate	618	12	38	7	56	5	47	10	759	10
Final	3053	59	216	39	233	22	193	41	3695	51
Other	18	0	0	0	2	0	3	1	23	0
Completed	8	0	0	0	0	0	1	0	9	0
All Undergrad	4389	85	323	58	378	35	313	66	5403	74
Postgrad	793	15	236	42	700	65	162	34	1891	26
Total	5182	100	559	100	1078	100	475	100	7294	100

Table A.11. University type, by nationality (undergraduates and taught postgraduates)

	UK		EU/EEA		Rest of world		Not answered		All respondents	
University	Number	%	Number	%	Number	%	Number	%	Number	%
Russell	2179	42	241	43	459	43	161	34	3040	42
1994	1193	23	118	21	239	22	93	20	1643	23
Other UK	1807	35	200	36	379	35	213	45	2599	36
Not answered	3	0	0	0	1	0	8	2	12	0
Total	5182	100	559	100	1078	100	475	100	7294	100

Table A.12 provides a regional breakdown of survey respondents, based on the home regions of the UK students. For comparison purposes HESA data on all UK students by region of their Higher Education Institution (HEI) are shown in the final (right) column of the table. Although not completely equivalent, the HESA data suggest that the distribution of survey respondents broadly reflects the national breakdown, although with an apparent under-representation of London as a domicile among survey respondents.

13% of UK respondents were from minority ethnic backgrounds and 5% reported that they had a disability or long term health condition that might affect their employment prospects.

Table A.12. Regional breakdown of UK undergraduate and taught postgraduate survey

respondents				
UK region	**Undergraduate %**	**Postgraduate %**	**All UK %**	**All UK students by region of HEI**
England: North West	10	9	10	10
England: North East	3	4	3	5
England: Yorkshire & Humber	5	7	5	8
England: East Midlands	6	7	6	7
England: West Midlands	8	9	8	8
England: East of England	4	4	4	5
England: London	11	12	11	17
England: South East	20	18	20	18
England: South West	11	8	10	7
Northern Ireland	6	6	6	2
Scotland	11	9	11	9
Wales	3	4	3	5
Other (e.g. Channel Islands)	2	2	2	*
Not answered	1	1	1	*
Number of cases	*4389*	*793*	*5182*	

Only 7% (216) of UK final year undergraduates had been employed full-time in a job that was intended to be permanent before they went to university. Not surprisingly, these students were older (78% aged 24 and over) than those students who had not worked (6% aged 24 and over), and more of them were studying part-time (24%) than other finalists (1.5%).

Table A.13 provides a breakdown of respondents by JACS subject group based on the subject coding of all respondents. Some key individual subjects of particular focus in the project have been identified separately in the table.

Table A.13 Subject breakdown (JACS subject codes): UK final year and postgraduate respondents to undergraduate and Masters survey. Cohort proportion derived from HESA, full-time UK undergraduates

		Number	%	% of cohort
A	**Medicine and Dentistry**	**25**	**1**	**n/a**
B	**Subjects allied to Medicine**	**208**	**5**	**16**
C	**Biological Sciences**	**895**	**23**	**29**
	Biology and related	428	11	10
	Psychology	385	10	11
	Sports Science	82	2	8
D	**Veterinary Science / Agriculture**	**13**	**0**	**n/a**
F	**Physical Sciences**	**1161**	**30**	**14**
	Chemistry	242	6	3
	Physics	275	7	3
	Geology	153	4	1
	Forensic Science/Archaeology	106	3	2
	Geography	320	8	3
G	**Mathematical & Computing Sciences**	**636**	**17**	**20**
	Mathematics	282	7	6
	Computer Science	354	9	14
H	**Engineering**	**688**	**18**	**21**
	Civil engineering	196	5	4
	Mechanical engineering	129	3	4
	Aerospace engineering	47	1	2
	Electronic & electrical	114	3	4
	Chemical, process & energy	59	2	1
J	**Technology**	**41**	**1**	**1**
K	**Architecture, Building and Planning**	**85**	**2**	**n/a**
Other Science (unspecified / joint degrees)		**55**	**1**	
Non-STEM subjects		**26**	**1**	
Not answered		**4**	**0**	
Total cases		**3837**	**100**	

For a rough comparison, the proportions of full-time UK undergraduate students for 2008/09 are given for the main range of subject groups investigated (derived from HESA, 2009). This shows that the overall sample obtained under-represented students in Subjects allied to Medicine, and also under-represented Sports Science, while somewhat over-representing the Physical Sciences. However, the sample did provide good numbers of respondents from the subjects of particular focus in the study.

In subsequent analyses, any respondents studying Medicine and Dentistry, Veterinary Science or Agriculture, and Nursing among those studying Subjects allied to Medicine were excluded from the analysis, along with those students studying other Science subjects. Students of Technology and Engineering group subjects were combined into a single category.

Just over a quarter (27%) of the UK final year undergraduates were studying for enhanced or integrated Masters degrees. However, these students were concentrated in a small number of subject areas where they made up a substantial proportion of the final year undergraduate cohort, particularly Chemistry (69%), Engineering & Technology (60%), Physics (51%) and Mathematics (25%), but 10% or less of the final year cohort in most other subjects.

A significant proportion of taught postgraduate students were studying a different subject as a postgraduate from the one they had studied as an undergraduate. While it is difficult to quantify this accurately, given the relatively small number of respondents and also because many had moved into cognate disciplines, it is clearer which subjects are net ‘exporters’ or ‘importers’ (i.e. have fewer or more students studying them as postgraduates than they had as undergraduates). The main ‘importers’ are the more explicitly vocational subjects – notably Subjects allied to Medicine, Computer Science, Engineering & Technology, Architecture, Building and Planning, and Forensic Science/Archaeology – while the net ‘exporters’ are the pure sciences – Physics, Chemistry and Biological Sciences.

A.3.1.3 Survey responses and sample dimensions: PhD students

A total of 4,550 PhD students responded to the survey of doctoral researchers. This survey was conducted in conjunction with the Vitae Programme and many respondents were studying non-STEM subjects. Once duplicate responses, incomplete responses and respondents from non-UK universities were excluded, 4,307 PhD student responses were retained for analysis, 2,908 of these researching STEM subjects. Those studying Medicine and Dentistry; Veterinary Science, Agriculture and related subjects; and Nursing, were excluded, to leave 2,732 respondents as the main STEM PhD student sample.

Inevitably, many of these respondents were in different years of their PhD and others were not from the UK or EU/EEA (see Table A.14), but it was considered helpful to include a wider range of years (than of the undergraduates) in certain analyses for comparison purposes. The small number of PhD respondents who reported that they were writing up, waiting for their viva, or had just completed, were coded as being in final year.

Table A.14 Year of study, by nationality (PhD students in STEM subjects)										
Year of Study	UK		EU/EEA		Rest of world		Not answered		All respondents	
	Number	%	Number	%	Number	%	Number	%	Number	%
First/ Second	974	53	217	51	221	60	48	51	1460	53
Third of four	242	13	32	8	32	9	16	17	322	12
Final	627	34	174	41	116	31	30	32	947	35
Other	2	0	0	0	1	0	0	0	3	0
Total	1845	100	423	100	370	100	94	100	2732	100

Just 7% of the STEM PhD students were studying part-time (compared to 24% of those studying non-STEM subjects) and they have been coded to the nearest full-time equivalent year for analysis purposes.

Table A.15 Regional breakdown of UK (PhD survey respondents)	
UK region	All STEM %
England: North West	9
England: North East	5
England: Yorkshire and the Humber	7
England: East Midlands	6
England: West Midlands	7
England: East of England	4
England: London	6
England: South East	20
England: South West	13
Northern Ireland	5
Scotland	11
Wales	4
Other (e.g. Channel Islands)	2
Not answered	1
Number of cases	*1845*

The STEM PhD students were studying at 106 UK universities and research institutes (see Appendix B, Table B.2 for a full listing). Of these, 61% were studying at a Russell Group university, 21% at a 1994 group university and 19% at other universities and research institutes.

Just over half (51%) of the UK PhD respondents were female, as were 52% of EU/EEA students, but the majority (56%) of students from the rest of the world were male. 13% of UK respondents were from minority ethnic backgrounds and 4% reported that they had a disability or long term health condition that might affect their employment prospects. Table A.15 shows the regional breakdown of the PhD survey respondents, based on the home regions of the UK students, which suggests that the survey received good geographical coverage, as had the undergraduate and Masters Survey. A breakdown of the subjects being studied by the PhD students is shown in Table A.16.

Almost half (48%) the UK final year PhD students had gone straight on to their PhD from an undergraduate degree and 20% from a Masters degree. Very few (2%) reported that they had done a research only Masters qualification, while 16% had been employed in a job that was intended to be permanent and 11% employed in temporary or casual work (including short-term research contracts).

Table A.16. Subject of study, by nationality (PhD survey respondents)

Subject	UK		EU/EEA		Rest of world		Not answered		All respondents	
	Number	%	Number	%	Number	%	Number	%	Number	%
Architecture, Building and Planning	33	2	2	0	14	4	3	3	52	2
Biological Sciences	370	20	85	20	46	12	15	16	516	19
Biomedical Sciences	190	10	51	12	37	10	11	12	289	11
Engineering	259	14	62	15	104	28	22	23	447	16
Environmental Sciences	69	4	30	7	16	4	3	3	118	4
Forensic/Archae-ological Sciences	28	2	12	3	6	2	1	1	47	2
Geography	41	2	7	2	6	2	6	6	60	2
Mathematical Sciences	85	5	17	4	9	2	5	5	116	4
Computer Science	90	5	23	5	37	10	4	4	154	6
Other subjects allied to Medicine	98	5	19	4	14	4	1	1	132	5
Physical Sciences	420	23	73	17	51	14	16	17	560	20
Psychology	114	6	32	8	15	4	3	3	164	6
Sports Science	24	1	6	1	4	1	0	0	34	1
Technology-related subjects	24	1	4	1	11	3	4	4	43	2
Total	1845	100	423	100	370	100	94	100	2732	100

A.3.2 Interviews with STEM graduates

A key aspect of the project was to obtain information about the real experiences of STEM graduates who had entered the labour force, to complement the views and career 'intentions' of STEM students who mostly were yet to make that transition. The principal targets were STEM graduates who were not working in STEM occupations or sectors, but STEM graduates who worked in STEM occupations and sectors were also targeted in order to document and compare their experiences, as well as a smaller number of graduates of other disciplines (working outside STEM) for comparative purposes. It was agreed that 'early career' graduates who had been in the workplace for 1-5 years would be the core focus, in order that they would have relatively good recollection of their perceptions and decision-making around graduation, but in work long enough for them to have genuine experiences in the labour force. Some flexibility was adopted in terms of time since graduation as the sample unfolded and to aid recruitment of interviewees with other criteria.

A qualitative method was used because it was not believed feasible to identify or reach a sufficiently large sample of STEM graduates working outside STEM occupations for a quantitative survey. On the other hand, a significant number of graduates was needed in order for the sample to include graduates with a range of agreed characteristics – key degree subjects, gender, and occupational and employment sector. However, the sample was neither aimed to be nor could be representative of the population of STEM graduates.

Telephone interviews were selected as the most appropriate methodology, along with a lesser number (about 20% by proportion) of face-to-face interviews to provide more in-depth insights and information. A semi-structured interview was devised for use in telephone interviews, with slight revision for the face-to-face interviews. The structure combined certain closed questions with open-ended questions and the opportunity to collect deeper insights and personal views.

A total of 555 interviews were conducted during the period December 2009 to early June 2010, of which 70 were face-to-face. The telephone interviews were undertaken by a specialised sub-contractor, Employment Research Ltd. CRAC's own researchers conducted the face-to-face interviews.

A.3.2.1 Attraction strategies

Obtaining a sample of STEM graduates in employment who were prepared to undertake interviews, at this large scale, and reflective of a range of characteristics and employment sectors, was challenging. The very nature of the main target group – STEM graduates not now working in STEM occupations – meant that many of the target graduates could be relatively harder to reach than, for example, Engineering graduates working for engineering companies, and some might be found in somewhat unpredictable occupations. It had originally been hoped that this could be achieved using a series of parallel strategies:

- Contact with graduates via specific employers;
- Contact with graduates via existing networks of varying kinds;
- Contact directly with graduates whose details had been recorded in existing research studies, through which specific occupational and degree subject targeting might be feasible;
- Contact directly with graduates selected within other groups, such as university alumni, also potentially enabling some targeting.

E-mails inviting relevant graduates to participate in the research were issued via a variety of networks, including STEM Ambassadors, Bright Futures (student) Societies' alumni, Teach First, the Cambridge Network and others. With the exception of the first of these, from which nearly 50 volunteers emerged (although all within STEM occupations), response levels to these invitations were very poor, and contributed little to the sample.

Discussions took place with a number of university careers services with a view to targeting graduates within their alumni, but none of these came to fruition. Although careers services were interested in assisting in the project, the relevant data were held by the universities' alumni offices which, presumably, saw less value in collaboration and did not respond positively. Respondents to the *Destinations of Leavers from Higher Education* (DLHE, or L-DLHE) surveys – potentially an ideal dataset – could not be contacted due to privacy restrictions. Contact with a number of other organisations with databases of graduates in employment did not lead far because of limitations in the type of data held.

This left employers as the only major conduit for invitations to relevant graduates to volunteer for interviews, and the overwhelming majority of graduates interviewed were recruited in this way. Over 150 employers were approached, one way or another, including organisations within the CRAC and CIHE networks, those where **icould** career stories[14] had been filmed, and others through personal contacts. This usually involved dialogue with senior members of Human Resources (HR) or graduate recruitment teams, who generously provided assistance. In most cases, the employer circulated an e-mail to employees, who responded to CRAC with contact and eligibility details. Relatively few companies were able to identify STEM graduates from their HR management information systems, which suggested that most did not consider degree subject to be critical in managing employee development.

Interviews were secured and conducted with individuals from 128 different employers (including 10 different Government departments) as well as a few who were self-employed. The number of graduates from each particular employer was generally very small (1-5); with 10 or more graduates recruited from only 12 employers. One employer, a large accountancy firm, provided a particularly large number of potential graduates, but not all of whom were brought into the sample in order to avoid any imbalance.

The volunteer recruitment process was extremely labour-intensive and fieldwork took over six months. However, progressively approaching new employers enabled a continuous re-focus of recruitment effort, resulting in the desired balanced range of demographic and employment characteristics in the sample. The rate of completion of telephone interviews was exceptionally high (485 achieved from 513 volunteers, or 94%) because the contacts supplied had all volunteered for interview and understood why they were being contacted.

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[14] **icould** is a national online resource containing films of over 1000 personal career stories, told by individuals across the occupational spectrum, developed and managed by CRAC.

However, it was reliance on this attraction strategy had other impacts in terms of the sample generated. The ‘contactability’ of employers, and the need for assistance of an HR or recruitment professional, almost certainly led to an over-representation of larger and more established employers of graduates within the sample. The number of graduates working for small and medium enterprises (SMEs) was relatively limited, purely due to the difficulty of reaching and engaging them, while certain professions (teaching, especially) presented particular problems as access via their employers was not feasible.

