skills development




Skills required by new

Forensic Science

graduates and their development in degree programmes

The Higher Education Academy
UK Physical Sciences Centre

Skills required by new forensic science graduates and their development in degree programmes

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Forensic Science Society

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1. Aim of Study

This report is the outcome of a survey of recent graduates of forensic science programmes across the UK. The aim of the survey was to identify which areas of the forensic science curriculum including generic skills are particularly useful for new graduates and to evaluate how well they are developed within undergraduate forensic science degrees.

2. Scope of Survey

The survey focused on the 2007 graduate cohort, ie about two and half years after graduation. Such graduates have had sufficient time to gain some understanding of the skills requirements of their employment (or further study), whilst retaining a reasonably up-to-date knowledge of their forensic science degree programmes. Another factor influencing the choice of this cohort was that the longer the time after graduation, the more difficult it becomes to contact graduates. The forensic science graduates surveyed included those who had taken 'Forensic science with' degrees, but not joint 'Forensic science and' degrees, as the intention was to focus on graduates who had studied predominantly forensic science. Both UK and international students were included. Seven universities in England, Scotland and Wales were surveyed, all post-1992 institutions. At five of the universities surveyed the courses were accredited by Forensic Science Society in all three essential accreditation elements (Forensic Science Society, 2008) and at the other two universities the courses were following the Forensic Science Society guidelines and were being progressed towards accreditation. The survey was undertaken between November 2009 and May 2010.

Parallel surveys of chemistry and physics graduates were carried out, the other disciplines supported by the HEA UK Physical Sciences Centre. The results of these surveys are reported separately (HEA UK Physical Sciences Centre, 2010a, 2010b), although reference to some of the results is made in this report.

This report is concerned with the combined results for all the universities surveyed, rather than university-specific results and inter-university comparisons, although these will be made available to the individual universities concerned.

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3. Background

Although several reports have discussed the graduate skills required by employers, eg QAA (2003) and CIHE (2008), relatively little has been reported on the knowledge and skills which graduates have found of value when they enter into employment or further study. The UUK/CBI report entitled *Future fit: Preparing graduates for the world of work* (2009) recommended that universities should obtain regular feedback from former students/alumni on how well the universities are fostering employability skills in their students.

The lack of evidence of the skills needed by graduates is a major gap in this important pedagogic area. For example, their views should be very pertinent to development of subject benchmark statements. Graduates are also in a unique position to comment on whether these skills are being developed within degree programmes. Their views, including results and comments that are university-specific, can feed directly into curriculum development.

In order to gather some of this evidence, a pilot survey of chemistry graduates was carried out in 2008 by the HEA UK Physical Sciences Centre on behalf of the Royal Society of Chemistry Education Division. This unpublished study of 2006 graduates from three universities allowed the development of an effective survey methodology. Results indicated that some generic skills were considered very useful by graduates, but were relatively poorly developed within degree programmes. The methodology developed in the pilot study was used with modifications for this survey of forensic science graduates.

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4. Methodology

4.1 Survey

The survey questionnaire aimed to determine which areas of knowledge and skills developed in the degree programmes had been of most use since graduation and how well they had been developed within the degree programmes. The areas chosen, given in Table 1, were based on the Forensic Science Society (2008) *Accreditation: Criteria & standards*, the QAA (2007) *Subject benchmark statement Biosciences* and the CIHE (2006) *Student employability profiles*.

In this report, the first eleven listed, A to K, are referred to as the 'forensic science knowledge/ skills' and the final nine, L to T, as the 'generic skills' (also known as 'transferable skills'), although it is appreciated that some of the skills

Table 1 : Areas of knowledge and skills included in the survey questionnaire

A	Crime scene management	Forensic science knowledge/skills
B	Crime scene investigation	
C	Crime scene evidence interpretation	
D	Location and recovery of trace materials	
E	Forensic analysis techniques	
F	Instrumental methods of analysis	
G	Interpretation of analytical results	
H	Safe working procedures	
I	Quality assurance	
J	Planning of casework related experiments	
K	Understanding relevant legal procedures	
L	Statistical techniques	Generic skills
M	Computing skills	
N	Report writing skills	
O	Oral presentation skills	
P	Information retrieval skills	
Q	Problem-solving skills	
R	Team-working skills	
S	Time management and organisational skills	
T	Managing own learning	

don't clearly fit into these designations. An additional question asked the graduates to choose which five areas of knowledge/skills out of the 20 listed above, they wished, in retrospect, they had been given the opportunity to develop more fully within their undergraduate degrees. Other questions gathered evidence on the graduates' careers since graduation and their general views (in open form answers) on how their degree programmes might be modified and developed.

4.2 Contacting the graduates and response rates

Graduates are contacted each year by all UK universities about six months after graduation in order to collect the Destinations of Leavers in Higher Education (DLHE) data for the Higher Education Statistics Agency (HESA). Normally these data are collected and held by the university Careers Services. Hence all universities have databases of graduates containing contact information, with some or all of postal addresses, telephone numbers and e-mail addresses. Some universities update this information, often via their Alumni Offices. Collection of the DLHE data is by postal survey, followed by telephone surveying, the latter being the main source of data. E-mailing is used to a small extent.

In 2006, HESA sponsored a longitudinal survey of the 2003 graduate cohort (HESA, 2007). The survey covered 20% of graduates from all subject areas at all UK universities who had responded to the initial DLHE survey. The survey involved e-mailing twice (inviting graduates to use an online survey form), followed by two postal surveys, followed by up to seven attempts to contact by telephone. Overall a 40% response rate was achieved.

Our approach was similar to this HESA survey. An initial postal survey (with a covering letter signed by a member of staff of the university Forensic Science Department) was followed by two e-mails and then several attempts at telephone contact. However, constraints of data protection legislation resulted in only two out of the seven collaborating universities being able to provide telephone contact information, which severely reduced the overall response rate. Graduates could, if they wished, fill in the survey form online in response to postal, e-mail or telephone contact. As an incentive, the names of all graduates completing the survey form were included in a prize draw for each university.

