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for Education

Evaluation of Subject Knowledge Enhancement Courses

Annual Report – 2011-12

Research Report

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CooperGibson Research

Contents

Table of figures	6
Acknowledgements	9
1. Executive Summary	10
1.1 Methodology	10
1.2 Key findings	11
1.2.1 Effectiveness of preparing trainees sufficiently in subject area	11
1.2.2 Effectiveness in equipping trainees to become subject specialists in schools	12
1.2.3 Comparing SKE and traditional entry teacher trainees	13
1.2.4 Meeting the targets for mathematics and science teaching in schools	14
1.3 Recommendations	16
2. Introduction	18
3. The Policy Context	20
3.1 Machinery of government changes	20
3.2 Policy overview: 2006 - 2012	21
3.2.1 The introduction of SKE courses	22
3.2.2 The quality of teaching	22
3.2.3 The importance of subject knowledge	24
3.3 SKE courses	26
3.3.1 Number of SKE trainees	27
3.3.2 Initial Teacher Training: recruitment allocations and funding	28
3.4 Updates for 2012	32
3.4.1 Teachers' Standards	33
3.4.2 Additional support for science and mathematics teachers	34
3.4.3 Wider research on SKE courses	39

3.5 Summary and conclusions	40
4. Methodology	42
4.1 Document review	42
4.2 Student data	42
4.2.1 Beginning of SKE course survey and interviews	43
4.2.2 End of SKE course survey and interviews	43
4.2.3 Postgraduate Certificate in Education (PGCE) survey and interviews	44
4.2.4 Newly Qualified Teacher (NQT) survey and interviews	45
4.2.5 SKE case studies	46
4.3 Tutor and colleague data	47
5. Profile of Participants	48
5.1 Surveys	48
5.1.1 SKE student demographics	49
5.1.2 Course of study	50
5.1.3 Respondent qualifications and experience	51
5.2 Interviews	53
5.3 Case studies	54
6. Effectiveness of Preparing Trainees Sufficiently In the Subject Area	56
6.1 Changes in subject knowledge	56
6.2 Confidence in the subject	58
6.3 Preparation for teacher training	62
6.3.1 Defining levels of subject knowledge and progress on teacher training	63
6.4 Previous qualifications	66
6.5 Course content and delivery	67
6.6 Summary and conclusions	71
7. Effectiveness in Equipping Trainees to Become Subject Specialists in Schools	73

7.1	Expectations and confidence to teach different key stages	73
7.2	Key stages being taught and required levels of subject knowledge	77
7.3	Are former SKE students 'subject specialists'?	79
7.4	Satisfaction and impact for those in teaching positions	82
7.5	Summary and conclusions	84
8.	SKE vs. Traditional Entry Teacher Trainees	86
8.1	Comparing subject knowledge	87
8.2	Comparing preparedness for the PGCE	89
8.3	Summary and conclusions	91
9.	Meeting the Targets for Mathematics and Science Teaching in Schools	93
9.1	Advantages and disadvantages of the SKE course and satisfaction levels	93
9.2	Barriers to enrolment and completion of the SKE course	96
9.3	Motivations for teaching, choosing the specialist subject and SKE course	97
9.4	Career aspirations of students	99
9.5	Enhancing employment prospects and gaining a teaching post	102
9.5.1	Meeting the objectives of the SKE programme	102
9.5.2	The NQT role and performance as a teacher	104
9.6	Awareness and perception of SKE courses	107
9.6.1	Awareness of SKE courses	107
9.6.2	Perception of SKE courses and students	108
9.7	Summary and conclusions	110
10.	Conclusions and Recommendations	113
10.1	Effectiveness of preparing trainees sufficiently in subject area	113
10.2	Effectiveness in equipping trainees to become subject specialists in schools	114
10.3	Comparing SKE and traditional entry teacher trainees	115
10.4	Meeting the targets for mathematics and science teaching in schools	116

10.5 Concluding comments and recommendations	118
11. Appendix 1: Case Studies	122

Table of figures

Table 1 The Importance of Teaching: DfE action points (2010)	23
Figure 1 Number of SKE registrations by subject – 2009/10 and 2010/11	27
Table 2 Demographic of student registrations – 2009/10 and 2010/11	28
Table 3 Allocation of teacher training places by subject, 2011/12	29
Table 4 Bursary funding for ITT 2011/12	30
Table 5 ITT bursary priorities for 2012/2013	31
Table 6 Science and mathematics ITT registrations against DfE targets - 2011/2012	31
Table 7 Science and mathematics ITT recruitment against DfE targets - 2012/2013	32
Table 8 Support mechanisms/specialist routes available to ITT recruits in science and mathematics	35
Figure 2 Science and mathematics subjects as a proportion of all GCSEs sat in England (2011-2012)	37
Figure 3 Science and mathematics subjects as a proportion of all A level examinations sat in England (2011-2012)	37
Figure 4 Science and mathematics subjects as a proportion of all AS level examinations sat in England (2011-2012)	38
Table 9 Overview of evaluation participants 2009-2012	48
Table 10 Profile of survey respondents by SKE subject (2011/12)	49
Table 11 Comparison of survey participant demographics	49
Table 12 Comparison of survey responses by main subject 2009-2012	50
Table 13 Length of SKE course across all surveys 2011/12	51
Table 14 Profile of interview respondents according to SKE subject (2011/12)	53
Table 15 Profile of interview respondents - age and gender of prior SKE students (2011/12)	54
Table 16 Profile of case study participants (2011/12)	55
Figure 6 Change in subject knowledge; beginning vs. end of course results - Beginning and End of Course surveys 2011/12	57