Nonetheless, the substantial number of interviews conducted offered a large amount of detailed information from graduates across a wide range of employment sectors and occupations, reflective of graduates with a wide range of degree subjects and other key personal characteristics (such as gender and location).

A.3.2.2 Sample characteristics and balance

Table A.17 shows the personal characteristics of all the graduates interviewed. We have distinguished those with first degrees in STEM subjects from those with degrees in non-STEM subjects. Overall, 53% of the graduates were male and 89% were aged under 30. More of the non-STEM graduates were female (70%) than the STEM graduates (43%). Nearly all those aged over 30 had recently completed postgraduate courses. A small number had undertaken their first degree as ‘mature’ students, in a subject closely related to their career, although these were deliberately not a major focus for the research due to the very distinct linkage between degree and occupation.

Table A.17 Background details of interview respondents						
	STEM Graduates		**Non-STEM Graduates**		**All respondents**	
Gender	Number	%	Number	%	Number	%
Male	266	57	26	30	292	53
Female	200	43	62	70	262	47
Not answered	1	0	0	0	1	0
Age						
21 to 24	179	38	41	47	220	40
25 to 29	228	49	45	51	273	49
30 to 39	50	11	2	2	52	9
40 and over	6	1	0	0	6	1
Not answered	4	1	0	0	4	1
Nationality						
British	435	93	81	92	516	93
EU / EEA	12	3	1	1	13	2
Rest of world	9	2	4	5	13	2
Not answered	11	2	2	2	13	2
Total cases	467	100	88	100	555	100

Nearly all the graduates interviewed were British nationals (93%) and 11% were from minority ethnic backgrounds, while 8% reported that they had a disability or long-term health condition.

In terms of occupational function, 27% of the STEM graduates worked in Accountancy/ finance, 16% in Engineering/technology, 10% in Administration/clerical work (mainly in Government departments), with smaller proportions in job functions such as ICT, project management and research and development. The remaining third were spread thinly over 22 different job functions (see Table A.18).

Table A.18 Occupational function of interview respondents (all graduates interviewed)						
	STEM Graduates		Non-STEM Graduates		All respondents	
Function	Number	%	Number	%	Number	%
Accountancy/finance	127	27	19	22	146	26
Administration/clerical	48	10	26	30	74	13
Building construction/skilled trades	2	0	0	0	2	0
Business strategy/analysis	7	1	1	1	8	1
Business/organisation management	11	2	3	3	14	3
Consulting	21	4	2	2	23	4
Creative/design	1	0	0	0	1	0
Customer support/client care	2	0	0	0	2	0
Editorial/writing	9	2	1	1	10	2
Education/teaching	20	4	1	1	21	4
Engineering/technology	74	16	0	0	74	13
Environmental management	1	0	0	0	1	0
Health and social care	5	1	1	1	6	1
Human resources	2	0	5	6	7	1
Insurance	6	1	0	0	6	1
ICT management/development	29	6	1	1	30	5
Legal	17	4	1	1	18	3
Logistics/distribution/transport	7	1	1	1	8	1
Marketing/Market Research	4	1	4	5	8	1
Production/operations	2	0	0	0	2	0
Project management	24	5	6	7	30	5
Public relations/advertising	0	0	1	1	1	0
Purchasing/procurement	10	2	3	3	13	2
Quality assurance/safety	1	0	0	0	1	0
Research and development	24	5	3	3	27	5
Retailing	5	1	6	7	11	2
Sales/business development	7	1	2	2	9	2
Security/protective services	1	0	0	0	1	0
Other	0	0	1	1	1	0
Total cases	467	100	88	100	555	100

By employment sector, 25% of the STEM graduates worked in Accountancy/bbusiness services, 17% in Government/public administration, 9% in Engineering, 9% in Energy/utilities and 6% in Education and training. The rest worked across 20 other employment sectors (see Table A.19).

Table A.19 Employment sector of interview respondents (all graduates interviewed)

	STEM Graduates		Non-STEM Graduates		All respondents	
Sector	Number	%	Number	%	Number	%
Accountancy and business services	115	25	16	18	131	24
Armed forces, defence and emergency services	4	1	0	0	4	1
Banking - investment	13	3	0	0	13	2
Banking - retail	1	0	0	0	1	0
Building and construction	3	1	0	0	3	1
Charity and development work	6	1	3	3	9	2
Chemical/pharmaceutical/biotech	7	1	1	1	8	1
Creative arts and cultural	6	1	0	0	6	1
Education and training	28	6	1	1	29	5
Energy and utilities	42	9	1	1	43	8
Engineering	43	9	0	0	43	8
Environment and agriculture	2	0	0	0	2	0
Government and public administration	80	17	41	47	121	22
Health	8	2	2	2	10	2
Human resources and recruitment	0	0	1	1	1	0
Insurance	3	1	1	1	4	1
IT and communications	24	5	0	0	24	4
Legal services	13	3	0	0	13	2
Manufacturing	8	2	2	2	10	2
Media	3	1	0	0	3	1
Publishing	13	3	4	5	17	3
Retail	10	2	10	11	20	4
Science	21	4	0	0	21	4
Sport and leisure	1	0	0	0	1	0
Tourism	4	1	1	1	5	1
Transport and logistics	9	2	3	3	12	2
Other	0	0	1	1	1	0
Total cases	467	100	88	100	555	100

The non-STEM graduates interviewed worked mainly for the large employers who had supplied multiple STEM graduate volunteers, and were concentrated in Accountancy/finance (22%) and Administration/clerical work (30%) with relatively small numbers in a wide range of other functions. By sector they worked mainly in Government/public administration (47%), Accountancy/business services (18%) and Retail (11%).

Both the employment sector and the job functions were broken down into three groups, as described in section A.2, shown in Table A.20. This shows that 41% of STEM graduate respondents were working in STEM Core jobs, 37% in STEM-related jobs and 22% in Unrelated jobs. By employment sector, they were split relatively evenly between those working for STEM Specialist (36%), STEM Generalist (34%) and non-STEM employers (30%), reflecting the targeting achieved during volunteer recruitment. Consideration of whether any specific job should be considered a “STEM job” or not could be made using the combination of sector and function classifications, as shown in Figure A.1.

Table A.20 Employment sector and function of interview respondents

	STEM Graduates		Non-STEM Graduates		All respondents	
STEM Sector	Number	%	Number	%	Number	%
STEM Specialist	168	36	9	10	177	32
STEM Generalist	160	34	18	20	178	32
Non-STEM	139	30	61	69	200	36
STEM Function						
STEM Core	190	41	14	16	204	37
STEM-related	173	37	23	26	196	35
Unrelated	104	22	51	58	155	28
Total cases	*467*	*100*	*88*	*100*	*555*	*100*

While the majority of non-STEM graduates were working in non-STEM employment sectors (69%) and in unrelated job functions (59%), a small number reported that they were working in STEM Specialist sectors (10%) and in STEM Core functions (16%).

The recruitment of volunteers aimed to provide interviews with respondents across a range of STEM degree subjects. A good spread was achieved across the target disciplines (see Table A.21). The graduates who had studied non-STEM subjects mainly had degrees in Arts/Humanities (27%), Social Sciences (24%), Modern Languages (13%), Economics (11%) and Business (10%).

Table A.21 Degree subjects (all STEM graduates interviewed		
	STEM Graduates	
Degree subject	Number	%
Biology and related subjects	109	23
Chemistry	44	9
Physics	65	14
Geography/Other Physical Sciences	35	7
Mathematical Sciences	53	11
Computer Science	30	6
Engineering and Technology	107	23
Other STEM	24	5
Total cases	467	100

The proportions of graduates from different degree subjects who worked in the three occupational groupings varied considerably, as can be seen in Table A.22. Much higher proportions of those interviewed with Computer Science (87%) or Engineering & Technology (72%) degrees were working in STEM Core occupations, compared with just 20% of graduates in Chemistry, 26% of Mathematics and 24% of Biology and related subjects. This reflects the more narrowly 'vocational' nature of certain degree courses.

Over half the graduates in Mathematics (55%), Chemistry (57%) and in 'other STEM subjects' (62%) were working in STEM-related occupations, while 43% of graduates in Geography and other physical science subjects and nearly a third (32%) of graduates in Biology and related subjects were working in Unrelated occupational functions.

There was a similar pattern by employment sector with 70% of Engineering/Technology graduates and 57% of Computer Science graduates working for STEM Specialist employers, compared with just 8% of Mathematicians and 20% of Chemists. Over half (57%) the Mathematicians worked for STEM Generalist employers (mainly in Accountancy/ Business Services or Education and training), while just over half (51%) of graduates in Geography and other physical science subjects worked for non-STEM employers.

Table A.22 Current employment sector and function, by undergraduate subject studied (all STEM graduates)

Sector	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Maths	Computer Science	Engineering and Technology	Other STEM subjects	All STEM
STEM Specialist	23	20	38	26	8	57	70	29	36
STEM Generalist	38	43	31	23	57	23	25	42	34
Non-STEM	39	36	31	51	30	20	13	29	30
Function									
STEM Core	24	20	38	40	26	87	72	21	41
STEM-related	44	57	37	17	55	3	25	63	37
Unrelated	32	23	25	43	19	10	11	17	22
Count	*109*	*44*	*65*	*35*	*53*	*30*	*107*	*24*	*467*

Table A.23 Higher education background of interview respondents

Highest qualification	STEM Graduates		Non-STEM Graduates		All respondents	
	Number	%	Number	%	Number	%
Undergraduate	353	76	69	78	422	76
Postgraduate	114	24	19	22	133	24
Degree class						
1st	162	35	24	27	186	34
2:1	234	50	54	61	288	52
2:2	45	10	9	10	54	10
3rd	3	1	0	0	3	1
Pass	11	2	1	1	12	2
Other	2	0	0	0	2	0
Missing	10	2	0	0	10	2
University						
Russell	300	64	46	52	346	62
1994	88	19	25	28	113	20
Other UK	72	15	12	14	84	15
European	5	1	1	1	6	1
USA/Canada	1	0	2	2	3	1
Rest of world	0	0	2	2	2	0
Not answered	1	0	0	0	1	0
Total cases	467	100	88	100	555	100

Just under a quarter (24%) of the STEM graduates interviewed had a postgraduate degree, while 64% had attended Russell Group universities (see Table A.23) and 86% had a obtained a first or upper second class degree. The background of the non-STEM graduates was relatively similar, reflecting their similar employers.

A number of the STEM graduates had gone on to study a non-STEM subject at postgraduate level, to support a move to a new career direction (such as, but not exclusively, teaching or law), while two of the non-STEM graduates had done postgraduate qualifications in IT (i.e. a STEM course).

Almost all had been full-time students. Although the proportion who have undertaken part-time degrees is significant in the overall graduate population, they were not targeted in this research. The majority of part-time degrees are undertaken while working, frequently with support from the employer, which almost certainly reflects that the degree subject is closely related to occupation, and it is likely that the qualification has been studied directly for advancement in that job or career, see NIESR (2010). As a result it was thought that they would add little to this study.

It is not surprising, given the way that they were recruited, that the non-STEM graduates interviewed had similar backgrounds to the STEM graduates in terms of where they had been to university and the level of qualifications obtained. Nonetheless, there are several key points to note about both the STEM and non-STEM graduates who were interviewed:

- They were highly qualified;
- The vast majority had been to Russell or 1994 Group universities;
- Many, but not all, were working for large and prestigious employers.

They therefore mainly represent a group of 'strong' graduates who would have been highly attractive to employers and were now in 'good' jobs. Although they were a diverse group in terms of subjects studied and qualifications obtained, and worked across a wide range of employment sectors and occupations, they were not (and had not been intended to be) a fully representative sample of STEM and non-STEM graduates in employment.

A.3.3 Employer interviews

Employers are clearly crucial in any investigation of the employment and practical career decisions of graduates. Their recruitment strategies and skills demands impose 'external' constraints upon graduates' career decisions and choices. It has been hypothesised that many STEM graduates could be working outside STEM occupations not because that was their career aim but because they were unable to secure employment within STEM occupations, conceivably due to the demands of the employers for particular skills.

A series of dialogues with employers was held between October 2009 and March 2010 to obtain information about their recruitment strategies in respect of STEM graduates, and their practical experiences of the supply of and demand for STEM-qualified graduates. Their perceptions of STEM graduate applicants and application strategies could also be useful to complement the primary research findings from STEM students and graduates. These employer discussions were conducted by CIHE as individual face-to-face or telephone interviews, supplemented by two group discussions.

Employers covering a wide range of industrial and services sectors were targeted, structuring the sample around the three main employer groups utilised throughout this report: STEM Specialist employers, STEM Generalist employers and Non-STEM employers.

Thirty individual interviews and two discussion groups were undertaken, which covered 51 different employers (organisations or divisions of business groups) in total. In addition, an interview with a recruitment consultant was undertaken to provide a broader perspective. The discussion groups were attended by 26 organisations: one was focused on the public sector and the second on financial services, held with the assistance of the AGR (Association of Graduate Recruiters). Five organisations within the discussion groups had been interviewed individually so have not been counted twice in the total of 51 employers. The 51 employers were classified as 15 STEM Specialists and 36 STEM Generalists or non-STEM employers.

In the prevailing economic climate, there was some reticence or lack of enthusiasm to take part in interviews, as a result of which many more employers had to be approached than had been envisaged originally. This also meant that many employers preferred to be interviewed by telephone, which tended to be less time-consuming for the employer. The interviews used a semi-structured format, although this evolved with time and tended to vary with the nature of the employer.

A.3.4 Implications of the nature of the samples

The samples achieved in the quantitative surveys of undergraduates and taught postgraduate students, and doctoral students, were substantial and also compared reasonably well with national cohort proportions for some key observable demographic characteristics, at least for the main subjects under scrutiny. On this basis, and the in-built element of randomness introduced through the attraction strategy, there seems little reason to believe that the samples are not at least reasonably representative of their respective national cohorts (and at least as robust as those used in many other studies).

The sample of graduates interviewed, on the other hand, was never intended to be representative of either STEM graduates now in employment, or of STEM graduates working in ‘non-STEM’ jobs. Instead the sample was designed to obtain understanding of the career decisions of a range of different STEM graduates who had made different career choices, with particular emphasis on those who had entered occupations not closely related to their degree, across a range of different degree subjects and other key characteristics.