For the two universities where telephone surveying was possible, the response rate was 45%, whereas for the five universities where only postal and e-mail contact was possible, the response rate was 21%. Completed survey forms were obtained from 147 graduates, an overall response rate of 33%. This comprised 78 responses from graduates from Forensic Science Society accredited university courses and 69 from non-accredited university courses.

The graduates were clearly informed that although their names were requested in the questionnaire, this was only to track who had completed the survey, and any information shared by the HE Academy UK Physical Sciences Centre, including with their university, would be completely anonymous. Graduate contact information was collected from the universities concerned on the basis that the universities would not be identified in any external reports and that the results collected for their graduates would be made available to them, but without graduates' names.

5. Results

5.1 Activities since graduating

Figure 1 gives the main activity of the forensic science graduates at the time of the survey, with chemistry and physics data from the parallel surveys included for comparison. Of the 121 graduates in employment as their main activity (82%), 32 were working in laboratories, 18 were employed by police forces (including 4 police officers), 7 were school teachers (including 1 primary teacher) and 4 were working as lecturers/demonstrators at universities or colleges. Of the forensic science graduates engaged in study, either as the main activity (15 graduates, 10%) or otherwise, 4 were undertaking PhDs, 10 Masters degrees (8 others had completed Masters degrees since graduating), 8 PGCEs, 1 a medical degree and 1 a pilot training course. The major difference between the subjects is in the percentages undertaking study as their main activity, resulting to a large extent from the high uptake of PhD study by chemistry and physics graduates.

Figure 2 gives the results for the question: ***To what extent have your activities since graduating involved a knowledge of forensic science?*** The figure also includes the results from the respective question in the chemistry and physics surveys and the results when only graduates in employment are considered.

When considering the three subjects for all graduates, it is seen that the forensic science graduates had a lower subject involvement in their activities since graduating with 34% indicating no involvement at all, compared with 16% for chemistry and 22% for physics. However the high proportion of the chemistry and physics graduates studying for PhDs (20% and 22% respectively, compared with 3% for forensic science) distorts the figures. If only the graduates in employment are considered, then the figures for no involvement are 35%, 21% and 31%, respectively. Looked at in another way, 30% of employed forensic science graduates selected 'Large extent/Very large extent' for subject involvement in their activities, very similar to physics at 29%, although still much lower than chemistry at 53%.

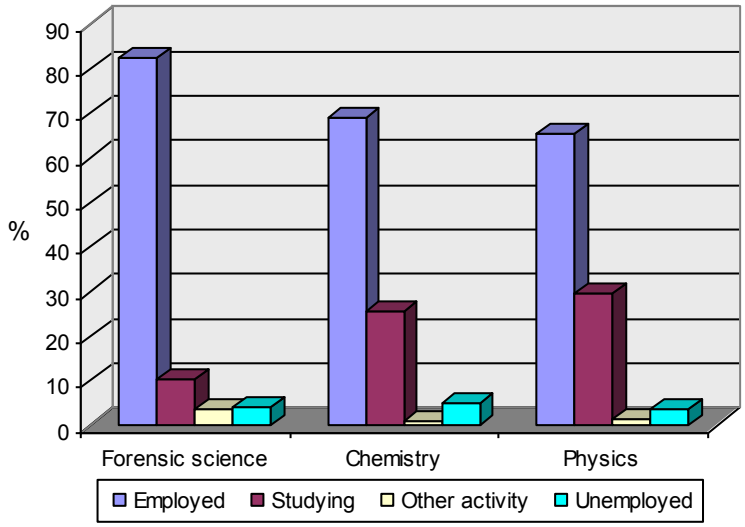

Figure 1: Current main activity

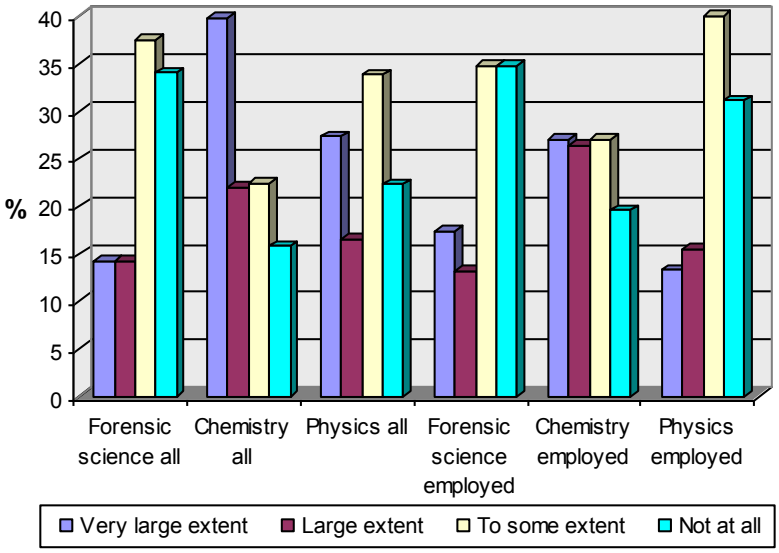

Figure 2: Involvement of subject in activities since graduation

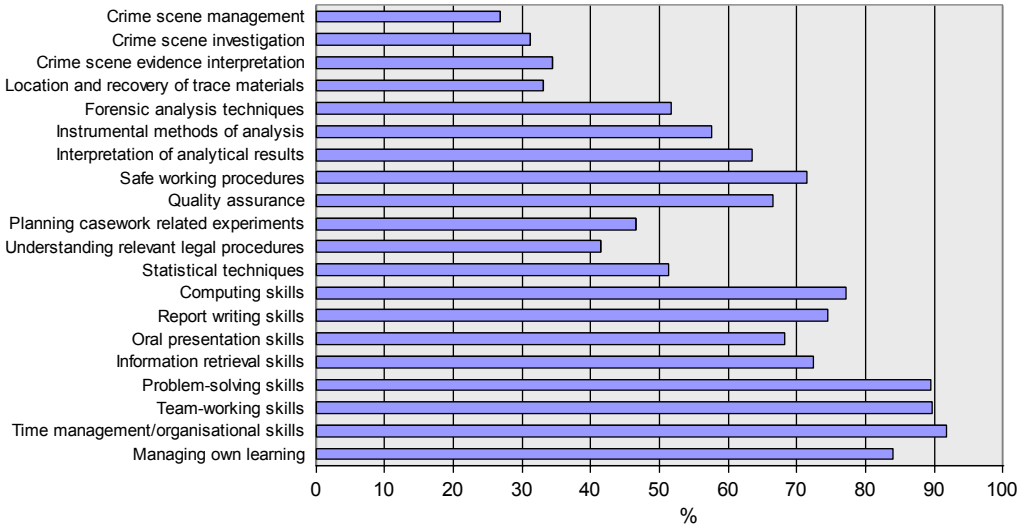

Figure 3: Percentage of all graduates selecting 'Useful/Very useful'