Table 17 Proportion (percentage) of SKE students rating their level of subject knowledge by length of SKE course - Beginning and End of Course surveys 2011/12	58
Figure 7 Level of confidence in subject by SKE subject - Beginning of Course Survey 2011/12	59
Figure 8 Level of confidence in subject by SKE subject - End of Course Survey 2011/12	60
Figure 9 Rating of confidence in subject knowledge of principal subject - PGCE Survey 2011/12	61
Figure 10 NQTs' current level of confidence in the principal SKE subject - NQT Survey 2011/12	62
Figure 11 Definition of level of subject knowledge - PGCE Survey 2011/12	64
Figure 12 How the SKE course has impacted on performance on the PGCE course - PGCE Survey 2011/12	65
Table 18 Subject knowledge needed to teach to key stages 3, 4 and 5 - PGCE Survey 2011/12	74
Figure 12 Expected levels to teach principal subject to once NQT year is completed - PGCE Survey 2011/12	74
Table 19 Level of confidence to teach to key stages 3, 4 and 5 in the principal subject - PGCE Survey 2011/12	75
Table 20 NQTs level of confidence in subject knowledge to teach to key stages 3, 4 and 5 - NQT Survey 2011/12	76
Table 21 Subject knowledge needed to teach principal SKE subject to key stages 3, 4 and 5 - NQT Survey 2011/12	77
Figure 13 The extent to which NQTs have found it necessary to develop their subject knowledge - NQT Survey 2011/12	78
Table 22 Do NQTs class themselves as subject specialists? - NQT Survey 2011/12	79
Figure 14 Impact of SKE courses on NQTs' performance as a teacher - NQT Survey 2011/12	82
Table 23 Top 2 advantages of completing the SKE course - BoC, PGCE, NQT surveys 2011/12	94
Figure 15 Overall satisfaction with the SKE course - End of Course Survey 2011/12	95

Figure 16 Career aspirations in the next 5 years by PGCE subject - PGCE survey	100
Figure 17 Career aspirations in the next 10 years by PGCE subject - PGCE survey	101
Figure 18 Time taken to secure a teaching post since completing the PGCE - NQT Survey 2011/12	104
Table 25 Principal subject that NQTs are teaching - NQT Survey 2011/12	105
Figure 19 School perception of SKE students - PGCE Survey 2011/12	109
Figure 20 NQT views on how schools perceive SKE students - NQT Survey 2011/12	110

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1. Executive Summary

The Teaching Agency commissioned CooperGibson Research to carry out the final year of an evaluation of the Subject Knowledge Enhancement (SKE) courses programme (initially commissioned by the Training and Development Agency for Schools). The evaluation looked at the effectiveness of the programme in equipping teacher trainees to specialise in teaching a subject in school and the impact it had on teacher trainees who had been through the SKE programme compared to those who had not. The overall aims of the evaluation were set in 2009 as:

- Assess the effectiveness of the SKE courses in preparing trainees sufficiently in their subject areas to meet the Qualified Teacher Status (QTS) standards.
- Evaluate the effectiveness of the SKE courses in equipping trainees to become subject specialists in schools.
- Investigate any differences between traditional entry and SKE candidates during all stages of becoming a teacher (successfully completing training, commencing teaching in schools, becoming high-quality teachers and progressing within the teaching profession).
- Gauge the SKE courses' effectiveness in terms of meeting the 2014 targets for mathematics and science teaching in schools.¹

Since the evaluation began in 2009, there have been significant changes in Government and several announcements in relation to teacher training and targets for teaching and learning (refer to the policy context section for further detail). Changes to the 2014 targets for mathematics and science teaching in schools has had a direct impact on the fourth aim of this evaluation. Whilst the political context within which SKE courses are operating has changed since the evaluation first started, overall, mathematics and science teaching and learning remains a key priority for Government, therefore this evaluation has continued to have this as a key focus of its aims.

These four main evaluation criteria therefore, underpin the structure of this report and its conclusions. This report is the final annual report of the evaluation. It is accompanied by a technical report which analyses survey findings.

1.1 Methodology

Across the three years of the evaluation, there have been nine surveys (with some run over two rounds of data collection) and a series of telephone interviews taking place. In total, there were 3,268 responses to the surveys and 456 interviews

¹ The 2014 targets were 25% of science teachers to have a physics specialism, 31% of science teachers to have a chemistry specialism and 95% of mathematics lessons to be delivered by a mathematics specialist.

completed. The final year was the most comprehensive in terms of the range of stakeholders involved. It included:

- A desk review to update the literature review carried out in previous years.
- A Beginning and End of course SKE survey and follow-up interviews.
- A survey of teacher trainees on the Postgraduate Certificate in Education (PGCE) and follow-up interviews – those who had completed an SKE course and for comparison, those who had not.
- A survey of newly qualified teachers (NQTs) who were former SKE students and follow-up interviews, plus interviews with a small number of NQT colleagues.
- Interviews with SKE tutors.
- Interviews with longitudinal case studies, tracked through the three evaluation years – example case studies can be viewed in Appendix 1.

As the evaluation progressed through each year, targets for each data collection strand changed to allow a wider variety of respondents to be included towards the final year. This design allowed for an incremental approach to data collection where data and knowledge built along with the journey of SKE students through their SKE course, onto PGCE training and into their NQT year.

1.2 Key findings

The range and volume of data collated throughout this evaluation has allowed an in-depth exploration of the four key evaluation objectives. A summary of the findings drawn from this evidence base is provided below.

1.2.1 Effectiveness of preparing trainees sufficiently in subject area

A key objective of the evaluation was to explore how effective SKE courses are in preparing teacher trainees sufficiently in their specialist subject area.