Due to the recruitment strategy, however, numerically there was a concentration of graduates who worked for larger organisations with established graduate recruitment structures, despite the wide range of 128 employers in total. Given the relatively higher entry criteria for those ‘premier’ graduate employers, it was perhaps inevitable that the majority of the graduates interviewed were high achievers academically, reflected in the high proportion with ‘good’ degrees and from Russell Group universities. This certainly means that the graduates interviewed are not representative of all STEM graduates, but this sub-population is of strong interest with sufficient qualifications to enter many different occupational sectors. As relatively high achievers they would be the type of graduates who would be targeted by employers competing in the graduate recruitment marketplace. In many cases the employers interviewed were similar, i.e. many larger firms which sought ‘good’ degrees, and this largely mirrored the focus of the graduate interviews

A.3.5 Data presentation

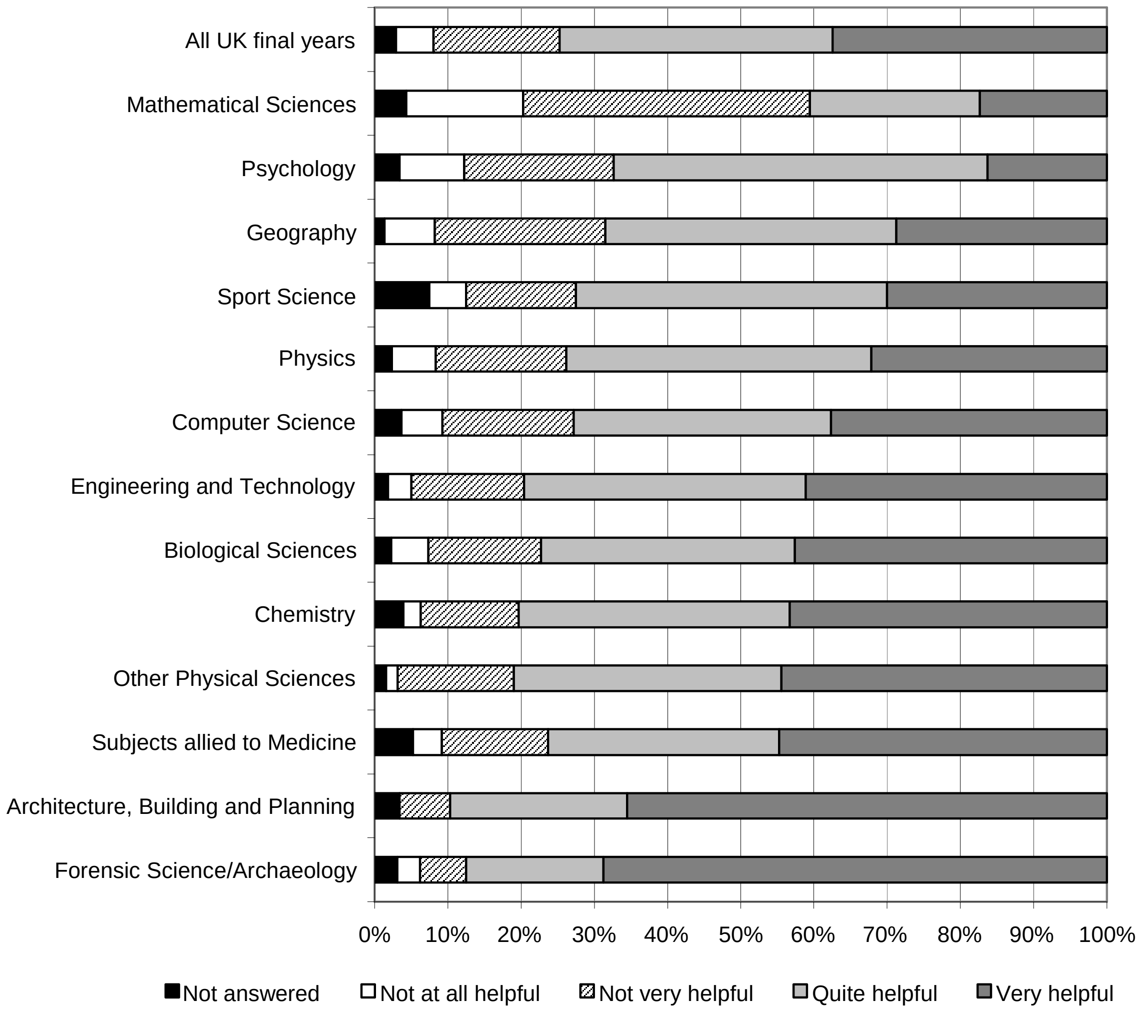
Data from the online surveys and graduate interviews are presented in Chapters 3 and 4 in textual, tabular and graphical formats. All data are unweighted. Percentages in the tables presented may not always sum to 100% due to rounding of individual items and, in some cases, percentages sum to more than 100% where respondents were able to give multiple responses to certain questions. The number of cases included in tables varies due to the number of respondents who completed each question/section of the questionnaire. Findings from the interviews and discussions with employers are presented in Chapter 5.

Appendix B: Additional tables

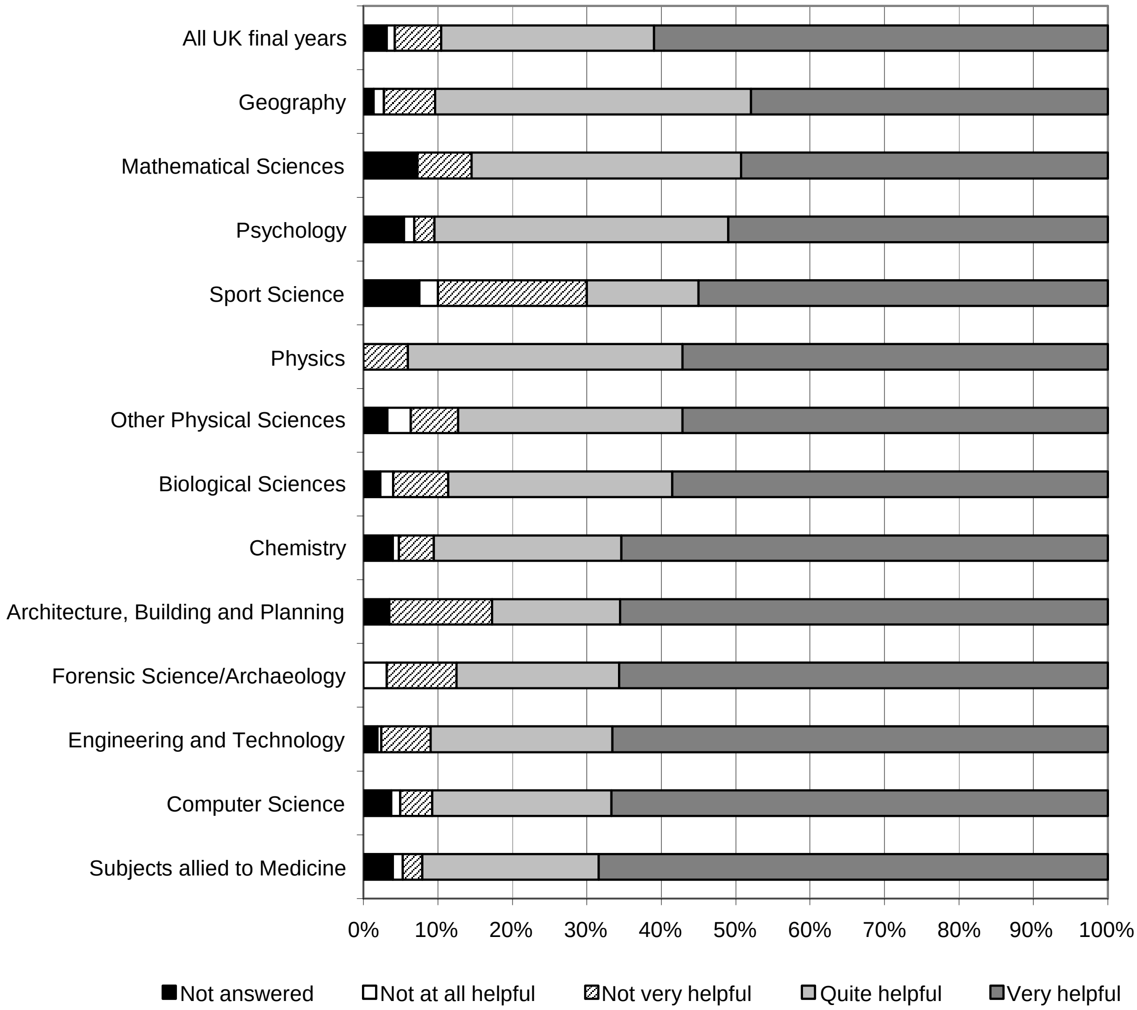
The numbering of tables within this Appendix follows the chapters to which they relate (and in which they are referred to). Thus, tables relating to Chapter 3 are numbered Table B3.1 onwards, and so on. Tables B.1 and B.2, at the rear, refer to Appendix A, section A.3.1.

All data are expressed as percentages except where shown (i.e. response count figures, *N*).

Appendix Figure B3.1 How helpful was skills/experience gained from work experience for degree



Appendix Figure B3.2 How helpful was skills/experience gained from work experience for career and work choices



Appendix Table B3.1: Career plans by subject of study (UK final year undergraduates and taught postgraduates)

UK Final Year Undergraduates	Subjects allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Computer Science	Engineering and Technology	Architecture, Building and Planning	Geography	Forensic Science/ Archaeology	All
Definitely want to pursue career in occupation directly related to degree	55	51	47	48	48	43	64	45	59	62	62	42	44	52
Might want to pursue career in occupation related to degree	31	32	44	36	33	36	27	40	33	30	36	45	41	34
Don't think want to pursue career in occupation related to my degree	6	9	5	11	11	12	4	10	5	6	2	6	11	8
Definitely do not want to pursue career in occupation related to degree	7	5	3	4	7	6	4	2	1	1	0	3	3	3
Do not know	1	3	2	2	1	3	1	2	1	1	0	3	1	2
Count	*146*	*371*	*64*	*309*	*213*	*236*	*166*	*233*	*272*	*578*	*47*	*259*	*75*	*2969*
UK Taught Postgraduates														
Definitely want to pursue career in occupation directly related to degree	90	86	82	88	80	68	74	49	77	84	81	65	79	77
Might want to pursue career in occupation related to degree	6	12	12	12	20	29	21	29	20	12	19	32	17	18
Don't think want to pursue career in occupation related to my degree	0	0	0	0	0	0	2	7	4	2	0	3	3	2
Definitely do not want to pursue career in occupation related to degree	0	0	6	0	0	0	0	9	0	2	0	0	0	1
Do not know	3	2	0	0	0	3	2	7	0	1	0	0	0	1
Count	*31*	*50*	*17*	*50*	*10*	*31*	*42*	*45*	*82*	*129*	*37*	*60*	*29*	*613*

Appendix Table B3.2: Career plans by subject of study (UK final year undergraduates by level: selected subjects)

UK Final Year Undergraduates	3 year undergraduates						Enhanced M-Level students					
	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Engineering and Technology	All 3 year	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Engineering and Technology	All M level
Definitely want to pursue career in occupation directly related to degree	32	37	59	45	57	49	55	49	76	47	65	60
Might want to pursue career in occupation related to degree	42	36	32	41	34	36	29	37	15	37	27	29
Don't think want to pursue career in occupation related to my degree	15	15	3	11	6	9	9	10	7	8	7	8
Definitely do not want to pursue career in occupation related to degree	8	9	5	2	2	4	6	3	2	3	1	2
Do not know	3	3	1	2	2	2	1	2	0	3	0	1
Count	*66*	*116*	*112*	*174*	*232*	*700*	*147*	*120*	*54*	*59*	*346*	*726*

Appendix Table B3.3: Career plans by subject of study (UK PhD students)											
	Architecture, Building and Planning	Biological Sciences	Biomedical Sciences	Engineering/ Technology	Environmental Sciences/ Geography/ Archaeology	Mathematical Sciences	Computer Science	Other subjects allied to Medicine	Physical Sciences	Psychology/ Sports Science	All
Definitely want to pursue a career in an occupation directly related to the broad subject of my research	71	50	55	52	68	45	65	64	51	65	55
Might want to pursue a career in an occupation related to the broad subject of my research	0	40	36	39	27	45	26	36	32	24	34
Don't think I want to pursue a career in an occupation related to the broad subject of my research	0	5	4	3	2	10	6	0	10	6	6
Definitely don't want to pursue a career in an occupation related to the broad subject of my research	14	3	1	5	0	0	0	0	2	0	2
Don't know	14	2	3	1	2	0	3	0	4	6	3
Count	*7*	*112*	*67*	*97*	*41*	*31*	*34*	*36*	*168*	*34*	*627*

Appendix Table B3.4: Reasons for STEM career intention (UK final year PhD students)

	Final Year UK PhD students		
	Definite	**Might**	**Might not**
	%	%	%
I will find the work interesting and exciting	90	72	35
To put my knowledge/subject expertise into practice	85	79	59
I enjoy my research so it seems logical to work in this field	70	44	5
To use my high-level skills (developed during research)	63	67	43
I have always wanted to work in this field	38	9	5
I have enjoyed related work experience	24	15	0
I will have better long-term career prospects	17	16	3
I will be better paid (than in other types of work)	10	12	14
It will enable me to work in my preferred location	10	12	0
I know other people who do this kind of work	10	12	3
I will find it easier to get a job	8	17	16
I will be letting people down if I don't	4	6	16
Other reason	2	2	5
Not answered	0	0	0
N of cases	*343*	*216*	*37*

Appendix Table B3.5: Reason for STEM career intention by subject of study (UK final year undergraduates with definite intention for occupation related to degree)

	allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Physical Sciences	Mathematical Sciences	Computer Science	and Technology	Building and Planning	Geography	Science/ Archaeology	All
I will find the work interesting and exciting	79	89	90	91	92	92	95	75	81	88	86	87	94	87
I want an opportunity to put my learning into practice	79	78	70	74	78	78	79	71	68	74	62	69	82	74
I enjoyed my degree course and so it seems logical to work in this field	70	70	60	76	69	58	76	52	50	56	34	72	61	63
I have always wanted to work in this field	49	51	57	69	36	49	54	43	66	52	55	52	58	53
I will have better long-term career prospects	40	33	40	39	24	24	51	36	45	53	62	19	30	40
I enjoyed my degree-related work experience	47	37	40	29	56	34	27	10	47	53	34	21	30	39
I will be better paid	36	16	13	24	18	15	37	39	36	40	38	11	15	28
I will find it easier to get a job	33	11	3	3	18	15	22	24	30	27	31	8	12	19
There are plenty of degree-related jobs in my preferred location	12	8	7	6	10	8	14	24	18	19	7	9	6	13
I know other people who do this kind of work	17	8	23	9	12	13	13	13	22	12	21	10	12	13
I have knowledge through a parent/relative who does this kind of work	10	4	7	5	5	3	7	6	6	11	21	7	3	7
I will be letting people down if I don't	2	5	3	2	2	5	4	3	2	4	3	2	3	3
Other reason	1	3	3	3	3	3	3	4	3	4	3	2	6	3
Already employed in this field	0	0	0	0	0	1	0	0	1	2	7	0	0	1
Not answered	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Count	*81*	*191*	*30*	*148*	*102*	*102*	*107*	*106*	*161*	*358*	*29*	*109*	*33*	*1557*