5.2 Knowledge/skills used since graduating

Figure 3 gives the results for the question: ***With respect to your career since completing your undergraduate degree, whether working, training or undertaking other activities, please indicate the value of the areas of knowledge or skills listed***. Respondents could select one of: 'No use', 'Little use', 'Useful' or 'Very useful'. The percentage of graduates selecting 'Useful' and 'Very useful' is given.

It can be seen that the generic skills generally tend to be scored at a higher level of usefulness than the forensic science knowledge/skills. This is not surprising in that generic skills are needed by all the graduates, whereas forensic science knowledge/skills are not. There is little difference between the generic skills with all, except 'Statistical techniques', having over 65% of graduates selecting 'Useful/Very useful'. Of the forensic science knowledge/skills, the analytical skills were considered to be of most use. These results for subject knowledge/skills compared with generic skills show a broadly similar pattern to those obtained in the parallel surveys for chemistry and physics graduates. To give an idea of the spread of the results, the data from three universities are shown in Figure 4. The main point to note is that the same general trends are seen for these universities (and this is indeed the case for all seven universities), with the generic skills and analytical skills scoring highest. The differences in the scores for analytical skills between the universities probably relate to the types of activities undertaken by the graduates, with a higher proportion of graduates from University C working in laboratories.

Figure 5 gives the results according to whether the graduates' activities since graduation involved a knowledge of forensic science 'Not at all', 'To some extent' or to a 'Large/Very large extent'. For the forensic science knowledge/skills, not surprisingly, those graduates whose activities since graduation had a high level of forensic science involvement gave much higher scores. It is not clear why these graduates also gave higher scores for the generic skills, although with less difference than for the forensic science knowledge/skills. It may result from those graduates having a higher degree of responsibility in their work requiring greater use of generic skills, but this cannot be readily verified from the data obtained in this survey.

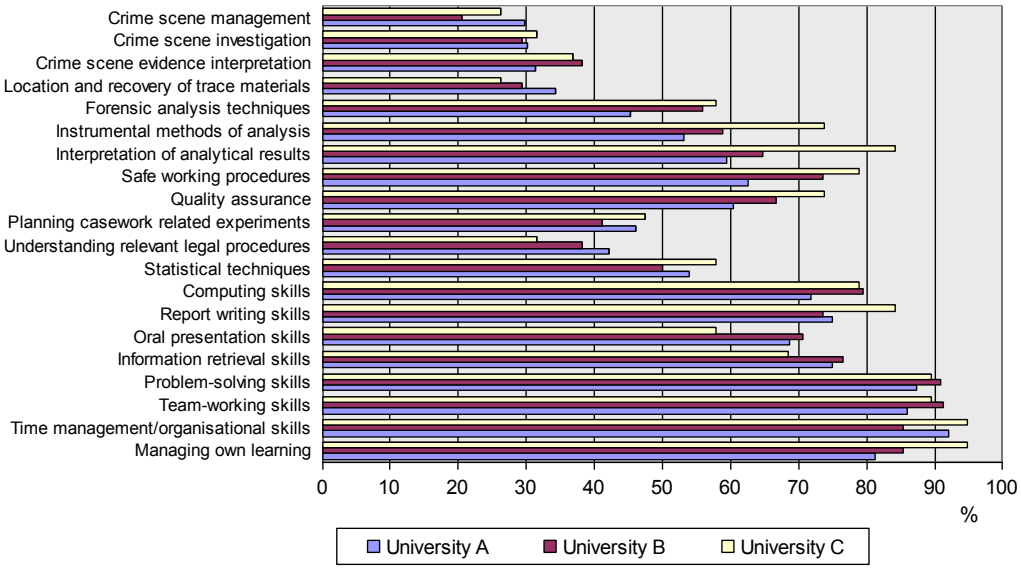

Figure 4: Percentage of graduates from three universities selecting 'Useful/Very useful'

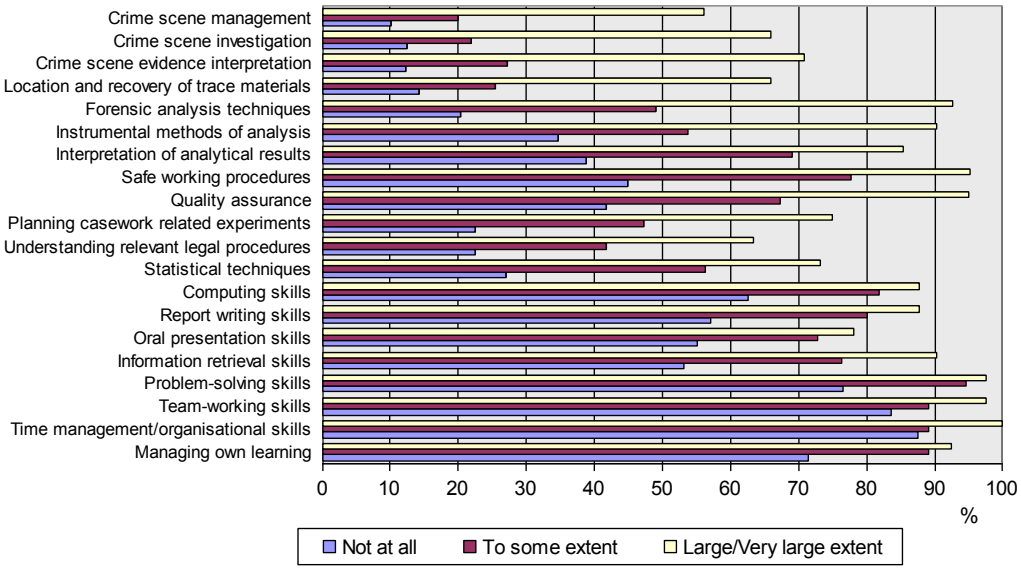

Figure 5: Percentage of graduates selecting 'Useful/Very useful' with respect to forensic science in their activities