The evidence gathered in year three of the evaluation supports the findings from the previous two years: SKE courses provide trainees with a high level of subject knowledge and confidence in the subject and a firm foundation and preparation for their PGCE training. Although the majority of students commence SKE courses with a perception of having a reasonable level of subject knowledge in their subject of study, it is clear that after completing the SKE course, trainees recognise that they over-estimated their levels of understanding of their subject. Overall, however, by the end of the SKE course, students thought that their subject knowledge had improved significantly.

During the PGCE year, the SKE students considered their subject knowledge to be at a lower level (level 5) than traditional route teacher trainees (subject graduates) who were more likely to rate it at graduate/postgraduate level. This is supported by findings from the interviews where several interviewees talked about subject graduates having higher levels of knowledge which would aid them to teach to higher levels and deal with more complex concepts and questions. They also felt however, that the knowledge that subject

graduates might have could be less relevant to the school context. This would indicate that SKE courses currently being delivered in some institutions, whilst being effective in providing relevant and useful subject knowledge for trainees, might not be providing sufficiently high levels of subject knowledge that some teacher trainees suggest they might require.

The content of SKE courses was an important consideration for trainees. They viewed the balance between subject knowledge and pedagogy of most SKE courses as being heavily weighted towards subject knowledge, with pedagogy being a much smaller aspect. However, students' preference would be for a more balanced ratio such as 60/40 or 50/50. The inclusion of subject-related pedagogy was seen by many students as particularly useful. Many former SKE students and SKE tutors highlighted the need to involve subject-related pedagogy in SKE course content, even if it was not explicitly covered. Current and former SKE students certainly valued the practical experience they gained from the courses and having examples and tips on how to teach their subject.

1.2.2 Effectiveness in equipping trainees to become subject specialists in schools

A second objective of the evaluation explored the effectiveness of SKE courses in equipping teacher trainees to become subject specialists in schools.

Students at both PGCE and NQT stages felt that in order to teach effectively they needed to have a level of subject knowledge at least one level higher than they would be expected to teach; this would enable them to have increased confidence in their knowledge and make them more effective in their teaching. The majority of PGCE students and NQTs said they felt highly confident to teach to key stage 3 and 4 but less so to key stage 5. Being familiar with the content and teaching experience at key stage 3 and key stage 4 were of significant benefit in terms of building their confidence to teach; however some students who felt they did not have sufficient knowledge on specific topics or sufficient grounding in the subject, noted the lack of a subject degree or A level in the subject and that this did present some gaps in their knowledge.

Most NQTs were teaching to key stage 3 and key stage 4 which fitted with their expectations and the levels that they had trained for; and most thought, to be properly equipped in terms of subject knowledge, that they should be at least one level ahead with a small proportion indicating the need to be two levels ahead in order to teach effectively. This could indicate a lack of confidence in knowing their subject sufficiently. However, some students did note that having a level above better equipped them to answer more complex or challenging questions from pupils. In terms of the need to develop their subject knowledge further, nearly half of NQTs thought they may do so in order to teach key stage 4. This again could also be an indication about levels of confidence in knowing their subject knowledge as well as the need for greater depth of knowledge.

Many NQTs who had completed an SKE course came to regard themselves as subject specialists in their principal subject but interestingly those with physics SKE background were less likely to do so. The majority of these also thought that their colleagues would class them as such. When discussing the term 'subject specialist', current and former SKE students and some tutors tend to relate this to their subject knowledge and ability to teach the subject rather than having subject knowledge per se. They are therefore referring to having specialist subject knowledge for teaching their subject. Some referred to a subject specialist as having greater depth and breadth of subject knowledge - recognised as graduate level understanding.

Almost all the NQTs in the sample were pleased that they had completed an SKE course, and didn't consider it could really be improved upon; most thought it had significantly enhanced their performance as a teacher. Of the small number of improvements suggested these were for: more focus on different levels (i.e. some wanted higher level knowledge, key stage 5, whilst one or two would have liked more on lower levels such as key stage 3); more input on all three sciences; more pedagogy and practical experience in school environment; and more instruction and guidance on concepts, particularly for those with additional needs.

1.2.3 Comparing SKE and traditional entry teacher trainees

This objective focuses on comparing the progress and development of those who have been through an SKE course with those who entered teacher training after graduating with a degree in their specialist subject. Whilst all respondents were asked to compare these two routes into teaching, the PGCE survey and interview responses were particularly important here since they included former SKE students on PGCE courses and traditional route PGCE students (subject graduates).

Nearly half of SKE students considered their subject knowledge as above or well above average for the PGCE course compared to nearly two-thirds of traditional route trainees. Their level of knowledge differed from traditional route trainees, with the latter more likely to rate their knowledge as graduate or postgraduate compared to SKE students rating it at level 5 (A level).

However, when comparing subject knowledge the SKE respondents thought that their knowledge was likely to be more up-to-date and relevant to the school curriculum than their traditional route counterparts, which in turn would help them to relate to pupils and better equip them to understand their needs. They felt they would be better equipped than traditional route trainees to be able to break down the subject for pupils, and to understand misconceptions and the difficulties pupils faced often having experience of them on the SKE course. The SKE course had provided them with the ability to pitch at the right level, and in addition, many science SKE students had had the advantage of refreshing their knowledge across more than one science.

Both the SKE and PGCE students (both former SKE students and subject graduates) thought that those with a specialist degree would have greater depth and breadth of knowledge which would help with answering complex questions, teaching to a higher level and would have a better grasp of complex concepts and underlying principles. Whilst the SKE course did help students in terms of building their confidence in the subject, at the NQT stage traditional route teacher trainees were more likely to rate their confidence at higher levels especially at key stage 5.