Appendix Table B3.6: Reason for STEM career intention by subject of study (UK final year undergraduates who might want occupation related to degree)

	allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Physical Sciences	Mathematical Sciences	Computer Science	and Technology	Building and Planning	Geography	Science/ Archaeology	All
I will find the work interesting and exciting	76	72	82	85	63	79	70	57	52	69	59	76	77	71
I want an opportunity to put my learning into practice	76	72	64	70	70	60	73	61	59	69	82	65	74	68
I enjoyed my degree course and so it seems logical to work in this field	51	47	43	55	39	49	55	41	20	33	24	56	45	43
I will have better long-term career prospects	13	29	18	37	37	34	34	47	49	47	47	15	19	35
I will be better paid	20	16	14	25	37	29	30	47	59	44	35	8	13	31
I will find it easier to get a job	9	18	18	16	21	24	18	34	35	31	18	11	13	23
I have always wanted to work in this field	13	22	50	28	8	14	25	12	23	15	35	11	32	19
I enjoyed my degree-related work experience	18	16	14	16	30	10	14	10	19	19	29	8	16	16
I know other people who do this kind of work	9	9	21	11	11	7	16	5	19	11	24	3	13	10
There are plenty of degree-related jobs in my preferred location	4	6	4	7	6	3	18	17	22	13	0	9	0	10
I will be letting people down if I don't	4	7	7	4	10	3	7	8	4	6	18	5	10	6
I have knowledge through a parent/relative who does this kind of work	7	5	7	4	1	3	11	9	8	6	6	9	0	6
Other reason	0	1	4	2	1	7	2	1	3	3	6	1	3	2
Not answered	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Count	*45*	*119*	*28*	*110*	*71*	*86*	*44*	*93*	*91*	*172*	*17*	*117*	*31*	*1024*

Appendix Table B3.7: Reason for STEM career intention by subject of study (UK final year students with possible intention to pursue occupation related to degree)

	allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Physical Sciences	Mathematical Sciences	Computer Science	and Technology	Building and Planning	Geography	Science/ Archaeology	All
I want an opportunity to put my learning into practice	67	44	33	42	70	55	14	21	21	39	100	50	38	43
I will find the work interesting and exciting	33	29	33	61	26	38	43	29	0	11	100	25	38	31
I enjoyed my degree course and so it seems logical to work in this field	33	35	0	36	39	17	43	17	7	11	0	25	0	24
I will be better paid	0	12	33	9	17	14	29	67	50	25	0	6	13	22
I will find it easier to get a job	0	15	0	3	9	14	14	33	14	42	100	19	13	18
I will have better long-term career prospects	0	6	0	12	0	14	14	13	7	19	0	13	38	11
There are plenty of degree-related jobs in my preferred location	0	3	0	15	13	7	29	4	21	14	0	13	0	10
I will be letting people down if I don't	0	9	0	3	9	7	0	13	21	17	0	6	13	9
I know other people who do this kind of work	11	12	0	12	4	7	0	0	0	8	0	13	0	7
I enjoyed my degree-related work experience	11	3	0	6	17	3	14	0	7	0	0	6	13	5
I have always wanted to work in this field	11	6	33	0	9	3	0	0	0	0	0	13	0	4
I have knowledge through a parent/relative who does this kind of work	0	3	0	3	0	3	0	4	0	0	0	0	0	2
Other reason	11	6	0	6	0	7	0	4	0	8	0	0	0	5
Not answered	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Count	*9*	*34*	*3*	*33*	*23*	*29*	*7*	*24*	*14*	*36*	*1*	*16*	*8*	*237*

Appendix Table B3.8 Reasons for STEM career intention (UK final year undergraduates by gender who definitely, might and might not want to pursue an occupation related to their degree)

	Male students			Female students		
	% Definite	% Might	% Might not	% Definite	% Might	% Might not
I will find the work interesting and exciting	88	70	26	87	71	36
I want an opportunity to put my learning into practice	74	66	42	75	69	45
I enjoyed my degree course and so it seems logical to work in this field	59	38	21	66	49	27
I have always wanted to work in this field	56	19	4	51	18	3
I will have better long-term career prospects	42	40	12	37	31	10
I enjoyed my degree-related work experience	40	16	5	37	15	6
I will be better paid	31	36	22	25	26	22
I will find it easier to get a job	24	24	19	14	21	17
There are plenty of degree-related jobs in my preferred location	13	11	12	13	9	9
I know other people in this kind of work	15	11	8	12	10	6
I have knowledge through a parent/relative who does this kind of work	8	7	1	6	4	3
I will be letting people down if I don't	4	5	11	3	7	8
Already employed in this field	1			0		
Other reason	4	4	5	3	1	4
Count	*793*	*503*	*121*	*764*	*521*	*116*

Appendix Table B3.9: Reason for non-STEM career intention by subject of study (UK final year undergraduates who might not or definitely did not want a degree-related occupation)

	allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Physical Sciences	Mathematical Sciences	Computer Science	and Technology	Building and Planning	Geography	Science/ Archaeology	All
I have become more interested in another field	58	63	40	74	62	45	43	41	63	50	0	50	50	56
I will be better paid	37	39	40	11	49	40	21	14	6	30	0	33	10	29
I have not enjoyed my degree course	21	22	20	26	30	38	14	34	50	36	0	4	30	28
I will have better long-term career prospects	47	41	40	20	32	26	36	10	13	30	0	29	0	28
I never intended to work in this field	26	29	0	13	22	26	14	31	6	5	0	42	10	21
There are too few career opportunities in my field	21	20	100	28	22	17	7	0	0	7	100	50	50	20
I will find it easier to get a job	21	22	40	33	14	24	14	3	0	7	0	33	10	18
There are too few jobs related to my degree in my preferred location	21	12	40	22	16	10	7	7	6	16	0	25	20	15
I was put off by my work experience	0	20	0	7	24	2	0	7	31	30	0	4	0	13
I was put off by knowledge of other people doing that kind of work	11	12	20	9	14	7	14	7	13	11	0	13	0	10
My course did not prepare me well enough to get a degree-related job	0	4	40	17	8	10	7	3	13	0	0	13	0	8
I have tried and failed to get jobs directly related to my degree	0	0	0	2	3	0	7	7	0	5	0	4	0	2
I was put off by knowledge from a relative doing that kind of work	0	2	0	0	3	0	0	0	13	2	0	0	0	1
Other reason	21	18	0	20	16	19	29	14	0	11	100	8	20	16
Not answered	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Count	*19*	*51*	*5*	*46*	*37*	*42*	*14*	*29*	*16*	*44*	*1*	*24*	*10*	*338*

Appendix Table B3.10: Reason for non-STEM career intention by subject of study (UK final year undergraduates who might want a degree-related occupation)

	allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Physical Sciences	Mathematical Sciences	Computer Science	and Technology	Building and Planning	Geography	Science/ Archaeology	All
I have become more interested in another field	33	30	14	28	31	33	20	32	35	42	12	22	29	31
There are too few jobs related to my degree in my preferred location	27	39	36	35	32	21	39	16	16	21	41	37	48	29
I will find it easier to get a job	24	24	32	39	30	22	36	17	14	22	24	35	42	27
There are too few career opportunities in my field	36	28	54	32	28	13	25	11	12	17	24	26	58	24
I will be better paid	29	21	11	17	23	29	30	3	9	22	12	25	29	20
My course did not prepare me well enough to get a degree-related job	9	15	11	18	15	9	16	14	27	9	24	17	6	15
I have not enjoyed my degree course	4	9	7	5	10	14	14	14	22	18	12	5	3	12
I will have better long-term career prospects	13	17	11	7	14	12	2	1	5	11	18	10	13	10
I was put off by my work experience	13	10	4	2	6	3	7	5	11	13	12	1	6	7
I have tried and failed to get jobs directly related to my degree	9	3	4	3	10	2	11	8	7	10	29	5	3	7
I was put off by knowledge of other people doing that kind of work	4	4	7	6	7	2	7	8	14	5	6	3	10	6
I never intended to work in this field	4	5	4	3	7	2	5	6	5	1	0	3	3	4
I was put off by knowledge from a relative doing that kind of work	0	3	0	0	3	0	5	3	5	1	6	0	0	2
Other reason	0	3	7	9	6	14	11	8	5	8	18	9	6	8
Not answered	0	2	0	3	1	3	0	3	1	1	0	1	0	1
Count	*45*	*119*	*28*	*110*	*71*	*86*	*44*	*93*	*91*	*172*	*17*	*117*	*31*	*1024*

Appendix Table B3.11 Reasons for non-degree related career intention (UK final year undergraduates, by gender, comparing those who might want with those who might not/definitely do not want to pursue an occupation related to their degree)

	Might want		Definitely/might not	
	Male	Female	Male	Female
	%	%	%	%
I have become more interested in another field	34	28	51	60
There are too few jobs related to my degree in my preferred location	24	34	15	15
I will find it easier to get a job	27	26	16	21
There are too few career opportunities in my field	20	27	20	21
I will be better paid	23	17	34	24
My course did not prepare me well enough to get a degree-related job	12	18	7	8
I have not enjoyed my degree course	13	10	28	28
I will have better long-term career prospects	11	9	29	27
I was put off by my work experience	7	7	15	11
I have tried and failed to get jobs directly related to my degree	8	5	3	2
I was put off by knowledge of other people doing that kind of work	6	6	13	7
I never intended to work in this field	4	3	22	20
I was put off by knowledge from a relative doing that kind of work	2	1	3	0
Other reason	8	7	16	16
Not answered	1	2	0	0
Number of cases	*503*	*521*	*174*	*164*

Appendix Table B3.12: Reasons for non-degree related career intention (UK final year PhD students)

	Final Year UK PhD students		
	Might	**Might not**	**Definitely not**
	%	%	**%**
There are too few career opportunities in my field	50	35	21
Too few relevant jobs in my preferred work location	38	16	21
I will be better paid doing other work	37	35	29
Better long-term career prospects doing something else	31	30	36
I have become more interested in another field	23	54	29
I want to use my high-level skills but not in this field	20	57	7
I will find it easier to get different kind of job	19	16	14
I have not enjoyed my postgraduate research	17	43	57
Knowledge of others doing this kind of work has put me off	15	27	29
Insufficient ability/experience to get a job related to my research	11	19	14
I never intended to work in this field	9	8	14
I have been put off by my work experience	6	14	29
I have tried and failed to get jobs related to my research	6	0	0
Other reason	7	5	14
Not answered	1	0	0
N of cases	*216*	*37*	*14*

Appendix Table B3.13: Career plans by subject of study (UK final year undergraduates)

Career plan when first went to university	Subjects allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Computer Science	Engineering and Technology	Building and Planning	Geography	Forensic Science/ Archaeology	All
Definite career in mind	38	19	22	22	11	16	14	18	14	24	55	9	25	19
Considering several career alternatives	18	29	30	28	24	19	28	21	29	30	21	17	33	26
Only vague idea of possible careers	27	34	30	35	45	36	37	30	40	35	21	41	25	35
No idea at all	17	18	19	16	20	28	21	31	17	11	2	33	16	20
Changed career plan														
Yes - completely	20	17	13	24	20	14	15	16	15	12	6	20	20	17
Yes - to some extent	37	53	58	55	58	49	57	45	49	56	53	53	57	52
No	43	30	30	21	22	37	28	39	36	32	40	27	23	31
Current career plan														
Definite career in mind	48	35	30	31	24	34	28	35	28	34	55	22	24	32
Considering several career alternatives	27	40	44	44	49	34	52	30	43	48	32	40	41	42
Only vague idea of possible careers	22	21	20	22	25	27	16	24	25	16	13	32	32	22
No idea at all	3	5	6	3	1	5	4	11	4	2	0	7	3	4
Count	*146*	*371*	*64*	*309*	*213*	*236*	*166*	*233*	*272*	*578*	*47*	*259*	*75*	*2969*

Appendix Table B3.14: Career sector and occupational function for those with definite career plans, by subject of study (UK final year undergraduates)

Sector	Subjects allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Computer Science	Engineering and Technology	Architecture, Building and Planning	Geography	Forensic Science/ Archaeology	All
STEM Specialist	89	80	63	55	54	59	70	14	73	82	92	32	56	65
STEM Generalist	7	15	21	30	33	30	19	80	16	5	0	41	22	23
Non-STEM	4	5	16	15	8	9	4	2	10	13	8	27	22	10
Other	0	0	0	0	6	1	4	2	1	1	0	0	0	1
Don't know	0	0	0	0	0	1	2	1	0	0	0	0	0	0
Function														
STEM Core	84	70	26	58	62	57	66	17	71	85	69	39	6	63
STEM-related	7	16	37	27	29	30	15	70	8	5	4	41	22	22
Unrelated	1	4	16	13	6	4	2	5	14	9	8	7	28	8
Other	7	10	16	2	4	10	15	5	6	1	19	7	22	7
Don't know	0	0	5	0	0	0	2	2	0	1	0	5	22	1
Count	*70*	*128*	*19*	*97*	*52*	*81*	*47*	*81*	*77*	*196*	*26*	*56*	*18*	*948*

Appendix Table B3.15: Career sector and occupational function for those with career plans, by subject of study (UK taught postgraduates)

Sector	Subjects allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Computer Science	Engineering and Technology	Architecture, Building and Planning	Geography	Forensic Science/ Archaeology	All
STEM Specialist	78	66	81	44	67	79	62	26	57	73	61	57	42	61
STEM Generalist	0	5	0	9	0	7	12	39	13	1	0	2	8	7
Non-STEM/Other	4	0	0	16	11	0	6	6	4	7	24	11	17	8
STEM Specialist/Generalist	7	17	6	9	0	11	6	16	7	5	0	4	8	7
Mixed sectors	11	12	13	22	22	4	15	13	16	15	15	26	25	16
Don't know	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Function														
STEM Core	81	56	38	64	67	64	62	35	54	65	67	60	33	59
STEM related	0	7	19	4	0	7	18	32	9	2	0	9	4	8
Other/unrelated	7	5	38	13	22	14	9	19	12	8	15	13	42	14
STEM Core/related	7	20	0	4	0	11	9	6	4	7	6	2	13	7
Mixed functions	4	12	6	13	11	4	3	6	21	17	12	15	8	12
Don't know	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Count	*27*	*41*	*16*	*45*	*9*	*28*	*34*	*31*	*68*	*107*	*33*	*47*	*24*	*510*

Appendix Table B3.16 Career sector and occupational function for those with definite career plans, by subject of study (UK taught postgraduates)

Sector	Subjects allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Computer Science	Engineering and Technology	Architecture, Building and Planning	Geography	Forensic Science/ Archaeology	All
STEM Specialist	93	88	100	65	80	89	63	36	57	88	71	67	55	73
STEM Generalist	0	12	0	15	0	11	25	55	32	2	0	7	18	15
Non-STEM	7	0	0	15	0	0	13	5	4	10	29	27	27	10
Other	0	0	0	4	20	0	0	5	4	0	0	0	0	2
Don't know	0	0	0	0	0	0	0	0	4	0	0	0	0	0
Function														
STEM Core	87	76	46	85	80	68	56	45	57	86	88	67	36	70
STEM-related	0	12	15	8	0	11	38	41	21	2	0	13	9	13
Unrelated	0	0	0	4	0	0	0	5	21	4	6	0	27	6
Other	13	12	38	4	20	21	6	9	0	8	6	20	27	11
Count	*15*	*17*	*13*	*26*	*5*	*19*	*16*	*22*	*28*	*50*	*17*	*15*	*11*	*254*