5.3 Knowledge/skills development in the degree programme

Figure 6 gives results to the question: ***With respect to your undergraduate degree (including work placement when included), please indicate how well the course assisted you in developing the areas of knowledge and skills listed***. Respondents could select one of: 'Not at all', 'To some extent', 'Well' or 'Very well'. The percentage of graduates selecting 'Well' and 'Very well' is given.

For all of the areas of knowledge/skills, except 'Computing skills', more than 60% of graduates considered they had developed them 'Well/ Very well' within their degree programmes. The average score of 76% compares with 78% for chemistry and 71% for physics found in the parallel surveys.

The development data in Figure 7 are for three universities selected to illustrate the spread of results (they are not the same universities as A, B and C in Figure 4). University 1 scored significantly higher than Universities 2 and 3 (p = 1% and 1% respectively, Student's t-test, testing for 5% and 1% significance levels), but scores are not significantly different when Universities 2 and 3 are compared. Some significant differences are also found when considering the other four universities. However, as mentioned above, this report is concerned with the overall results for all universities rather than university-specific results, although these will be made available to the individual universities concerned.

For all of the areas of knowledge/skills, except 'Computing skills', more than 60% of graduates considered they had developed them 'Well/Very well' within their degree programmes

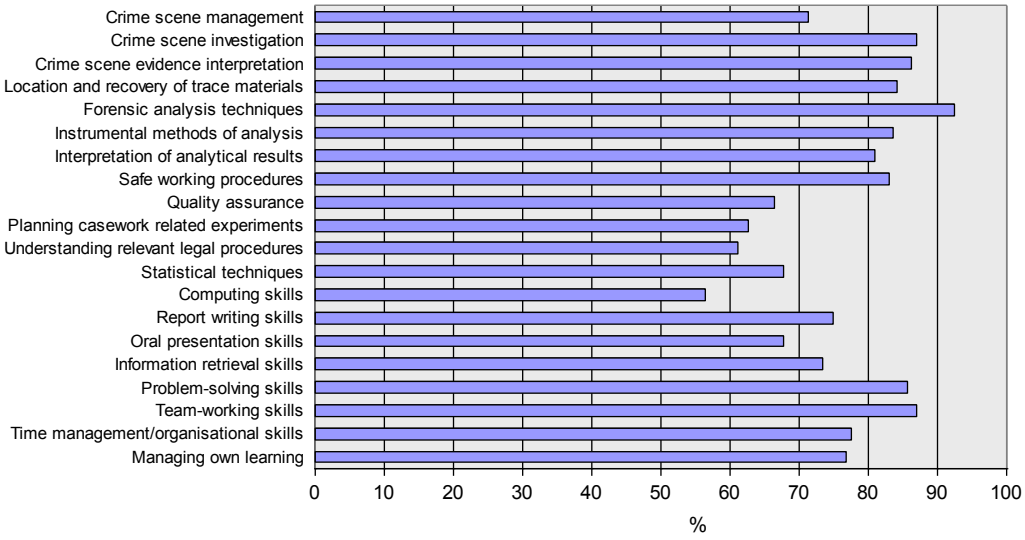

Figure 6: Percentage of all graduates selecting 'Well/Very well' for development in their degree

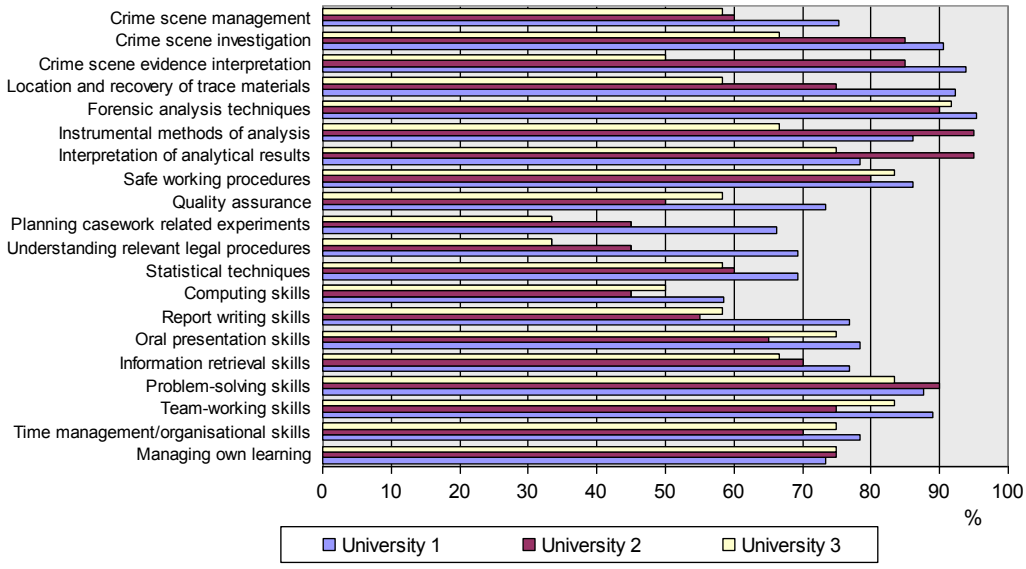

Figure 7: Percentage of graduates from three universities selecting 'Well/Very well' for development in their degree