In terms of preparing students for the PGCE course, the SKE is considered to be ideal preparation. The majority of PGCE respondents thought former SKE students would be better prepared to do the PGCE course than traditional route students although they did think that the latter would have more confidence in their subject knowledge. The main reasons were that they would be more prepared for the demands of the PGCE course; more familiar with the curriculum, have experience of conducting practicals and laboratory work; have experience of teaching methods and insight into school practices; have built up a bank of resources; have built a network of support and be familiar with the institution and tutors and style of working; and have a wider grasp of the three science subjects taught in schools.

1.2.4 Meeting the targets for mathematics and science teaching in schools

The final objective of the evaluation explored whether SKE courses are able to support recruitment of teachers to mathematics and science subjects.

Almost all respondents were positive about the value of the SKE course especially in terms of enabling them to go on to a teaching career in mathematics or the sciences in schools. Many respondents said that without the course that they would not have been able to realise their ambitions to teach. The main factors that the NQTs valued were the relevance and usefulness of the teaching methods, pace and content of the course, level of support, and preparation for completing the PGCE. The majority also considered that it provided them with sufficient knowledge to become a successful teacher.

The majority of PGCE students who had not completed an SKE thought they did not need to complete one but this was not because they thought it had no value but that they already had sufficient knowledge, experience or had recently finished education. However, a third of those without an SKE background did think that they would have benefited in terms of being able to refresh their subject knowledge, gain familiarity with the curriculum and practical experience in schools, gain more confidence and get into the process of learning again.

Most SKE students thought that the SKE course went well and there were few issues, those mentioned included the quality of support, being able to cope with the workload, fitting work into other commitments, confidence, communication skills, organisation and timing of courses, lack of clarity on expectations of the course and limited formal contact

time. Potential barriers included the introduction of course fees and reduction of bursaries, both of which it was suggested would lead to a reduction in applicants.

Most trainees came into teaching because they wanted to teach rather than for economic reasons; they wanted to 'make a difference' and said it was because they 'enjoyed working with young people'. These findings replicate findings from the previous evaluation years. For many SKE students this was their second career and the SKE gave them the opportunity to realise it. This partly explains the two main reasons given for enrolling on an SKE course which were that it was a condition of their PGCE (which is a requirement within the SKE regulations) and they felt that their subject knowledge was not sufficient. For those for whom it was a second career it was often a substantial amount of time since they had been in education. When choosing a specific subject to specialise in, across all surveys, the two main reasons given were 'enjoyment of the subject' and 'to pass on enthusiasm for the subject to young people'. Having better job prospects was also referred to and some were aware of the initiative to recruit and increase the number of teachers in mathematics and the sciences.

Career aspirations whilst on the SKE and PGCE courses were similar and did not change significantly; they related mainly to middle management with nearly half aspiring to become a head of department. At the end of the course their short-term goals were to focus on teaching their subject with a view to specialise in teaching in one or more subjects within five years and become a head of department. Longer term goals included more senior roles such as deputy head teacher, head of year.

The aspirations of NQTs were similar although those in mathematics are more likely to aim to specialise in teaching one subject with about a quarter aiming to become a head of department. Much higher proportions of chemistry and physics PGCE students aspire to positions of deputy or head teacher within 10 years. In the shorter term most NQTs were focusing on their teaching responsibilities. Changes in aspirations were in terms of having higher aspirations to progress and reach leadership roles, due to having more confidence, feeling more ambitious and wanting to have wider impact on young people. A small number had changed their mind from wanting to become a head teacher as they preferred to focus on pastoral duties.

Former SKE students have, on the whole, moved quickly into full-time employment, teaching the same subject that they studied their SKE in. Just over two-thirds of NQTs were offered teaching posts before completing their training and the majority were full-time posts. Just over half were teaching mathematics as their principal subject; followed by general sciences and then physics. Only 5% taught chemistry as their principal subject. In general they taught their main subject to key stages 3 and 4. This is complemented by the apparent satisfaction that NQTs had with their first year in teaching – with a high proportion saying they were satisfied and only a very small minority expressing some kind of dissatisfaction.

SKE courses have been very successful, on the whole, in preparing students to move into new careers as science and mathematics teachers with sufficient subject knowledge suited to the school curriculum and the ability to teach with confidence to at least key stages 3 and 4.

Despite the success of the SKE courses to date in preparing successful and well-equipped graduates, it appears that there remain issues in terms of awareness of SKE courses, particularly in schools. Most former SKE teacher trainees and NQTs felt that schools had some awareness of SKE courses but it was limited. A small number of PGCE students thought that schools should be better informed about the SKE courses and their value. There were several students who thought that this had an impact on schools in terms of recruitment. A similar finding emerged when interviewing colleagues of NQTs; it emerged there were several who were not aware of SKE courses, even though one of their colleagues had been through the programme.

However, just under half of the PGCE students did think that schools were on the whole positive about SKE students and just over half of NQTs considered that they were very positively or quite positively regarded by schools. The most common response, by more than a third of NQTs was that they thought schools did not have an opinion either way. This may be indicative of the lack of awareness of the SKE course rather than simply not having an opinion.

Finally, another issue raised by tutors was the notification of their institution's allocation of places in relation to being able to plan and recruit SKE students. Tutors mentioned that they often didn't know in good time how many places that they would be allocated by the Teaching Agency which made recruitment of students difficult.