Appendix Table B3.17 Career sector and occupational function for those with career plans by subject of study (UK PhD students)

Sector	Architecture, Building and Planning	Biological Sciences	Biomedical Sciences	Engineering/ Technology	Environmental Sciences/ Geography/ Archaeology	Mathematical Sciences	Computer Science	Other subjects allied to Medicine	Physical Sciences	Psychology/ Sports Science	All
STEM Specialist	60	71	58	69	71	44	78	39	65	47	63
STEM Generalist	20	2	2	6	0	19	3	0	8	0	5
Non-STEM/Other	0	5	17	9	3	7	3	25	5	23	9
STEM Specialist/Generalist	0	5	2	8	3	19	3	0	5	0	5
Mixed sectors	20	11	19	8	23	7	6	32	14	23	14
Don't know	0	4	2	0	0	4	6	4	3	7	3
Function											
STEM Core	60	63	63	71	52	37	59	71	61	57	61
STEM related	40	9	8	3	16	22	9	4	5	17	9
Other/unrelated	0	7	8	8	0	15	16	7	5	7	7
STEM Core/related	0	13	10	12	23	15	6	11	9	10	11
Mixed functions	0	9	12	5	10	11	9	7	19	7	11
Don't know	0	0	0	1	0	0	0	0	1	3	1
Count	*5*	*91*	*52*	*77*	*31*	*27*	*32*	*28*	*130*	*30*	*503*

Appendix Table B3.18 Main aim for year after complete course, by subject of study (UK final year UK undergraduates)

	allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Physical Sciences	Mathematical Sciences	Computer Science	and Technology	and Planning	Geography	Archaeology	All
Obtain employment related to longer-term career plans	35	27	28	31	39	35	35	41	53	62	62	28	35	41
Obtain other long-term employment	5	4	5	1	4	5	7	7	6	6	0	7	3	5
Obtain temporary employment	4	8	8	11	5	6	1	6	8	2	4	14	11	7
Travel or take time out	10	12	16	12	9	8	11	15	10	12	6	17	7	12
Become self-employed	1	0	0	0	0	1	0	0	2	1	2	0	1	1
Enrol on a full-time higher degree course	25	37	27	31	34	32	38	20	12	11	6	26	37	25
Undertake vocational training	3	3	5	3	2	3	2	3	2	1	2	2	0	2
PGCE	0	2	0	2	1	2	0	3	0	0	0	1	0	1
Continue in current employment	0	0	2	0	0	1	1	0	0	1	4	0	0	0
Study medicine	8	2	0	0	0	0	1	0	0	0	0	0	1	1
Another undergraduate course	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Complete Pre-Reg year	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	3	2	3	5	2	3	1	1	1	2	6	2	4	2
Don't know	3	3	8	3	3	4	3	3	4	3	6	3	1	3
Count	*145*	*371*	*64*	*309*	*213*	*235*	*166*	*233*	*271*	*575*	*46*	*259*	*75*	*2962*

Appendix Table B3.19 Reasons for undertaking further study/training, by subject of study (UK final year undergraduates)

	allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Physical Sciences	Mathematical Sciences	Computer Science	and Technology	and Planning	Geography	Archaeology	All
I want to develop more specialist knowledge and expertise	44	57	64	63	61	61	68	41	62	60	40	56	76	59
It will give me access to better career opportunities	49	65	61	67	64	46	58	45	42	59	90	60	68	58
I am interested in the course	58	56	36	64	62	70	60	51	49	55	30	51	61	57
It is essential for the career I wish to develop	72	65	85	76	45	55	49	63	36	28	60	50	55	56
I want to continue studying to a higher level	35	46	33	49	55	55	53	37	38	41	0	41	53	46
I want to develop a broader range of knowledge and expertise	27	36	30	46	37	36	39	38	40	32	40	35	53	37
It will be easier to find the type of job I want with this additional qualification	28	37	48	52	40	16	50	23	26	36	40	38	47	36
It is difficult to get the type of job I want at the present time	12	15	27	20	21	8	20	5	12	24	10	14	13	16
I want to change career direction	13	11	0	9	11	11	4	9	13	11	0	5	11	9
I have been unable to get work directly related to my undergraduate degree	5	2	6	6	3	2	1	2	5	6	10	4	3	4
Other	0	2	0	1	2	2	0	0	4	3	0	1	0	2
Not answered	0	0	0	0	2	0	2	1	6	2	0	1	0	1
Count	*78*	*234*	*33*	*172*	*122*	*132*	*96*	*94*	*78*	*157*	*10*	*114*	*38*	*1358*

Appendix Table B3.20 Reasons for undertaking postgraduate course, by subject of study (UK taught postgraduates)

	allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Physical Sciences	Mathematical Sciences	Computer Science	and Technology	and Planning	Geography	Archaeology	All
It will give me access to better career opportunities	77	76	88	84	80	58	79	44	76	78	70	70	59	73
I wanted to develop more specialist knowledge and expertise	61	76	94	78	70	65	76	62	74	58	38	67	86	68
I was interested in the course	81	64	47	68	60	58	74	87	66	53	46	53	72	63
I wanted to continue studying to a higher level	48	66	47	68	50	52	69	73	63	50	22	45	69	56
It will be easier to get the type of job I want with this additional qualification	52	42	65	44	50	23	55	18	44	49	38	53	55	45
I wanted to develop a broader range of knowledge and expertise	26	48	35	42	50	32	43	44	51	43	32	35	34	41
It is essential for the career I wish to develop	61	46	53	54	40	39	43	18	28	40	46	35	38	40
I wanted to change career direction	16	10	6	4	0	23	17	16	24	25	46	37	17	21
It was difficult to get the type of job I wanted at the time	13	24	18	18	20	10	10	7	23	22	11	22	24	18
I had been unable to get work directly related to my undergraduate degree	13	14	18	10	20	19	7	7	12	9	8	20	21	12
Other	10	6	0	4	10	13	0	4	7	4	16	2	14	6
Not answered	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Count	*31*	*50*	*17*	*50*	*10*	*31*	*42*	*45*	*82*	*129*	*37*	*60*	*29*	*613*

Appendix Table B3.21 Career sector expectation, by job seeking behaviour (UK final year students with career plan)

	STEM Specialist	STEM Generalist	Non-STEM	STEM Specialist/ Generalist	Mixed	Don't know	All with plan
Started looking for employment	63	44	62	65	69	50	62
Applied for jobs related to long-term career plans	45	38	50	40	43	25	44
Been offered job related to long-term career plans	15	22	19	12	8	25	14
Count	*1120*	*249*	*151*	*213*	*450*	*4*	*2187*

Appendix Table B3.22 Career function expectation, by job seeking behaviour (UK final year students with career plan)

	STEM Core	STEM related	Unrelated	STEM Core/ related	Mixed	Don't know	All with plan
Started looking for employment	64	44	57	64	72	70	62
Applied for jobs related to long-term career plans	48	33	38	38	45	43	44
Been offered job related to long-term career plans	17	17	14	9	9	8	14
Count	*1030*	*261*	*263*	*195*	*401*	*37*	*2187*

Appendix Table B3.23 Most important factors for choice of undergraduate course, by subject of study (UK final year undergraduates)

	allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Physical Sciences	Mathematical Sciences	Computer Science	and Technology	and Planning	Geography	Archaeolog y	All
I had a personal interest/aptitude in this subject	71	74	77	84	72	83	82	81	82	73	60	77	76	77
I enjoyed studying this subject at A-level (or equivalent)	64	77	66	68	85	81	61	89	58	48	13	83	33	67
I felt this course would keep a lot of career options open for me	27	42	36	50	52	62	39	67	59	61	47	45	39	52
I wanted to follow a career in this field	51	47	64	59	35	40	50	41	63	54	66	32	60	49
I liked the university/department when I visited it	52	40	33	39	58	41	55	36	36	43	26	45	57	43
It is a required qualification for my chosen career	23	13	22	21	15	12	14	11	12	25	26	5	21	16
My teacher at school/college recommended it	11	10	23	13	26	21	16	23	7	13	4	18	5	15
I was influenced by my parents/relatives	14	10	16	10	9	13	8	13	13	16	17	9	12	12
I wandered into this course after my A-levels (or equivalent)	9	10	8	9	12	8	11	10	8	13	11	9	15	10
I was influenced by other people I know who had studied it	7	8	16	7	7	6	8	7	13	11	13	7	1	9
Other factor	4	4	3	2	2	1	2	2	3	4	9	1	3	3
Not answered	1	0	0	0	0	0	0	0	0	1	2	0	0	0
Count	*146*	*371*	*64*	*309*	*213*	*236*	*166*	*233*	*272*	*578*	*47*	*259*	*75*	*2969*

Appendix Table B3.24 Reason for choice of undergraduate course, by subject of study (UK taught postgraduates)

	allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Physical Sciences	Mathematical Sciences	Computer Science	and Technology	and Planning	Geography	Archaeology	All
I had a personal interest/aptitude in this subject	55	88	71	78	70	71	83	78	74	67	46	73	86	73
I enjoyed studying this subject at A-level (or equivalent)	61	74	82	58	90	58	48	67	48	38	43	70	31	54
I wanted to follow a career in this field	45	58	53	58	40	61	57	38	48	60	38	43	59	52
I felt this course would keep a lot of career options open for me	39	40	29	52	40	52	33	31	43	50	41	43	31	43
I liked the university/department when I visited it	32	44	41	38	50	35	38	20	23	28	30	37	34	32
It is a required qualification for my chosen career	6	24	24	26	10	23	17	9	9	16	11	8	17	15
I was influenced by my parents/relatives	16	6	0	12	10	10	7	11	13	12	14	12	10	11
I wandered into this course after my A-levels (or equivalent)	13	12	6	10	0	23	10	7	13	5	14	12	7	10
My teacher at school/college recommended it	3	12	18	4	10	13	10	7	10	12	8	10	10	10
I was influenced by other people I know who had studied it	10	0	0	8	10	13	5	4	11	8	8	15	7	8
Other factor	10	2	6	4	0	6	7	4	4	4	11	3	7	5
Not answered	0	0	0	0	0	0	0	0	1	3	5	0	0	1
Count	*31*	*50*	*17*	*50*	*10*	*31*	*42*	*45*	*82*	*129*	*37*	*60*	*29*	*613*

Appendix Table B3.25 Reason for choice of undergraduate course, by subject of study (UK final year PhDs)

	Architecture, Building and Planning	Biological Sciences	Biomedical Sciences	Engineering/ Technology	Environmental Sciences/ Geography/ Archaeology	Mathematical Sciences	Computer Science	Other subjects allied to Medicine	Physical Sciences	Psychology/ Sports Science	All
I had a personal interest/aptitude in this subject	71	71	78	74	80	94	85	64	85	74	78
I enjoyed studying this subject at A-level (or equivalent)	14	61	64	53	63	100	65	39	83	35	65
I wanted to follow a career in this field	57	59	54	59	54	29	47	56	48	41	52
I liked the university/department when I visited it	43	42	37	38	41	45	47	22	51	41	42
The course would keep lots of career options open for me	14	24	34	49	41	77	35	33	53	35	42
It is a required qualification for my chosen career	14	18	15	14	7	10	15	31	13	12	15
I was influenced by my parents/relatives	14	13	15	14	2	10	12	8	15	9	13
My teacher at school/college recommended it	0	10	4	9	7	26	3	6	15	9	10
I wandered into this course after my A-levels (or equivalent)	14	8	6	2	7	3	0	11	8	9	6
I was influenced by other people I know who had studied it	29	3	7	7	5	3	0	17	4	6	5
Other factor	0	4	3	7	7	0	3	3	2	0	4
Not answered	0	0	0	0	0	0	0	3	0	0	0
Count	*7*	*112*	*67*	*97*	*41*	*31*	*34*	*36*	*168*	*34*	*627*

Appendix Table B3.26 Reasons for undertaking postgraduate study, by subject of study (UK PhD students)

	Architecture, Building and Planning	Biological Sciences	Biomedical Sciences	Engineering/ Technology	Environmental Sciences/ Geography/ Archaeology	Mathematical Sciences	Computer Science	Other subjects allied to Medicine	Physical Sciences	Psychology/ Sports Science	All
I was interested in this subject	71	72	60	73	88	97	71	78	85	76	77
I wanted to continue studying to a higher level	71	58	52	52	76	90	59	58	79	56	65
I wanted to develop more specialist knowledge and expertise	14	58	54	57	59	68	68	64	57	50	58
I wanted to develop more high-level skills	0	40	51	49	34	39	50	64	51	38	46
It will broaden the range of potential career opportunities	29	45	46	48	37	39	47	36	46	38	44
It is essential for the career I wish to develop	43	51	46	12	39	29	26	22	38	50	36
It should help me get the type of job I want in the long term	14	40	28	36	44	26	35	42	35	24	35
I wanted to change career direction	29	10	15	11	7	3	12	0	4	12	8
It was difficult to get the type of job I wanted at the time	0	8	1	10	7	10	6	6	8	3	7
I was unable to get degree-related work with my first degree	14	10	3	1	5	0	3	6	2	6	4
Other	14	2	3	3	5	0	6	6	2	6	3
Not answered	14	0	0	0	0	0	0	0	0	0	0
Count	*7*	*112*	*67*	*97*	*41*	*31*	*34*	*36*	*168*	*34*	*627*

Appendix Table B3.27 Percentage that changed course at any stage, by subject of study (UK students)

	UK Final year undergraduates				**UK Taught postgraduates**			
Subject group	New subject	Different degree in same dept	Not changed course	N of cases	New subject	Different degree in same dept	Not changed course	*N of cases*
Subjects allied to Medicine	6	19	75	145	13	6	81	*31*
Biological Sciences	4	18	78	368	0	12	88	*50*
Sports Science	8	0	92	63	6	6	88	*17*
Psychology	6	3	91	307	4	8	88	*50*
Chemistry	4	14	82	213	10	0	90	*10*
Physics	3	14	83	235	10	6	84	*31*
Other Physical Sciences	7	18	75	166	10	10	81	*42*
Mathematical Sciences	6	15	79	232	7	13	80	*45*
Computer Science	6	15	79	271	11	7	81	*81*
Engineering and Technology	4	10	86	575	7	7	86	*128*
Architecture, Building and Planning	2	4	93	46	19	5	76	*37*
Geography	7	7	86	259	8	5	87	*60*
Forensic Science/ Archaeology	3	0	97	74	3	0	97	*29*
All students	5	12	83	2954	8	7	85	*611*

Appendix Table B3.28 Percentage who would choose same undergraduate course again, by subject of study (final year UK undergraduates)

Subject group	Same/ similar course	Different course	Delay entry	Not go at all	Do not know	*N of cases*
Subjects allied to Medicine	64	33	7	1	3	*146*
Biological Sciences	72	26	10	2	4	*371*
Sports Science	70	28	8	2	3	*64*
Psychology	74	24	5	3	5	*308*
Chemistry	74	24	9	3	6	*212*
Physics	81	18	6	1	2	*236*
Other Physical Sciences	82	16	4	4	3	*165*
Mathematical Sciences	76	16	8	2	5	*233*
Computer Science	69	28	8	2	5	*269*
Engineering and Technology	76	22	4	4	5	*574*
Architecture, Building and Planning	57	34	6	4	11	*47*
Geography	66	31	5	4	3	*258*
Forensic Science/ Archaeology	73	32	4	0	4	*75*
All students	73	24	6	3	4	*2958*

Appendix Table B3.29 Whether would choose same undergraduate course again, by subject of study (UK students)														
Final Year UK undergraduates	Subjects allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Computer Science	Engineering and Technology	Architecture, Building and Planning	Geography	Forensic Science/ Archaeology	All
Same/similar undergraduate course	64	72	70	74	74	81	82	76	69	76	57	66	73	73
Different undergraduate course	33	26	28	24	24	18	16	16	28	22	34	31	32	24
Delay your entry to higher education	7	10	8	5	9	6	4	8	8	4	6	5	4	6
Not go to university at all	1	2	2	3	3	1	4	2	2	4	4	4	0	3
Do not know	3	4	3	5	6	2	3	5	5	5	11	3	4	4
Count	146	371	64	308	212	236	165	233	269	574	47	258	75	2958
UK Taught Postgraduates														
Same/similar undergraduate course	65	70	76	76	80	58	76	89	57	70	46	68	72	68
Different undergraduate course	29	26	24	18	20	32	24	16	38	22	43	32	17	27
Delay your entry to higher education	3	4	0	12	0	6	7	0	10	12	11	8	0	8
Not go to university at all	0	4	0	0	0	0	2	0	4	3	9	5	3	3
Do not know	10	6	0	4	0	6	0	2	2	5	11	2	7	4
Count	*31*	*50*	*17*	*50*	*10*	*31*	*42*	*44*	*82*	*128*	*35*	*59*	*29*	*608*

Note: column percentages do not sum to 100% as students could choose more than one option.