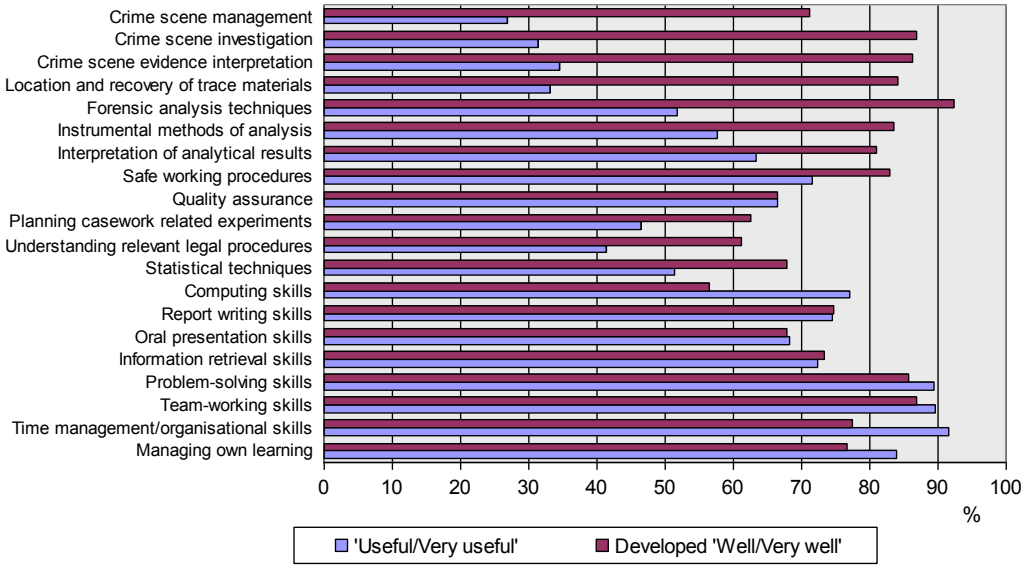

Figure 8: Use versus development for all graduates

5.4 Use versus development

In order to ascertain how well the skills usage by graduates relates to their development in degree programmes, 'Use' and 'Development' percentages are plotted together in Figure 8. This shows that relative to usage, the forensic science knowledge/skills are in general much better developed within degree programmes than the generic skills.

This is illustrated more clearly in Figure 9 where the 'Development' scores are subtracted from the 'Use' scores to give a so-called 'Development deficit'. A positive 'Development deficit' indicates that the area of knowledge/skill has been developed to a low level relative to usage, a negative value that it has been developed to a high level relative to usage. Although 'Development deficit' is a rather crude measure, it can highlight the apparent deficits in development within the degree programmes for particular areas of knowledge/skills, eg 'Computing skills', 'Time management and organisational skills' and 'Managing own learning'.

In Figure 10, 'Development deficits' are given for the same three universities as in Figure 7. Note that the scale here is from -70% to 50%, unlike in the previous figure. The same general pattern is observed for Universities 2 and 3, with most of the forensic science knowledge/skills having negative 'Development deficits', although 'Quality assurance' and 'Planning casework related experiments' show positive deficits for both universities. For Universities 2 and 3, several of the generic skills have positive 'Development deficits', with 'Computing skills' having the highest deficits for both universities. University 1 shows positive deficits only for 'Computing skills', 'Time management and organisational skills' and 'Managing own learning'. This probably reflects the high level of graduates from this university who had no involvement of forensic science in their activities since graduation.