1.3 Recommendations

There is clear evidence in this evaluation of the success of SKE courses in preparing teacher trainees sufficiently with subject knowledge they require, equipping them to specialise in teaching a subject in schools, providing an alternative route into teaching which is on a par with traditional entry teacher training and supporting the supply and quality of teachers into the profession.

There are however, opportunities to further enhance the delivery and quality of SKE courses. Recommendations are presented below.

The Teaching Agency to:

1. Consult with SKE providers to explore the variations in content, design and delivery with a view to developing guidance around the structure of SKE courses whilst retaining flexibility at institution level. This would improve the coherence and consistency across institutions which would in turn help to ensure high quality provision for all SKE students.

2. Review the current format of SKE courses and the value of including subject-related pedagogy to a greater extent in relation to current regulations of the SKE programme.
3. Review and consider how coverage of more than one science could be achieved to some extent within the design of SKE programme.
4. Work with SKE providers to ensure that there is an appropriate and consistent recruitment process for SKE students.
5. Provide guidance to schools to encourage schools to provide newly qualified teachers with further training in terms of Continuing Professional Development (CPD) to further enhance subject knowledge and confidence to enable them teach to required levels.
6. Provide appropriate information to schools to raise awareness of the value and purpose of SKE courses with the aim of supporting recruitment of former SKE trainees into teaching.
7. Review the process and timing of allocation of SKE places to institutions, to assist with providing sufficient time for recruiting of students.

SKE providers to:

8. Consider including more emphasis on key stages 4 and 5 when designing content of SKE courses, to help build trainees' confidence at these levels.
9. Be encouraged to work collaboratively with other local SKE providers to ensure that students are recruited to the appropriate course for their needs e.g. in terms of length and subject area.
10. Build on support networks developed through their SKE courses and to ensure continued support (including academic support) into PGCE stages.
11. Liaise with local agencies to look at demand for specialist subject teachers and whether this fits with the numbers that are training locally on the SKE courses.

2. Introduction

The Teaching Agency commissioned CooperGibson Research to carry out the final year of an evaluation of the Subject Knowledge Enhancement (SKE) courses programme (initially commissioned by the Training and Development Agency for Schools). The evaluation looked at the effectiveness of the programme in equipping teacher trainees to specialise in teaching a subject in school and the impact it had on teacher trainees who had been through the SKE programme compared to those who had not. The overall aims of the evaluation were set in 2009 as:

- Assess the effectiveness of the SKE courses in preparing trainees sufficiently in their subject areas to meet the Qualified Teacher Status (QTS) standards.
- Evaluate the effectiveness of the SKE courses in equipping trainees to become subject specialists in schools.
- Investigate any differences between traditional entry and SKE candidates during all stages of becoming a teacher (successfully completing training, commencing teaching in schools, becoming high-quality teachers and progressing within the teaching profession).
- Gauge the SKE courses' effectiveness in terms of meeting the 2014 targets for mathematics and science teaching in schools.²

Since the evaluation began in 2009, there have been significant changes in Government and several announcements in relation to teacher training and targets for teaching and learning (refer to the policy context section for further detail). This includes the abolition of the 2014 targets for mathematics and science teaching in schools which has a direct impact on the fourth original aim of this evaluation. Whilst the political context within which SKE courses are operating has changed since the evaluation first started, overall, mathematics and science teaching and learning remains a key priority for Government, therefore this evaluation has continued to have this as a key focus of its aims.

These four main evaluation criteria therefore, have been used to set the structure of this report and its conclusions.

The report presents the policy background to this evaluation and key drivers, an overview of the methodology used for the evaluation, profiles of respondents and the sample, and then analysis of quantitative and qualitative data in relation to the four evaluation criteria above. It presents an analysis of findings from several strands of data collection activity carried out during 2011 and 2012 with brief comparison to findings from previous years of the evaluation, where this is appropriate. Separate annual reports are held by the Teaching Agency for 2009/10 and 2010/11 (Training and Development Agency for Schools at the time of their submission). This report is accompanied by a technical report for 2011/12 which provides more detailed analysis

² The 2014 targets were 25% of science teachers to have a physics specialism, 31% of science teachers to have a chemistry specialism and 95% of mathematics lessons to be delivered by a mathematics specialist.

of the survey findings. Conclusions and recommendations are presented in the final chapter.

3. The Policy Context

This is the final iteration of the SKE literature review first carried out in 2010. It was amended in 2011 to reflect changes in Government and the subsequent amendment of strategies for teaching and learning. This final review takes into account further changes and the most up-to-date data available from the Teaching Agency regarding Subject Knowledge Enhancement (SKE) trainees.

Note on the definition of SKE

Although 'subject knowledge enhancement' is the term for the current courses, there have been programmes designed to enhance subject knowledge for trainee teachers or prospective trainee teachers for a number of years. These courses have variously been known as extension, booster and pre-ITT courses, as well as in some cases being the additional part of two year PGCEs – they are now considered as being SKE courses. Their inclusion under the SKE banner serves to highlight the overall identity of SKE courses as representing all courses designed to enhance subject knowledge pre-initial teacher training.

3.1 Machinery of government changes

As part of the current government's wide-scale review and reform of arm's length bodies and the Department for Education's (DfE) resultant programme for change, the former Training and Development Agency for Schools (TDA) was closed and the Teaching Agency assumed some of the functions which the TDA had previously discharged, including responsibility for ensuring teacher supply. In April 2012 the Teaching Agency became operational as an executive agency of the DfE³. The Teaching Agency's remit is to ensure a supply of high-quality teachers, trainers and supporting staff, special education needs co-ordinators (SENCOs), educational psychologists and examination officers. It is tasked with overseeing three key areas of delivery:

1. Supply and retention of the education workforce.
2. Quality of the education workforce.
3. Regulation of teacher conduct.