Appendix Table B3.30 Career plans, by subject of study (UK taught postgraduates)

Career plan when first went to university	Subjects allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Computer Science	Engineering and Technology	Building and Planning	Geography	Forensic Science/ Archaeology	All
Definite career in mind	16	18	12	30	20	39	17	22	17	28	32	10	28	23
Considering several career alternatives	32	32	41	22	30	13	24	7	18	18	22	17	21	21
Only vague idea of possible careers	23	40	29	26	30	29	36	44	46	36	22	38	31	35
No idea at all	29	10	18	22	20	19	24	27	18	18	24	35	21	22
Changed career plan														
Yes - completely	13	20	47	16	10	23	19	16	28	18	30	18	21	21
Yes - to some extent	65	58	41	50	40	35	52	42	45	43	41	55	52	48
No	23	22	12	34	50	42	29	42	27	40	30	27	28	32
Current career plan														
Definite career in mind	48	34	76	52	50	61	38	49	34	39	46	25	38	41
Considering several career alternatives	39	48	18	38	40	29	43	20	49	44	43	53	45	42
Only vague idea of possible careers	10	14	6	8	0	6	17	16	15	13	11	20	17	13
No idea at all	3	4	0	2	10	3	2	16	2	4	0	2	0	4
Count	*31*	*50*	*17*	*50*	*10*	*31*	*42*	*45*	*82*	*129*	*37*	*60*	*29*	*613*

Appendix Table B3.31 Career plans, by subject of study (UK PhD students)											
Career plan when first went to university	Architecture, Building and Planning	Biological Sciences	Biomedical Sciences	Engineering/ Technology	Environmental Sciences/ Geography/ Archaeology	Mathematical Sciences	Computer Science	Other subjects allied to Medicine	Physical Sciences	Psychology/ Sports Science	All
Definite career in mind	29	20	10	24	22	0	18	33	10	12	16
Considering several career alternatives	14	28	31	33	17	13	26	31	24	35	27
Only vague idea of possible careers	29	36	39	35	49	61	41	14	45	26	39
No idea at all	29	17	19	8	12	26	15	22	21	26	18
Changed career plan											
Yes - completely	14	21	16	14	22	23	18	19	14	24	18
Yes - to some extent	57	37	46	47	39	58	50	31	55	41	46
No	29	42	37	38	39	19	32	50	31	35	36
Current career plan											
Definite career in mind	57	29	30	30	24	29	38	28	23	44	29
Considering several career alternatives	14	52	48	49	51	58	56	50	54	44	51
Only vague idea of possible careers	29	15	13	15	22	13	3	19	20	9	16
No idea at all	0	4	9	5	2	0	3	3	3	3	4
Count	*7*	*112*	*67*	*97*	*41*	*31*	*34*	*36*	*168*	*34*	*627*

Appendix Table B3.32 Planned career sector and function at initial entry to university, by subject of study (UK taught postgraduates)

Sector	Subjects allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Computer Science	Engineering and Technology	Architecture, Building and Planning	Geography	Forensic Science/ Archaeology	All
STEM Specialist	93	96	78	65	80	81	82	38	59	85	65	69	79	76
STEM Generalist	7	4	11	12	0	13	18	54	21	2	15	13	7	12
Non-STEM	0	0	11	12	20	6	0	8	17	12	20	19	14	11
Other	0	0	0	12	0	0	0	0	0	2	0	0	0	2
Don't know	0	0	0	0	0	0	0	0	3	0	0	0	0	0
Function														
STEM Core	87	92	44	81	100	69	76	38	69	80	60	75	71	74
STEM-related	0	4	44	8	0	19	24	62	24	2	10	13	0	13
Unrelated	7	0	11	12	0	13	0	0	7	14	10	6	21	9
Other	7	0	0	0	0	0	0	0	0	5	15	6	0	3
Don't know	0	4	0	0	0	0	0	0	0	0	5	0	7	1
Count	*15*	*25*	*9*	*26*	*5*	*16*	*17*	*13*	*29*	*59*	*20*	*16*	*14*	*264*

Appendix Table B3.33 Influences on career plans, by subject of study (Final Year UK undergraduates who had changed plans)

	Subjects allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Computer Science	Engineering and Technology	Building and Planning	Geography	Science/ Archaeology	All
My personal interests/values	72	71	71	77	63	70	74	61	62	67	79	72	71	69
The content of my university course	48	58	60	57	58	55	70	47	57	64	32	55	72	58
My friends/fellow students/peer group	45	40	29	35	42	42	38	42	40	42	25	33	26	39
My tutors/faculty staff	34	39	40	35	36	30	54	21	33	37	36	30	34	35
People I know working in a particular career	30	27	42	26	31	28	26	26	35	28	43	22	24	28
My work experience employer	33	27	24	17	38	26	19	18	39	41	25	15	17	28
My parents/relatives/friends of my parents	29	28	22	28	23	32	27	33	26	24	32	34	19	28
Employer websites, brochures or information	22	21	7	23	28	30	26	35	29	31	32	23	10	26
Employer presentations or visits to employers	14	15	7	16	22	21	34	31	27	31	21	13	12	22
University careers service	14	18	9	29	22	18	11	28	10	15	14	18	3	18
Other career/recruitment websites or resources	14	16	13	19	17	16	18	23	14	19	4	13	9	17
Other student activities	20	12	13	14	11	14	8	14	8	18	0	15	10	14
General media (newspapers, TV etc)	7	11	9	11	12	10	18	11	14	11	11	14	7	12
Other reason	4	4	7	5	7	7	2	8	4	5	11	4	3	5
Not answered	0	0	0	0	0	1	0	0	0	1	0	0	0	0
Count	*83*	*259*	*45*	*243*	*166*	*148*	*119*	*142*	*173*	*392*	*28*	*189*	*58*	*2045*

Appendix Table B3.34 Influences on career plans, by subject of study (UK taught postgraduates who had changed plans)	Subjects allied to Medicine	Biological Sciences	Sport Science	Psychology	Chemistry	Physics	Other Physical Sciences	Mathematical Sciences	Computer Science	Engineering and Technology	Building and Planning	Geography	Science/ Archaeology	All
My personal interests/values	67	74	80	70	40	67	67	81	72	67	58	70	81	70
The content of my university course	67	67	53	55	60	56	77	46	58	46	46	75	76	59
My tutors/faculty staff	29	54	47	52	80	22	50	38	32	31	19	39	52	38
My friends/fellow students/peer group	25	26	13	30	80	22	40	31	47	38	35	27	14	33
People I know working in a particular career	33	44	33	24	0	33	20	23	33	19	23	23	29	27
My work experience employer	17	26	27	21	20	39	13	23	30	23	35	5	14	22
My parents/relatives/friends of my parents	25	15	7	15	40	11	27	19	28	23	23	11	19	20
Employer websites, brochures or information	4	15	13	15	0	28	23	19	20	23	12	18	14	18
Employer presentations or visits to employers	0	18	7	9	20	11	17	19	18	27	8	16	5	16
Other career/recruitment websites or resources	4	10	0	12	0	28	13	27	15	21	27	14	5	15
University careers service	8	15	0	9	40	22	0	35	5	10	12	11	14	11
Other student activities	8	5	20	6	0	11	3	15	18	6	4	11	0	9
General media (newspapers, TV etc)	0	8	7	6	40	17	3	4	8	10	4	14	10	8
Other reason	8	8	7	12	0	17	13	0	8	10	12	5	19	9
Not answered	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Count	*24*	*39*	*15*	*33*	*5*	*18*	*30*	*26*	*60*	*78*	*26*	*44*	*21*	*419*

Appendix Table B4.1 Reasons for taking current job, by undergraduate subject (all graduates interviewed by telephone)

	Biology and related	Chemistry	Physics	Geog./Other Phys Sci	Maths	Computer Science	Eng. and Technol.	Other STEM	All STEM	Non-STEM	All respondents
Type of work wanted	38	39	41	42	24	50	35	33	37	31	36
Salary/benefits	17	22	18	10	15	46	25	29	21	14	20
Locality/region	13	10	16	6	17	21	21	4	15	6	13
Previous employer	2	2	4	6	2	4	2	4	3	4	3
Interesting work	48	56	54	42	41	71	52	38	50	51	50
Experience	7	2	0	6	2	0	5	4	4	0	3
Job security	0	0	4	0	5	0	4	0	2	5	2
Partner's is main career	0	0	0	3	0	0	0	0	0	0	0
Short term suitability	0	2	4	0	0	4	1	0	1	1	1
Needed a job	15	22	18	6	7	0	6	8	11	8	11
Could not get or was rejected for degree work	0	0	0	0	0	0	0	0	0	0	0
Graduate scheme	14	10	9	23	5	38	10	8	13	16	13
Training and development	9	10	11	6	7	8	8	17	9	11	10
Opp to gain qualifications	10	5	13	3	5	0	6	13	7	6	7
Reputation/Big company	13	15	23	23	17	8	12	25	16	24	17
Opp to work abroad	3	0	4	13	5	4	6	8	5	6	5
Variety of work	9	0	7	6	15	13	11	8	9	20	11
Public sector	1	12	2	10	7	0	0	4	3	28	7
Career prospects	12	10	5	6	5	0	5	8	7	10	7
Done work experience/ internship there	2	2	2	10	17	13	11	13	8	1	7
Liked people	5	5	2	6	20	4	8	4	7	8	7
Friend recommended	3	0	2	6	7	0	2	0	3	6	3
Make a difference	2	5	4	0	0	0	1	4	2	6	3
Other	15	20	11	19	15	17	15	13	15	25	17
Not answered	1	0	2	3	2	0	3	0	2	0	1
Count	*86*	*41*	*56*	*31*	*41*	*24*	*99*	*24*	*402*	*80*	*482*

Appendix Table B4.2 Reasons for taking current job, by employment sector and function (STEM graduates interviewed by telephone)

	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Type of work wanted	44	25	44	43	29	40	37
Salary/benefits	28	21	12	26	19	16	21
Locality/region	18	15	11	19	15	5	15
Previous employer	4	2	3	3	3	4	3
Interesting work	58	35	60	56	40	55	50
Experience	4	4	5	2	5	5	4
Job security	3	1	2	3	1	1	2
Compatible with partner's career	0	1	0	0	1	0	0
Short term suitability	1	1	2	1	2	1	1
Needed a job	12	11	10	12	10	12	11
Could not get or was rejected for degree work	0	0	0	0	0	0	0
Graduate scheme	14	8	18	13	7	22	13
Training and development	7	13	8	7	12	9	9
Opp to gain qualifications	2	17	3	1	19	0	7
Reputation/company	10	30	6	9	28	9	16
Opp to work abroad	7	4	3	6	5	4	5
Variety of work	7	12	8	7	11	9	9
Public sector	0	1	11	1	2	12	3
Career prospects	5	10	6	5	10	6	7
Done work experience/ internship there	7	13	1	9	9	3	8
Liked people	6	12	1	7	9	3	7
Friend recommended	1	5	2	1	5	3	3
Make a difference	0	1	7	2	1	5	2
Other	18	13	15	16	15	16	15
Not answered	2	1	2	2	1	4	2
Count	*153*	*142*	*107*	*174*	*151*	*77*	*402*

Appendix Table B4.3 Reasons for taking current job, by gender and university type (STEM graduates interviewed by telephone)

	Male	Female	Russell	1994	Other UK	All STEM
Type of work wanted	36	38	35	35	52	37
Salary/benefits	24	18	21	22	23	21
Locality/region	14	16	15	15	12	15
Previous employer	3	3	3	1	5	3
Interesting work	54	45	49	50	55	50
Experience	3	5	4	5	3	4
Job security	3	1	2	1	2	2
Compatible with partner's career	0	1	0	0	2	0
Short term suitability	0	2	2	0	2	1
Needed a job	11	12	10	17	11	11
Could not get or was rejected for degree work	16	14	13	17	23	0
Graduate scheme	0	0	0	0	0	13
Training and development	14	10	15	5	14	9
Opp to gain qualifications	9	9	9	14	5	7
Reputation/company	7	8	9	8	0	16
Opp to work abroad	17	15	18	15	11	5
Variety of work	6	4	5	5	5	9
Public sector	9	8	10	8	8	3
Career prospects	3	5	4	4	0	7
Done work experience/ internship there	8	5	9	5	3	8
Liked people	7	9	8	5	9	7
Friend recommended	3	12	7	5	9	3
Make a difference	3	2	2	4	5	2
Other	3	1	1	8	0	15
Not answered	2	1	2	4	0	2
Count	*236*	*165*	*256*	*78*	*66*	*402*

Appendix Table B4.4 Career situation at graduation, by undergraduate subject (all graduates interviewed by telephone)