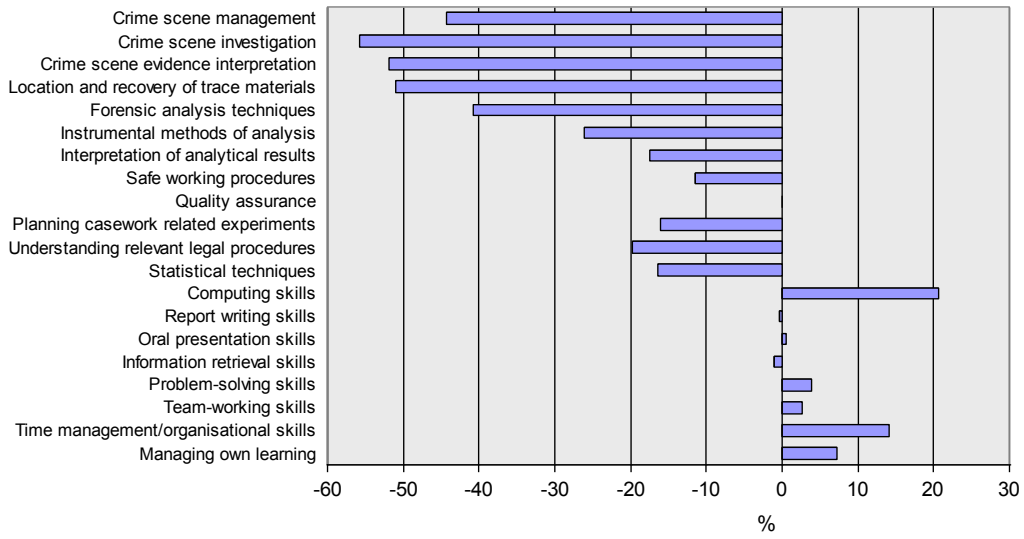

Figure 9: 'Development deficits' for all graduates

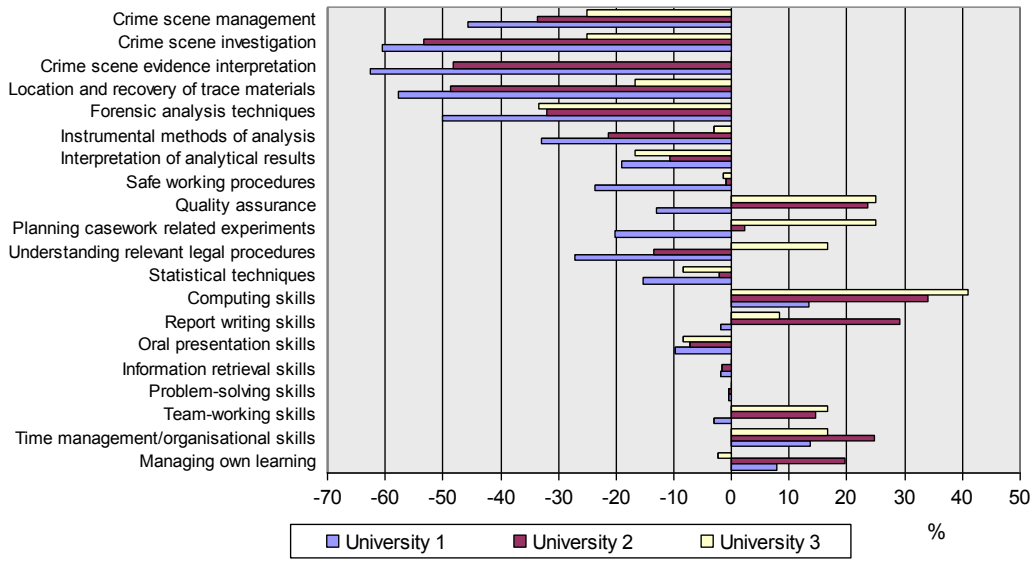

Figure 10: 'Development deficits' for graduates from three universities

'Development deficits' are given in Figure 11 relative to involvement of forensic science in the graduates' activities since graduation. Note that the scale here is from -80% to 50%.

When considering the forensic science knowledge/skills, for those graduates indicating 'Not at all' or 'To some extent' for involvement of forensic science in their activities, all these knowledge/skills have negative 'Development deficits', indicating a high level of development relative to usage; this is as might be expected. For those graduates indicating a 'Large/Very large extent' for involvement of forensic science in their activities, 'Quality assurance', 'Safe working procedures' and some of the analytical/experimental skills have positive deficits.

When considering the generic skills, for those graduates indicating 'To some extent' or 'Large/ Very large extent' for involvement of forensic science in their activities, almost all these skills have positive 'Development deficits', with 'Computing skills' having the highest deficits for both groups.

5.5 Knowledge/skills graduates would have liked more opportunity to develop within their degree

The analysis in the previous section has identified areas of knowledge/skills, particularly generic skills, where their use after graduation appears to be high compared with their development within degree programmes. However, it does not necessarily follow that graduates would have liked these to have been developed more within their forensic science degree programmes; they may, for example, consider the development of some of these skills to be more suited to extra-curricular activities. To address this point, the following question was asked: ***Of the 20 areas of knowledge/skills listed above, please indicate the FIVE which, in retrospect, you wish you had been given more opportunity to develop within your undergraduate degree.***

The results for all graduates are given in Figure 12; the average score is 21% (not 25%, as some respondents made less than five choices). The nine highest scoring areas of knowledge/skills fall into four groups: crime scene; analytical; statistics and computing; and report writing and oral presentation.

When compared with 'Development deficits' (see Figure 9), there is very little agreement, with only 'Computing skills' having high scores for both parameters. It is interesting to note that in the parallel surveys carried out in chemistry and physics, there was broad agreement between the two parameters. It is not clear why the situation is different for forensic science and, in particular, why the crime scene areas of knowledge, which were scored low for usefulness and high for development, score highly for what graduates would have liked more in their degrees. This apparent anomaly was put forward for discussion by a focus group, as reported below.

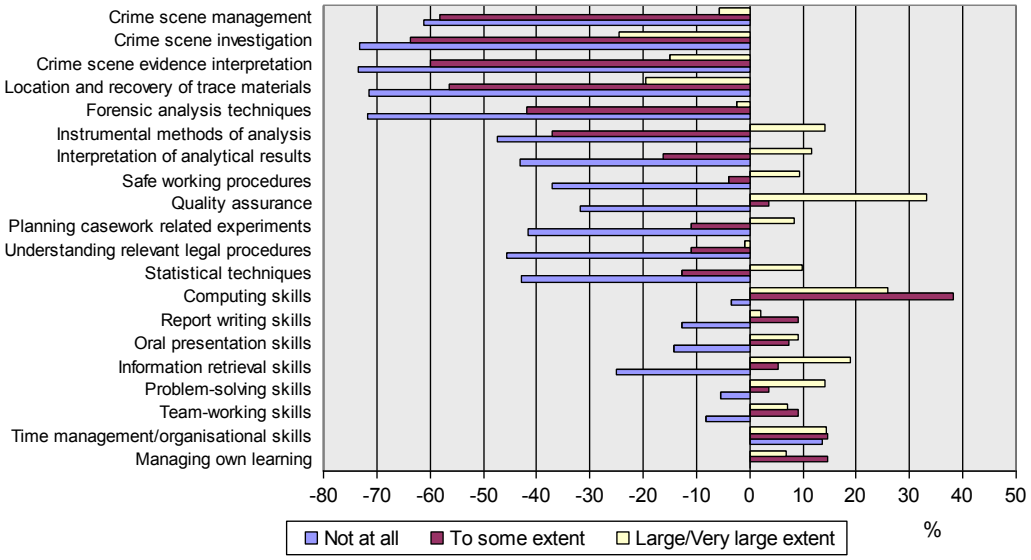

Figure 11: 'Development deficits' for all graduates with respect to forensic science in their activities