Ensuring high-quality training and development of the education workforce remains a key role for the Teaching Agency, particularly in respect of making sure this is 'responsive to the changing educational landscape'⁴. The quality of Initial Teacher Training (ITT) provision in terms of developing (among other aspects) the skills of

³ Three other executive agencies were created: the Standards & Testing Agency (opening in October 2011); the National College and the Education Funding Agency, both of which also came into operation in April 2012.

⁴ DfE (2012), Teaching Agency: Framework Document, p.16

trainees in teaching mathematics is also highlighted as a priority in the Teaching Agency framework documentation⁵.

3.2 Policy overview: 2006 - 2012

When SKE courses were first introduced, the shortage of subject specialist teachers for science and mathematics had been brought to the fore through NFER's *Mathematics and Science in Secondary Schools: The Deployment of Teachers and Support Staff to Deliver the Curriculum* (2006). This report stated that less than one third of those teaching the physics element of double award science GCSEs had a degree in physics or were qualified to teach it through Initial Teacher Training (ITT).

The NFER team also reported that the majority of mathematics (76%) and science (93%) teachers either had a mathematics/science-related degree or had specialised in mathematics/science at ITT level. Within these figures however, there were still great imbalances in terms of the distribution of science teachers, with 44% having a biology specialism, whilst only 25% had specialised in chemistry and 19% in physics. This in turn meant that over a quarter (26%) of 11-16 secondary schools lacked a physics specialist in 2006.

Moreover, imbalances were evident *between* schools in terms of the qualifications of staff teaching mathematics and science, and *within* schools in terms of pupil ability and teaching expertise. For example, mathematics teachers who were not specialists in the subject were most often found in the lowest attaining schools, whilst pupils who had been assigned to low ability groups were often taught by teachers without a post-16 qualification in the given subject (NFER, 2006).

Concerns about the *impact* of teaching shortages in chemistry, mathematics and physics remained, even after the introduction of SKE. In 2010, the Confederation of British Industry (CBI) highlighted the need for more specialist science teachers in order to inspire and encourage young people to study science and therefore meet the economy's need for science and mathematics graduates. It anticipated a need for mathematics and science skills so great that '*the number of those studying for degrees in science, engineering and technology must increase by over 40% on current levels if this demand is to be met*⁶.

This lack of teachers within subjects such as chemistry, mathematics and physics was thought not only to impact school provision and the learning experiences of young people, but also trainee teachers and those with Newly Qualified Teacher (NQT) status in these curriculum areas. Faced with a shortage of current subject specialists, for example, new entrants to the workforce are unable to '*access the subject-specific and pedagogical*

⁵ DfE (2012), Teaching Agency: Framework Document, p.17

⁶ CBI (2010), *SET for growth: Business priorities for science, engineering and technology*

support and guidance they require’ from colleagues within the school setting (SCORE, 2011).

3.2.1 The introduction of SKE courses

SKE courses quickly came to the forefront as an answer to the short supply of mathematics and science graduates entering teaching. In 2006/2007, the former Department for Education and Skills (DfES) made a specific call for further availability of training in chemistry, mathematics and physics that would cover the continuing demand for teachers in these subject areas. Following this call the former TDA identified that although the numbers of graduates with first degrees in mathematical or physical sciences was relatively small, there was a great number of other graduates with a science or science-related degree who potentially could, with appropriate training, be recruited. The resulting response was to increase the volume of pre-ITT subject knowledge training in the form of SKE courses by 40% in the areas of mathematics and physical sciences.

Meeting recruitment targets is part of the Teaching Agency’s key performance indicators, and achievement against them relies greatly on sustained improvements to recruitment over several years. Significant resources – and continuing investment – have been given to SKE courses, as teacher recruitment in these subject areas remains challenging.

3.2.2 The quality of teaching

Ofsted, in *Success in Science* from 2008, suggested that the quality of science teaching is related to teachers’ initial qualifications. The report supported a fundamental proposition upon which SKE was introduced: that effective teaching (particularly in scientific subjects) comes from a combination of expertise in approaches to teaching and learning, *and* strong subject knowledge.

The publication of the Schools White Paper, *The Importance of Teaching*, in November 2010 saw the first clear statement of intent from the coalition Government that the focus for education policy and teacher training would be to improve the quality of teaching, raise standards and support the autonomy of schools. All of this was based firmly on a ‘*vision of the teacher as society’s most valuable asset*’⁷. It led the Government to set out five action points related directly to teaching and leadership in schools (see Table 1).

⁷DfE (2010), *The Importance of Teaching: The Schools White Paper 2010*

Table 1 The Importance of Teaching: DfE action points (2010)

Improving Quality	<ul style="list-style-type: none"> ✓ Aiming to raise standards of new entrants into teaching by changing eligibility criteria so that only those with a minimum degree classification of 2:2 can receive DfE funding for initial teacher training; ✓ The expansion of 'Teach First' and development of 'Teach Next' courses ✓ Introducing financial incentives for graduates from shortage subjects ✓ Enabling 'talented' career changers to become teachers more easily
Reforming Initial Teacher Training	<ul style="list-style-type: none"> ✓ Embedding more classroom time into initial teacher training to support the development of practical teaching skills ✓ This will particularly focus on teaching mathematics, reading and behavioural management techniques
Introducing Teaching Schools	<ul style="list-style-type: none"> ✓ A national network of these to be set up (akin to teaching hospitals), to lead training/CPD for teachers and headteachers ✓ Work to increase the number of National and Local Leaders of Education (headteachers of excellently performing schools who commit resources to supporting other schools)
Reducing Bureaucracy	<ul style="list-style-type: none"> ✓ Minimising the amount of administration, processes, guidance and requirements placed upon schools to free up time and resources for the children and young people in their care
Emphasising pastoral care	<ul style="list-style-type: none"> ✓ Recognising and promoting the links between mental and physical health, safety and educational achievement ✓ Ensuring schools are able to offer additional support to those pupils who may require it

(Source: DfE,2010)

The focus on quality and reform of ITT required close attention in terms of the continuing development and demand for SKE provision, since these criteria linked into on-going debates over pedagogy, teacher training, and the need for both classroom experience and subject knowledge.