At graduation, did you have:	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
A definite career in mind	31	34	21	6	38	54	53	33	36	35	35
Some ideas about you might do	31	32	48	61	43	42	24	42	37	41	37
Only a vague idea	24	24	18	16	12	4	16	21	18	9	16
No idea at all	13	10	11	16	7	0	4	4	8	11	9
Not answered	2	0	2	0	0	0	3	0	1	4	2
Applied for jobs while at university											
Applied for jobs directly related to career	40	54	52	48	69	88	68	58	57	61	58
Applied for job not related to career	2	7	4	10	0	4	6	4	4	5	5
Not applied for jobs	58	37	43	42	29	8	26	38	38	34	37
Not answered	0	2	2	3	2	0	1	0	1	1	1
Count	*88*	*41*	*56*	*31*	*42*	*24*	*99*	*24*	*405*	*80*	*485*
Jobs directly related to degree/subject course											
Yes, all the jobs	38	29	45	38	69	86	75	33	57	65	58
Yes, some of the jobs	15	17	13	13	17	5	16	13	14	4	13
No	47	54	42	50	14	9	9	53	29	31	30
Count	*34*	*24*	*31*	*16*	*29*	*22*	*69*	*15*	*240*	*48*	*288*

Appendix Table B4.5 Career situation at graduation, by gender/university type (STEM graduates interviewed by telephone)

At graduation, did you have:	Male	Female	Russell	1994	Other UK	All STEM
A definite career in mind	36	36	32	36	48	36
Some ideas about you might do	37	35	39	36	26	36
Only a vague idea	19	17	18	19	17	18
No idea at all	7	11	9	8	9	8
Not answered	2	1	2	1	0	1
Applied for jobs while at university						
Applied for jobs directly related to career	56	58	59	59	47	57
Applied for job not related to career	5	4	5	1	8	4
Not applied for jobs	37	39	35	38	45	38
Not answered	2	1	1	1	2	1
Count	*236*	*165*	*256*	*78*	*66*	*402*
Jobs directly related to degree/subject course						
Yes, all the jobs	56	57	57	50	67	57
Yes, some of the jobs	13	15	15	11	12	14
No	30	28	28	39	21	29
Count	*142*	*97*	*160*	*46*	*33*	*240*

Appendix Table B4.6 Career situation at graduation, by undergraduate subject (all graduates interviewed by telephone without postgraduate qualification)

At graduation, did you have:	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
A definite career in mind	33	38	26	7	45	57	54	35	40	33	39
Some ideas about you might do	33	29	43	67	39	39	24	40	35	40	36
Only a vague idea	18	21	21	13	6	4	15	20	16	10	15
No idea at all	13	13	7	13	9	0	4	5	8	13	8
Not answered	2	0	2	0	0	0	4	0	2	5	2
Applied for jobs while at university											
Applied for jobs directly related to career	48	75	60	73	82	87	74	65	68	68	68
Applied for job not related to career	2	8	5	13	0	4	7	5	5	6	5
Not applied for jobs	50	17	36	20	15	9	19	30	27	25	27
Not answered	0	0	0	0	3	0	1	0	1	2	1
Count	*60*	*24*	*42*	*15*	*33*	*23*	*85*	*20*	*302*	*63*	*365*
Jobs directly related to degree/subject course											
Yes, all the jobs	34	26	41	25	74	86	74	36	56	60	57
Yes, some of the jobs	14	11	15	17	11	5	17	7	13	5	12
No	52	63	44	58	15	10	9	57	31	35	32
Count	*29*	*19*	*27*	*12*	*27*	*21*	*65*	*14*	*214*	*43*	*257*

Appendix Table B4.7 Reasons applied for degree-related jobs, by undergraduate subject (all graduates interviewed by telephone)

	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Interest/enjoyment	86	86	100	100	95	100	90	100	93	97	94
Nature of work	0	0	21	0	5	0	8	20	7	12	8
Pay	7	14	0	0	10	16	2	0	6	6	6
Career prospects	29	29	7	0	30	37	19	0	22	27	23
Easy to find a job	0	0	7	0	5	0	0	0	1	0	1
Enjoyed work experience	7	0	0	17	0	0	4	0	3	6	4
Use of specialist skills/knowledge	29	29	7	17	20	11	31	20	23	15	21
Develop skills/knowledge	0	0	7	0	10	16	2	0	5	3	5
Positive feedback from people in the field	14	0	0	0	0	0	6	0	4	0	3
Degree-related jobs in preferred location	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	7	0	0	16	4	0	4	9	5
Not answered	0	0	0	0	0	0	2	0	1	0	1
Count	*14*	*7*	*14*	*6*	*20*	*19*	*52*	*5*	*137*	*33*	*170*

Appendix Table B4.8 Reasons for applying for degree-related jobs, by gender, and employment sector and function (STEM graduates interviewed by telephone who made only degree-related job applications at university)

	Male	Female	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Interest/enjoyment	92	96	93	93	100	91	97	100	93
Nature of work	9	4	7	5	7	7	6	0	7
Pay	9	2	6	8	0	6	6	0	6
Career prospects	27	16	21	33	0	20	31	0	22
Easy to find a job	3	0	0	5	0	0	6	0	1
Enjoyed work experience	3	4	2	3	7	3	3	0	3
Use of specialist skills/knowledge	21	23	19	33	13	23	20	14	22
Develop skills/knowledge	5	5	6	5	0	4	6	14	5
Positive feedback from people in the field	3	5	2	5	7	3	6	0	4
Degree-related jobs in preferred location	6	2	7	0	0	5	3	0	4
Other	0	2	1	0	0	1	0	0	1
Not answered	1	0	1	0	0	1	0	0	1
Count	*78*	*57*	*81*	*40*	*15*	*94*	*35*	*7*	*136*

Appendix Table B4.9 Reasons for applying for non-related jobs, by undergraduate subject (graduates interviewed by telephone who applied only for non-related jobs while at university)

	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Interest/enjoyment	24	15	14	38	20	0	33	13	21	33	23
Nature of work	18	0	0	0	0	0	0	0	4	7	5
Not enjoyed course	18	0	14	13	20	0	33	13	14	0	11
Better pay	29	31	36	0	0	50	33	38	27	0	23
Better career prospects	35	38	36	50	20	0	50	50	38	7	33
Easy to find a job	12	15	0	13	20	0	0	25	11	20	13
Hard to find a job	6	8	21	13	0	0	0	13	10	0	8
Lack of experience	6	0	0	0	0	0	0	0	1	0	1
Change of career direction	35	31	21	25	20	50	33	13	27	20	26
Not good enough for degree-related work	6	0	0	0	0	0	0	0	1	0	1
Enjoyed work experience	0	0	0	0	0	0	0	0	0	0	0
Put off by work experience	12	15	7	0	0	0	0	13	8	13	9
Use of specialist skills/knowledge	0	8	0	0	0	0	0	0	1	13	3
Opportunity to develop new skills/knowledge	18	8	7	0	0	0	0	0	7	20	9
Positive feedback from people in the field	12	15	14	25	0	0	0	13	12	33	16
Priority to find employment	6	0	0	0	0	0	0	13	3	13	5
Limited degree-related jobs in preferred location	0	0	0	0	0	0	0	0	0	7	1
Other	6	15	14	13	0	0	17	0	10	0	8
Not answered	18	15	7	0	20	50	17	0	12	13	13
Count	*17*	*13*	*14*	*8*	*5*	*2*	*6*	*8*	*73*	*15*	*88*

Appendix Table B4.10 Reasons applying for non-related jobs, by gender, employment sector and function (STEM graduates who made applications only for non-related jobs while at university)

	Male	Female	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Interest/enjoyment	20	21	14	26	14	33	19	14	21
Nature of work	7	0	0	5	5	0	5	5	4
Not enjoyed course	16	11	14	16	10	13	14	14	14
Better pay	36	14	21	29	29	13	30	33	27
Better career prospects	38	39	29	47	29	20	49	33	38
Easy to find a job	7	18	7	18	0	7	19	0	11
Hard to find a job	9	11	14	8	10	20	5	10	10
Lack of experience	2	0	0	0	5	0	0	5	1
Change of career direction	31	21	29	26	29	40	24	24	27
Not good enough for degree-related work	0	4	0	3	0	0	3	0	1
Enjoyed work experience	0	0	0	0	0	0	0	0	0
Put off by work experience	9	7	7	8	10	13	11	0	8
Use of specialist skills/knowledge	2	0	0	0	5	0	3	0	1
Opportunity to develop new skills/knowledge	7	7	0	8	10	0	8	10	7
Positive feedback from people in the field	11	14	7	16	10	0	19	10	12
Priority to find employment	2	4	0	3	5	0	3	5	3
Limited degree-related jobs in preferred location	0	0	0	0	0	0	0	0	0
Other	4	18	0	13	10	7	11	10	10
Not answered	13	11	29	8	10	20	11	10	12
Count	*45*	*28*	*14*	*38*	*21*	*15*	*37*	*21*	*73*

Appendix Table B4.11 Reasons for choice of undergraduate course, by undergraduate subject (all graduates interviewed by telephone)

Reason	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Broader skills	5	5	13	16	12	8	13	21	11	15	11
Specialist skills	3	5	2	0	2	0	2	4	2	1	2
Improved job prospects	17	12	14	19	19	29	38	25	23	26	24
Career qualification	2	2	0	0	0	0	0	0	1	3	1
Interest	90	80	89	94	79	79	80	92	85	90	86
Enjoyment	3	2	11	10	10	4	4	0	5	6	6
Personal ability	28	32	39	26	67	21	34	17	34	36	35
Status	0	0	0	0	0	0	0	0	0	0	0
Student lifestyle	1	0	0	3	0	0	1	0	1	0	1
Influenced by friends/family	3	10	4	3	0	0	11	4	5	0	5
Influenced by people who have studied the subject	1	5	0	0	0	4	1	4	1	0	1
Teacher/school recommendation	5	12	0	13	5	0	4	0	5	6	5
Impressed after visiting	5	0	2	3	5	21	8	4	5	6	6
Close to home	1	5	0	0	0	4	0	0	1	0	1
Lack of competition	1	0	0	3	2	4	1	0	1	0	1
Other	5	7	5	3	5	13	5	0	5	4	5
Not answered	5	0	0	0	0	0	0	0	1	0	1
Count	*88*	*41*	*56*	*31*	*42*	*24*	*99*	*24*	*405*	*80*	*485*

Appendix Table B4.12 Reasons for choice of undergraduate course, by current employment sector and function (STEM graduates interviewed by telephone)

Reason	STEM Specialist	STEM Generalis t	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Broader skills	12	8	13	10	8	18	11
Specialist skills	3	1	4	3	3	0	2
Improved job prospects	25	22	21	28	17	22	23
Career qualification	1	0	1	1	1	0	1
Interest	80	87	89	79	88	91	85
Enjoyment	7	4	6	6	3	8	5
Personal ability	24	44	34	28	42	32	34
Status	0	0	0	0	0	0	0
Student lifestyle	1	0	1	1	0	1	1
Influenced by friends/family	6	4	7	6	5	4	5
Influenced by people who have studied the subject	1	3	1	2	1	1	1
Teacher/school recommendation	3	6	6	2	7	6	5
Impressed after visiting	10	3	2	9	2	4	5
Close to home	1	1	1	1	1	1	1
Lack of competition	1	1	1	2	1	0	1
Other	10	2	2	8	3	4	5
Not answered	1	0	3	2	0	1	1
Count	*153*	*142*	*107*	*174*	*151*	*77*	*402*

Appendix Table B4.13 Whether graduates would do the same/similar degree course again, by undergraduate subject (all graduates interviewed by telephone)											
	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathem a-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Same or similar course	67	56	79	68	79	75	80	58	72	79	73
Different course	28	39	11	26	21	25	15	42	23	18	22
Delay entry	5	5	4	6	0	0	2	0	3	3	3
Not answered	0	0	7	0	0	0	3	0	2	1	2
Count	*88*	*41*	*56*	*31*	*42*	*24*	*99*	*24*	*405*	*80*	*485*

Appendix Table B4.14 Whether graduates would do the same/similar course, by current employment sector and function (STEM graduates interviewed by telephone)							
	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Same or similar course	78	72	63	74	70	71	72
Different course	18	23	31	21	26	23	23
Delay entry	2	3	4	3	2	5	3
Not answered	1	2	2	2	1	1	2
Count	*153*	*144*	*108*	*174*	*151*	*80*	*405*

Appendix Table B4.15 Career planning at entry to, and change during, university, by undergraduate subject (all graduates interviewed by telephone)

When first went to university	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Yes, definite career in mind	19	17	5	6	12	13	18	13	14	24	16
Yes, some ideas about career	23	27	27	19	31	17	29	25	26	19	25
Very vague idea of career	24	20	27	29	19	38	29	25	26	16	24
No idea at all	31	34	39	42	36	33	22	29	32	39	33
Work specified	3	0	2	0	2	0	1	4	2	3	2
Not answered	0	2	0	3	0	0	0	4	1	0	1
Career plan change											
Yes, completely	9	10	11	6	10	4	12	13	10	13	10
Yes, some extent	47	41	48	61	50	58	48	33	48	23	44
No	32	34	38	23	29	29	30	46	32	38	33
Not answered	13	15	4	10	12	8	9	8	10	28	13
Count	*88*	*41*	*56*	*31*	*42*	*24*	*99*	*24*	*405*	*80*	*485*

Appendix Table B4.16 'Top three' influences on career planning while at university, by undergraduate subject (all graduates interviewed by telephone)

Reason	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
University course	41	44	36	48	38	38	48	42	42	45	43
Work experience employer	24	37	21	10	24	54	56	33	34	25	32
Interest/values	31	22	23	42	31	21	23	25	27	45	30
Family and family friends	25	12	29	32	26	21	23	17	24	16	22
Employer visits/ presentation	15	17	23	10	36	13	16	4	18	19	18
Personal friends/peers	16	20	30	10	14	25	15	21	18	11	17
University careers service	20	5	16	10	10	13	7	13	12	15	13
Industry specific websites/magazines	14	10	20	6	17	13	13	13	14	8	13
Faculty staff	6	17	11	10	5	17	15	17	11	8	11
Salary prospects	14	15	7	0	10	21	8	13	10	1	9
People in a particular career	2	7	5	0	7	8	12	17	7	5	7
Employer website/ information	3	7	5	3	0	17	8	4	6	11	7
General media	2	10	5	10	0	13	6	8	6	8	6
Other employers	6	2	0	10	0	4	4	4	4	13	5
Career websites/ magazines	2	0	2	6	5	0	0	0	2	8	3
Course performance	3	2	2	0	0	0	2	0	2	3	2
Recruitment websites	2	0	0	0	0	0	0	0	0	0	0
Other	1	2	2	0	0	0	2	0	1	1	1
Not answered	3	2	2	0	2	0	1	0	2	3	2
Count	*88*	*41*	*56*	*31*	*42*	*24*	*99*	*24*	*405*	*80*	*485*

Appendix Table B4.17 'Top three' influences on career planning at university, by employment sector and function (STEM graduates interviewed by telephone)

Reason	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
University course	49	29	51	48	32	51	43
Work experience employer	39	32	28	40	32	22	34
Interest/values	27	25	29	28	26	27	27
Family and family friends	23	25	23	21	24	30	24
Personal friends and peers	13	24	19	14	23	19	18
Employer visits/presentation	14	25	13	15	21	16	17
Industry specific websites/ magazines	15	11	14	11	13	18	13
University careers service	12	10	16	11	11	16	12
Faculty staff	14	11	8	15	10	6	11
Salary prospects	6	20	4	7	18	4	10
People in a particular career	7	8	6	7	9	4	7
Employer website/information	8	6	3	6	5	6	6
General media	7	2	8	6	3	10	6
Other employers	5	3	4	4	3	4	4
Career websites/magazines	1	1	4	1	2	4	2
Course performance	2	1	3	3	1	1	2
Recruitment websites	1	0	1	0	1	1	0
Other	2	1	0	2	1	0	1
Not answered	1	3	1	1	3	1	2
Count	*153*	*142*	*107*	*174*	*151*	*77*	*402*