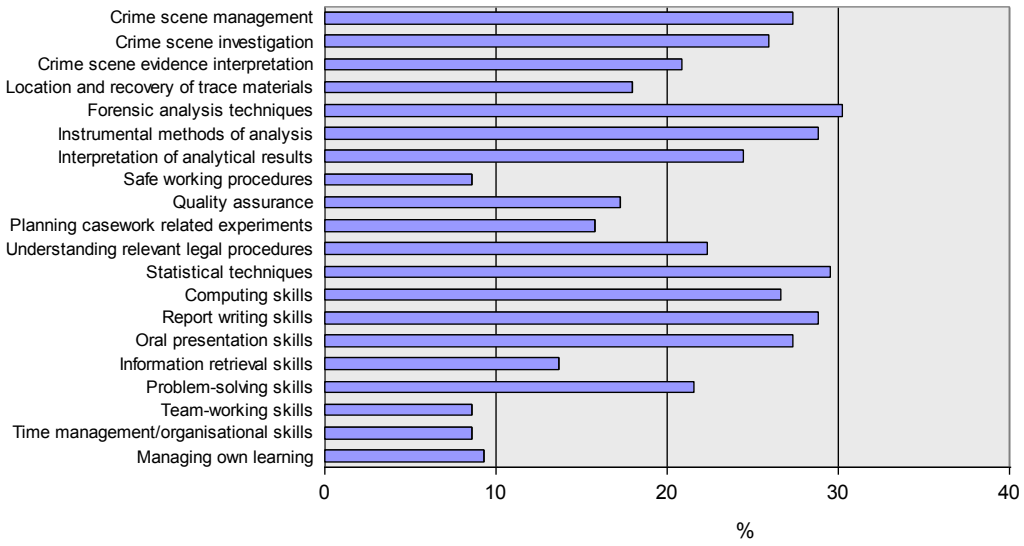

Figure 12: Percentage of all graduates indicating they would have liked more opportunity to develop the areas of knowledge/skills in their degree

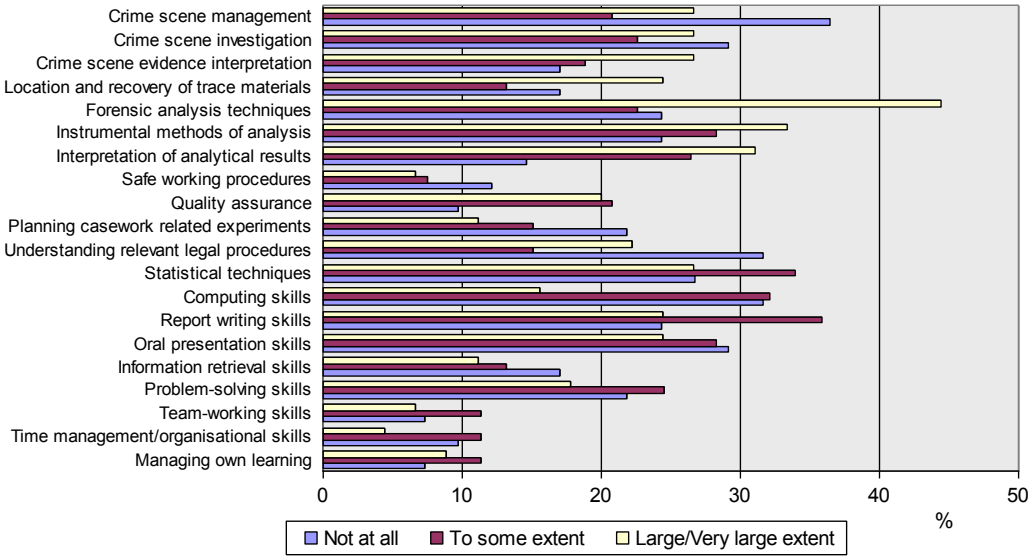

Figure 13: Percentage of all graduates indicating they would have liked more opportunity to develop the areas of knowledge/skills in their degree, with respect to forensic science in their activities

In Figure 13 results are broken down according to the extent that the graduates' activities since graduation involved a knowledge of forensic science. Note that the scale here is from 0% to 50% and that all three sets of data are given with average scores of 21%. It is seen that for graduates with high involvement of forensic science in their activities, the analytical skills score highest, with 'Forensic analysis techniques' being chosen by 44%. For graduates with no involvement of forensic science in their activities, it is seen, nevertheless, that 'Crime scene management' and 'Crime scene investigation' score highly.

5.6 Answers to open form questions

The survey included three open form questions.

Please indicate any areas of knowledge or skills, other than the 20 given above, which you have had to acquire in your career since completing your undergraduate degree and which were not covered, or were not covered sufficiently, in your degree.

This produced 78 responses. Most frequently mentioned (by 13 graduates) were analytical techniques (even though they were included in the 20 given above). Individual answers, which may be university-specific, included:

- *More detailed analytical techniques. Updated analytical techniques.*
- *More hands on experience on equipment would have been useful, maybe something incorporated into an individual student project to allow you to understand the development of a method and troubleshooting.*

Other areas indicated by several graduates were: chemistry; computing skills, use of databases; hands-on crime scene experience; careers advice and information about job prospects; and various generic skills.

Please indicate any areas of knowledge or skills, other than the 20 given above, which were part of your undergraduate degree, but have been of little or no use in your career.

This produced 59 responses. Several graduates answered that most of the forensic areas of the degree had been of little use and some picked out chemistry and the analytical techniques. However this indicates that these areas of knowledge had not been involved in their activities since graduation rather than being suggestions for changes to the curriculum. Others appreciated the transferable aspect of many parts of their degrees. An area mentioned by several graduates was business skills, although this appears to relate to only two of the universities. Individual answers included:

- *Due to lack of jobs in forensic science - all of it!*
- *Unfortunately the crime scene investigation skills*
- *My undergraduate degree provided me with very useful knowledge or skills that I use everyday. All skills and knowledge are useful.* (A graduate in employment with no forensic science involvement.)

Most frequently mentioned... were analytical techniques

Please provide any comments which you think may be useful in developing the curriculum of undergraduate forensic science degrees. Additionally, if you wish, please explain or expand on any of the answers you have given above.

This produced 81 responses. The overwhelming message from the answers was that graduates experienced difficulty in obtaining relevant employment and that many believe that more hands-on experience, particularly work placements, would have helped in this regard. Some graduates indicated that they would have liked more careers advice.