From the action points, it was clear that deep subject knowledge had taken precedence in the coalition Government's vision of teaching, particularly with the introduction of incentives for attracting the 'best' graduates, further emphasised with a move towards practical school-based training in priority subjects.

3.2.3 The importance of subject knowledge

The importance of subject knowledge has been an area for much debate within educational circles. The 1944 Education Act, which introduced grammar schools, put subject knowledge at the centre of the skills required to be a teacher. However, with the advent of the National Curriculum, less flexibility was permitted in curriculum content, and so the processes and guidelines involved in teaching came to the forefront during the training of new recruits. However in recent years, and particularly for those across the science community, the importance of fostering the knowledge and skills of the science teaching workforce has become a topic of renewed discussion.

Ofsted, in its report on *Success in Science*, examined the strengths and weaknesses of science education between 2004 and 2007. The report found that, in most cases, teachers:

'were working outside their own science specialisms...A teacher's own lack of understanding in the area of science to be taught can lead them to operate in 'safe' mode. This involves telling pupils facts, requiring them to copy notes and avoiding activities that would require discussion and the possible revelation of their own lack of understanding' (Ofsted, 2008)⁸.

Ofsted went on to assert that *'subject knowledge alone is not a measure of effective teaching'*, but that it does – when combined with effective teaching practices – *'make a major contribution to raising pupils' achievements'*. This brought to the fore a point raised, again by Ofsted, back in 2002 that despite the importance of teachers having a solid grounding in their chosen subject, trainees (primary level science) were not always identifying gaps in knowledge and, where they were, schools could find it difficult to address these gaps whilst also taking responsibility for the development of planning, teaching and assessment skills⁹. The links between knowledge and pedagogical practice was again confirmed during Ofsted's survey of post-16 science¹⁰, which found 'effective' teaching in science to be carried out by those teachers:

- Regarded as subject specialists.
- Able to confidently engage learners in discussions and debates about science.
- Competent in using practical investigations to apply and reinforce theoretical knowledge and learning.

⁸Ofsted (2008), *Success in Science*

⁹Ofsted (2002), *Science in Primary Initial Teacher Training*

¹⁰Ofsted (2007), *Identifying good practice: a survey of post-16 science in colleges and schools*

Such 'effective' teaching practices required appropriate subject knowledge that meant teachers were not relying on textbooks and other external materials to fill gaps in understanding; nor were they avoiding debate with and among young learners about areas of the curriculum because they themselves did not feel confident in their own grasp of a subject area.

Developments such as SKE pre-ITT courses and CPD for existing teachers address these issues by placing subject knowledge at the centre of effective teaching, and support for such programmes for science teachers is clear. For example, in its response to the Government's consultation on teacher training reform, SCORE recently proposed that SKE courses specifically should become a required element of teacher training¹¹. In this way, an entrance test for ITT focused on 'school appropriate knowledge' would be a more 'direct measure' of subject knowledge, even than the degree class achieved by the candidate during their own study of the subject:

'SCORE recommends that the Department explores the use of subject-specific tests for initial teacher trainees. These tests could lend confidence that trainees/teachers have a sufficient breadth and depth of knowledge and understanding of their discipline. The Department should consider whether such tests could be introduced either for applicants to initial teacher training courses in the sciences or as part of the conditions satisfying the awarding of qualified teacher status or both. It should be possible for graduates to attend a subject knowledge enhancement (SKE) course before taking (or retaking) an entrance test. Such tests are being developed and trialled by the Institute of Physics and Royal Society of Chemistry with support from the Gatsby Charitable Foundation and all SCORE member organisations would welcome the opportunity to discuss the potential of such tests with the Department.' (SCORE, 2011)

This response was supported by the publication of SCORE's own briefing paper on *Subject Specialist Teaching in Science*¹², which went into greater detail regarding the need for defined measurements of what constitutes 'specialism', and how far this impacts on the experiences and aspirations of young people and their attitudes towards science. In short, SCORE outlined a need to make distinctions between 'subject specialism' and 'teaching expertise'. This was emphasised by the Campaign for Science and Engineering in the UK (CaSE) which also highlighted that schools not only need to 'teach the concepts and details of science and maths', but that they also need to 'inspire more of

¹¹SCORE (2011), *Training our next generation of outstanding teachers: An improvement strategy for discussion – A SCORE response*

¹²SCORE (2011), *Subject Specialist Teaching in The Sciences: Definitions, Targets and Data*

the next generation to realise that these subjects provide the basis for stimulating and highly important further study and careers'¹³.

This would then allow, SCORE argued, to create more flexibility in the subjects taught by new recruits – for example, greater recognition that due to the implications of 'specialist' subject knowledge, a physics graduate should be able to train to teach physics and *mathematics*, rather than just 'science'¹⁴. In this way, development of subject knowledge can potentially enhance the delivery of a wider range of curriculum areas.