Appendix Table B4.18 Percentage with work experience, and its usefulness, by undergraduate subject (all graduates interviewed by telephone)

	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Done work experience	48	56	39	42	40	88	76	58	56	47	55
As an undergraduate	43	54	38	35	36	88	76	54	53	46	52
As a postgraduate	5	2	5	10	5	0	1	4	4	1	3
Count	*88*	*41*	*56*	*31*	*42*	*24*	*99*	*24*	*405*	*80*	*485*
Undergraduate work experience											
Not at all helpful	0	5	0	0	0	0	0	0	0	0	0
Not very helpful	5	9	5	0	0	0	4	14	5	3	4
Quite helpful	38	9	36	45	31	10	26	29	28	24	27
Very helpful	56	77	59	55	69	90	70	57	67	73	68
Count	*39*	*22*	*22*	*11*	*16*	*20*	*74*	*14*	*218*	*37*	*255*

Appendix Table B4.19 Impact of influences on career plans, by undergraduate subject (all graduates interviewed by telephone)

	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Decided wanted to work in degree-related work	38	34	41	48	69	83	69	42	52	70	55
Decided not want to work in degree-related work	39	29	39	32	14	29	29	33	32	15	29
Needed further training	7	0	4	3	2	0	3	0	3	0	3
Information about specific work	17	29	9	13	21	38	23	25	20	19	20
Discovered new areas of work	11	7	13	16	14	25	13	13	13	5	12
Desirable employer	15	24	25	23	29	33	22	25	23	38	25
Undesirable employers	1	5	4	0	0	0	1	0	1	3	2
Needed to rethink career plans	7	10	11	6	5	0	4	4	6	9	7
Put off looking for work	1	0	2	6	0	0	2	0	1	1	1
No degree-related jobs in preferred location	2	2	0	0	0	0	0	0	1	0	1
Other	1	2	2	3	0	0	1	4	1	0	1
Not answered	3	10	4	3	5	0	4	0	4	3	4
Count	*88*	*41*	*56*	*31*	*42*	*24*	*99*	*24*	*405*	*80*	*485*

Appendix Table B4.20 Impact of influences on career plans, by employment sector and function (STEM graduates interviewed by telephone)

	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
Decided wanted to work in degree-related work	68	39	48	71	40	35	52
Decided not want to work in degree-related work	20	40	36	21	38	43	31
Needed further training	5	3	2	3	3	3	3
Information about specific work	18	24	20	18	24	19	20
Discovered new areas of work	18	12	7	17	11	9	13
Desirable employer	25	27	14	24	23	19	23
Undesirable employers	1	3	1	1	3	0	1
Needed to rethink career plans	5	6	9	5	5	10	6
Put off looking for work	2	1	1	2	1	1	1
No degree-related jobs in preferred location	0	1	1	0	1	1	1
Other	1	2	1	1	2	1	1
Not answered	5	2	5	5	3	4	4
Count	*153*	*142*	*107*	*174*	*151*	*77*	*402*

Appendix Table B4.21 Whether used University Careers Service as an undergraduate and, if so, its usefulness, by undergraduate subject (all graduates interviewed by telephone)

	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathem a-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Yes	65	49	66	48	60	63	66	63	61	69	63
No	32	51	32	52	40	38	34	33	37	31	36
Not answered	3	0	2	0	0	0	0	4	1	0	1
Count	*88*	*41*	*56*	*31*	*42*	*24*	*99*	*24*	*405*	*80*	*485*
Not at all helpful	4	15	0	0	0	7	0	0	2	0	2
Not very helpful	11	25	11	40	24	0	25	33	19	24	20
Quite helpful	37	45	54	47	28	53	49	60	45	40	44
Very helpful	49	15	30	13	40	33	26	7	31	36	32
Not answered	0	0	5	0	8	7	0	0	2	0	2
Count	*57*	*20*	*37*	*15*	*25*	*15*	*65*	*15*	*249*	*55*	*304*

Appendix Table B4.22 Use of degree knowledge and more general skills, by undergraduate subject (all graduates interviewed by telephone)

Using and building on specific skills and knowledge	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Not at all	38	29	27	10	15	0	14	25	22	19	22
Only to a little extent	16	34	20	32	37	25	25	33	26	25	26
To some extent	30	10	39	39	29	46	45	42	35	35	35
To a great extent	13	27	14	19	17	29	15	0	16	19	17
Not answered	2	0	0	0	2	0	0	0	1	3	1
General skills											
Not at all	2	0	2	0	2	0	1	0	1	1	1
Only to a little extent	6	7	13	13	5	13	6	0	7	3	7
To some extent	41	34	32	39	41	38	30	50	37	31	36
To a great extent	49	59	54	48	49	50	63	50	54	63	55
Not answered	2	0	0	0	2	0	0	0	1	3	1
Count	*86*	*41*	*56*	*31*	*41*	*24*	*99*	*24*	*402*	*80*	*482*

Appendix Table B4.23 General skills learnt from degree, by undergraduate subject (all graduates interviewed by telephone)

	Biology and related	Chemistry	Physics	Geography/ Other Physical Sciences	Mathem-a-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Written communication/ presentation skills	69	54	57	61	51	58	55	58	58	80	62
Spoken communication	45	49	38	55	44	46	33	46	42	59	45
Analytical	52	69	72	71	83	54	48	63	59	-	-
Logical/rigorous approach to problem solving	65	64	84	42	48	45	59	44	60	29	52
Analytical skills	7	0	3	12	24	9	10	0	9	68	24
Ability to assess risk/probability	4	0	0	0	0	0	3	0	1	5	2
Numeracy	14	20	25	19	27	4	12	8	16	10	15
Computer literacy	10	0	14	10	2	8	7	8	8	6	8
Team working	35	24	14	32	17	38	39	29	30	30	30
Leadership skills	2	5	0	0	2	13	6	4	4	6	4
Self-confidence	2	5	4	10	2	8	3	0	4	4	4
Self-discipline	16	22	16	16	29	42	21	21	21	15	20
Creativity	1	7	2	6	5	0	0	4	2	0	2
Project management	7	12	0	10	0	4	17	17	9	3	8
Time management	17	20	5	23	12	8	9	25	14	8	13
Research Skills	21	7	7	19	2	4	5	17	10	18	12
Organisation Skills	6	10	0	0	5	4	7	25	6	8	6
Other	10	7	5	3	2	4	8	8	7	1	6
Not answered	2	2	2	0	2	4	4	4	3	1	2
Count	*86*	*41*	*56*	*31*	*41*	*24*	*99*	*24*	*402*	*80*	*482*

Notes:

1. Question wording was revised part-way through interviews.
2. Percentages for Analytical based on first 170 interviews.
3. Percentages for Logical/rigorous approach to problem solving, Analytical skills and Ability to assess risk/probability based on remaining 315 interviews
4. Percentages for Time management, Research Skills and Organisation Skills are based on recoding 'Other' replies.

Appendix Table B4.24 Importance of degree for undertaking current job, by undergraduate subject (all graduates interviewed by telephone)

How essential	Biology and related	Chemistry	Physics	Geography/Other Phys Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Essential	27	32	32	26	27	46	47	25	34	16	31
Preferred	23	34	30	45	54	46	34	38	35	45	37
Not essential	50	34	36	29	17	8	17	38	30	39	32
Not answered	0	0	2	0	2	0	1	0	1	0	1
Count	*86*	*41*	*56*	*31*	*41*	*24*	*99*	*24*	*402*	*80*	*482*

Appendix Table B4.25 Job and career progress satisfaction, by undergraduate subject (all graduates interviewed by telephone)

How satisfied with present job	Biology and related	Chemistry	Physics	Geography/Other Phys Sciences	Mathema-tical Sciences	Computer Science	Engineering and Technology	Other STEM subjects	All STEM	Non-STEM	All respondents
Very dissatisfied	0	0	2	0	0	0	1	0	0	1	1
Dissatisfied	3	7	9	0	2	0	3	4	4	3	4
Neither satisfied nor dissatisfied	8	2	4	6	10	0	2	4	5	0	4
Satisfied	35	37	27	29	41	33	43	54	37	34	37
Very satisfied	51	54	59	65	46	67	51	38	53	63	55
Not answered	2	0	0	0	0	0	0	0	0	0	0
How satisfied with progress of career											
Dissatisfied	2	0	4	3	5	8	8	8	5	4	5
Neither satisfied nor dissatisfied	5	10	11	0	5	0	3	0	5	5	5
Satisfied	38	41	43	55	34	42	44	54	43	41	43
Very satisfied	51	46	41	39	56	50	42	38	46	50	46
Not answered	3	2	2	3	0	0	2	0	2	0	2
Count	*86*	*41*	*56*	*31*	*41*	*24*	*99*	*24*	*402*	*80*	*482*

Appendix Table B4.26 Reasons for desire for more degree-related work, by current employment sector and function (STEM graduates interviewed by telephone who were not in degree-related jobs but would like degree-related work)

	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
More interesting/ enjoyable	78	90	82	78	91	79	84
Nature of work	0	3	7	3	5	3	4
Change of direction	0	2	0	0	2	0	1
Degree-related too narrow	0	0	0	0	0	0	0
Too competitive	3	0	0	3	0	0	1
Better paid	3	0	0	3	0	0	1
Better career prospects	3	2	0	3	2	0	1
Enjoyed work experience	0	0	2	0	0	3	1
Not enjoyed working in this area	3	0	0	3	0	0	1
Use specialist skills/ knowledge	38	25	41	31	26	50	33
Develop skills	6	0	2	6	0	3	2
Positive feedback from people in the field	0	0	0	0	0	0	0
Other	3	5	5	6	5	3	4
Count	*32*	*59*	*44*	*36*	*65*	*34*	*135*

Appendix Table B4.27 Reasons for not wishing to have more degree-related work, by employment sector and function (STEM graduates interviewed by telephone not in degree-related jobs who would not like more degree-related work)

	STEM Specialist	STEM Generalist	Non-STEM	STEM Core	STEM-related	Unrelated	All STEM
More interesting/ enjoyable	38	14	17	41	14	9	22
Nature of work	0	2	3	0	2	4	2
Change of direction	7	19	30	3	23	35	19
Degree-related too narrow	24	52	27	24	45	39	37
Too competitive	7	10	7	0	14	9	8
Better paid	3	12	3	3	11	4	7
Better career prospects	7	21	17	3	25	17	16
Enjoyed work experience	0	0	0	0	0	0	0
Not enjoyed working in this area	14	12	20	18	14	13	15
Use specialist skills/ knowledge	0	0	0	0	0	0	0
Develop skills	3	2	0	3	2	0	2
Positive feedback from people in the field	0	2	0	0	2	0	1
Other	14	2	0	12	2	0	5
Count	*29*	*42*	*30*	*34*	*44*	*23*	*101*

Appendix Table B.1 List of Higher Education Institutions (undergraduate and taught postgraduate survey)

Aberdeen	Coventry
University of Abertay Dundee	University College for the Creative Arts
Aberystwyth	Cumbria
Anglia Ruskin	De Montfort
Aston	Derby
Bangor	Dundee
Bath Spa	Durham
Bath	East Anglia
Bedfordshire	East London
Birkbeck, University of London	Edge Hill University
Birmingham City	Edinburgh
Birmingham	Essex
Bournemouth	Exeter
Bradford	Glamorgan
Brighton	Glasgow Caledonian
Bristol	Glasgow
Brunel	Gloucestershire
Bucks New University	Glyndwr University
Cambridge	Goldsmiths, University of London
Canterbury Christ Church	Greenwich
Cardiff	Heriot-Watt
University of Wales Institute, Cardiff	Hertfordshire
Central Lancashire	Huddersfield
Chester	Hull
Chichester	Imperial College London
City University London	Keele

Kent

King's College London

Kingston

University of Wales Lampeter

Lancaster

Leeds Metropolitan

Leeds

Leicester

Lincoln

Liverpool Hope

Liverpool John Moores

Liverpool

London Metropolitan

London School of Economics and Political Science

London South Bank

University College London

Loughborough

Manchester Metropolitan

Manchester

Middlesex

Edinburgh Napier University

Newcastle

Northampton

Northumbria

Nottingham Trent

Nottingham

Open University

Oxford Brookes

Oxford

Plymouth

Portsmouth

Queen Mary, University of London

Queen's University Belfast

Reading

Robert Gordon

Roehampton

Royal Holloway, University of London

Royal Veterinary College

Salford

Sheffield Hallam

Sheffield

Southampton Solent University

Southampton

St Andrews

St George's, University of London

Staffordshire

Stirling

Strathclyde

Sunderland

Surrey

Sussex

Swansea

Teesside

Ulster

Warwick	Wolverhampton
University of the West of England	Worcester
University of the West of Scotland	York
Westminster	York St John
Winchester	

Appendix Table B.2 List of universities and research institutes (STEM PhD student survey)

Aberdeen	City University London
University of Abertay Dundee	Coventry
Aberystwyth	Cranfield
Anglia Ruskin	Cumbria
Armagh Observatory	De Montfort
Aston	Derby
Bangor	Dundee
Bath	Durham
Birkbeck, University of London	East Anglia
Birmingham City	East London
Birmingham	Edinburgh
Bolton	Essex
Bradford	Exeter
Brighton	Glamorgan
Bristol	Glasgow Caledonian
Brunel	Glasgow
Cambridge	Gloucestershire
Canterbury Christ Church	Glynd?r University
Cardiff	Goldsmiths, University of London
University of Wales Institute, Cardiff	Greenwich
Central Lancashire	Heriot-Watt

Hertfordshire

Huddersfield

Hull

Imperial College London

Keele

Kent

King's College London

Kingston

Lancaster

Leeds Metropolitan

Leeds

Leicester

Liverpool John Moores

Liverpool

London School of Hygiene & Tropical Medicine

London South Bank

University College London

Loughborough

Manchester Metropolitan

Manchester

Edinburgh Napier University

Newcastle

Northampton

Northumbria

Norwich University College of the Arts

Nottingham Trent

Nottingham

Open University

Oxford Brookes

Oxford

Plymouth

Portsmouth

Queen Margaret University, Edinburgh

Queen Mary, University of London

Queen's University Belfast

Reading

Robert Gordon

Roehampton

Royal Holloway, University of London

Royal Veterinary College

Salford

School of Pharmacy, University of London

Sheffield Hallam

Sheffield

Southampton

St Andrews

St George's, University of London

Stirling

Strathclyde

Sunderland

Surrey

Sussex

Swansea

UHI Millennium Institute

Ulster	York
Warwick	York St John
University of the West of England	Institute of Animal Health
University of the West of Scotland	Rothamstead
Westminster	Highlands and Islands

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