Individual answers included:

- *Could include practical work placements in which students could gain the experience wanted by many employers, also could include more generic science units within the course to widen the field of jobs which can be applied for as there are very few jobs in forensic science.*
- *I feel that there should be some form of placement for students as I could not get a job within forensics or in a research lab due to a lack of lab experience, therefore I've decided to go into retail management and volunteer policing. Students should be encouraged to do free work within labs while at university, and the university should help plan this by making good relationships with local labs/hospitals which would allow students to get the relevant experience to help them find a job after graduation.*
- *Hands on experience should be encouraged and the importance of the experience emphasized and supported much more. Without hands on experience it is almost impossible to get work.*
- *I think it would be useful to have more information/advice on career paths after graduating and how to pursue this and also job application writing skills for applying for these jobs*

5.7 Focus group and additional comments

A small focus group was held at one of the collaborating universities (with Forensic Science Society accredited courses) in order to gain further insight into the results obtained in the survey. The focus group was attended by two graduates who had completed the survey questionnaire and a Careers Adviser who deals with forensic science students. One of the graduates had indicated that forensic science was involved to a 'Very large extent' in activities since graduation, the other 'To some extent'. Two main aspects were discussed.

The group was informed that the crimes scene areas of knowledge had high scores for development and low scores for usefulness, yet many graduates indicated in the survey that they would have liked more chance to develop them within their degrees. Two explanations, not mutually exclusive, were put forward by the group. One explanation was that these areas are particularly interesting parts of the curriculum and often the reason why a forensic science degree was chosen, hence the desire for more development within the degree programmes. The other explanation was that if those areas had been developed more, then it might have been easier for graduates to have found relevant employment.

This led on to the second aspect, the difficulties encountered by graduates in obtaining forensic science related employment. The graduates indicated that they would have liked more help in obtaining employment after graduation and more assistance in obtaining work experience, which they believe would have helped in obtaining relevant employment. However the Careers Adviser pointed out that undergraduates did not always take up available placements, possibly because as undergraduates they did not appreciate their value.

Several graduates from other collaborating universities provided comments (by e-mail or verbally) in response to being informed of some of the survey findings. Their responses largely reflected the discussion at the focus group. Individual comments included the following (both from graduates from non-accredited courses):

- *I know that personally I have not used Crime Scene Investigation for my career… however, I think there is more to University than career planning, and I would not have attended (named university) if it wasn't for the inclusion of this aspect of the degree. Also, when choosing a degree aged 17 you think of a different set of criteria than how you use that degree aged 21, I think that (named university) had a good balance of topics to suit the 17 year old who only wanted to learn things that were interesting and varied and the 21 year old who wanted a job with the skills!*
- *I've been unsuccessful in getting a job within forensics as I don't have practical experience and was unable to get a place that would help me gain the experience.*

I think there is more to University than career planning

6. Discussion

For new forensic science graduates it is clear from this study that a range of generic skills are very important, irrespective of whether the graduates are employed in forensic science or non-forensic science related jobs. This is very much in line with reports, mentioned above in the Background, that list the graduate skills required by employers. The evidence presented here should be valuable to academic staff when advising undergraduates on the importance of generic skills development during their undergraduate programme. It has been observed by the authors that the views of recent alumni are often more convincing to undergraduates than the views of employers.

This study shows some imbalance between the use of skills after graduation and their development within degree programmes. This is demonstrated both by 'Development deficit' data and by answers to the question about which skills the graduates would have liked the opportunity to develop more within their degrees.

Generic skills, such as computing, statistics, oral presentation and report writing, are considered useful but are relatively underdeveloped in degree programmes, and, not surprisingly, graduates would have liked more chance to develop them within their degrees. The analytical skills are also considered useful, but are relatively well developed in degree programmes, nevertheless, graduates would have liked more chance to develop them within their degrees, perhaps reflecting the nature of graduate employment. Although crime scene areas of knowledge do not score highly for use after graduation, and are well developed in degree programmes, graduates would have liked the opportunity to develop them even more within their degrees. This appears to be partly because of their intrinsic interest, but also because graduates believe that it may have helped them to gain relevant employment.

The open form answers provide a useful source of information for degree programme development, although some is university-specific. Answers indicated that graduates experienced difficulty in obtaining relevant employment and that they believe that more hands-on experience and also more careers advice would have helped in this regard.

Graduates' answers to the open form questions did not suggest any areas of knowledge/skills that should be dropped from degree programmes (other than on a university-specific basis), hence an increase in generic skills development would appear to be an issue of pedagogical innovation rather than curriculum content.

7. Conclusions

7.1 Completed survey forms were received from a total of 147 graduates from seven universities (78 from Forensic Science Society accredited courses, 69 from non-accredited), an overall response rate of 33%.

7.2 A total of 121 graduates (82%) were in employment and 15 graduates (10%) were undertaking further study as their main activity. Only 4 graduates (3%) were undertaking PhDs. About 34% of the graduates indicated no involvement of forensic science in their activities since graduation, compared with 16% for chemistry and 22% for physics in the parallel surveys.

7.3 The generic skills generally tend to be scored at a higher level of usefulness than the forensic science knowledge/skills. Of the forensic science knowledge/skills, the analytical skills were considered to be of most use.

7.4 For all of the areas of knowledge/skills except 'Computing skills', more than 60% of graduates considered they had developed them 'Well/Very well' within their degree programmes.

7.5 Significant differences were found between universities in how well the different areas of knowledge/skills had been developed.

7.6 Relative to usage the generic skills were less well developed than the forensic science knowledge/skills within degree programmes. This is particularly notable for 'Computing skills', 'Time management and organisational skills' and 'Managing own learning'.

7.7 Graduates indicated that they would have liked more opportunity to develop the following areas of knowledge/skills within their degree programmes: crime scene; analytical skills; statistics and computing; and report writing and oral presentation.

7.8 In the open form answers graduates indicated that they had experienced difficulty in obtaining relevant employment and that more hands-on experience might have helped in this regard and also more careers advice.

8. Recommendations

It is recommended that when undergraduate forensic science degree programmes are being revised, additional opportunities should be provided for developing generic skills, in particular computing, statistics, report writing and oral presentation.

Additional opportunities should also be provided for development of analytical skills, including more hands-on laboratory experience. Crime scene related areas of knowledge need to be maintained in degree courses and if possible expanded.

More assistance should be provided to help undergraduates in finding relevant work experience, both long and short term, and more careers guidance should be provided.

Undergraduates should be advised about the skills new graduates require and the importance of relevant work experience; presentations by recent alumni may be one of the best ways to put over this message.

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