3.3 SKE courses

SKE courses:

- Are intensive pre-ITT programmes specifically developed for graduates with some previous knowledge of the subject area who need to develop the depth of their understanding.
- Are undertaken by individuals prior to proceeding onto a PGCE or for Qualified Teacher Status (QTS).
- Enable those whose first degree was not focused on mathematics, physics or chemistry to train as a specialist teacher in one of these areas.
- Focus on building and improving knowledge acquired by candidates at A-level, as part of a degree, or through occupational experience, in order to reach sufficient depth and breadth of subject knowledge appropriate for teaching secondary pupils.
- Have been designed to allow flexibility for both the course providers and trainees in terms of addressing individual needs in subject knowledge training.
- Are not intended to include significant in-school experience, but are designed instead to focus on subject knowledge.

The range of SKE courses currently searchable via the Teaching Agency website focus on the priority subject areas of **chemistry**, **mathematics** and **physics**. Courses are however also still available via some providers in subjects such as Design and Technology, Music, ICT, Modern Foreign Languages and Religious Education.

Duration of long courses varies depending on the discipline and requirement but typically ranges from sixteen to 36 weeks. For people who have already applied for or started their ITT, but need to improve specific aspects of their subject knowledge, there are short SKE courses which can last from two to twelve weeks.

¹³CaSE (2011), Letter to Michael Gove, 14.02.2011: <http://sciencecampaign.org.uk/?p=2829>

¹⁴SCORE (2011), *Subject Specialist Teaching in The Sciences: Definitions, Targets and Data*

3.3.1 Number of SKE trainees

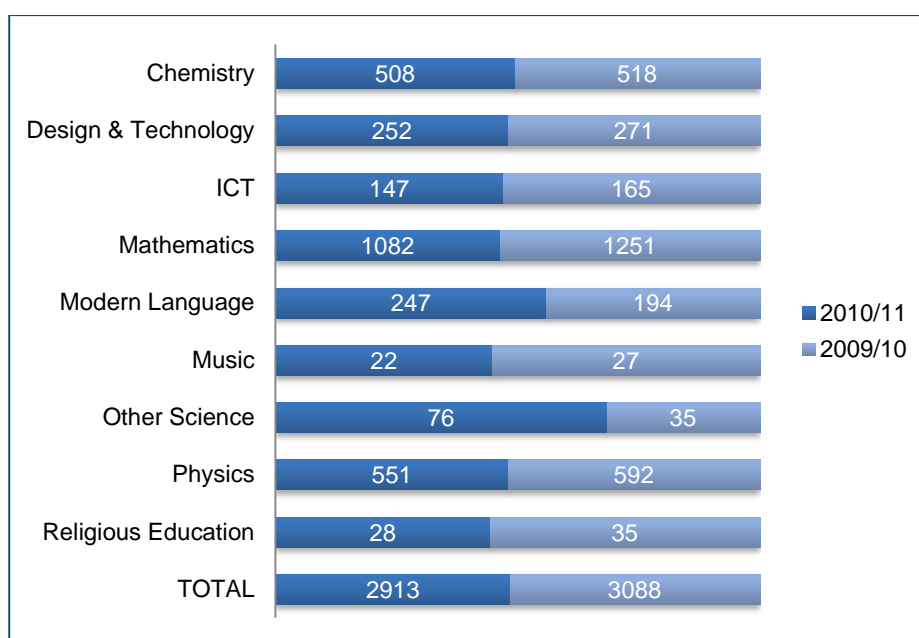
In academic year 2010/2011, there were 2,913 registrations onto SKE courses and a comparable number (3,088) previously in 2009/2010¹⁵.

Looking at data currently available, 57 providers are delivering SKE courses to trainees. Whilst some offer courses in one subject only, most have a combination of courses on offer, with the vast majority of registrations in 2010/11 related to training for:

- Mathematics (37.1%)
- Physics (18.9%), or
- Chemistry (17.4%)

Figure 1 shows the number of registrations in the last two years by subject¹⁶.

Figure 1 Number of SKE registrations by subject – 2009/10 and 2010/11



(Source: Teaching Agency data)

The demographic of individuals registering for SKE courses has remained fairly static across the last two years in terms of disability, ethnicity, gender and age (where known). The figures for each are given in the table below, showing the only notable change is the proportion of mature students down by 3 percentage points in 2010/11.

¹⁵ Data supplied by the Teaching Agency

¹⁶ NB: all data is based on the number of registrations as provided by the Teaching Agency. However it should be noted that in 2010/11, 698 registrations withdrew the course and in 2009/10, 1,055 registrations are recorded as having withdrawn from the course.

Table 1 Demographic of student registrations – 2009/10 and 2010/11

	2010/11	2009/10
Gender	Male: 1242 (42.6%) Female: 1671 (57.4%)	Male: 1304 (42.2%) Female: 1784 (57.8%)
Disability	183 (6.3%)	193 (6.2%)
Ethnic minority	609 (20.9%)	597 (19.3%)
Mature students	1857 (63.7%)	2044 (66.2%)

(Source: Teaching Agency data)

Data on trainee progression routes (e.g. from SKE onto PGCE courses) is not available, and data for recruitment to ITT for 2012/2013 has not yet been published.

3.3.2 Initial Teacher Training: recruitment allocations and funding

In terms of ITT recruitment during 2011/12, the importance of science and mathematics teaching was emphasised with a total of 5,470 allocations making up nearly 16% of all teacher training places, the highest proportion across all subjects.

Table 2 Allocation of teacher training places by subject, 2011/12

Subject	Place allocation (2011/12)
Total	34,825
Total Primary	19,730
Total Secondary	14,555
Mathematics	2,635
English and Drama	2,100
Total Science	2,835
Chemistry	1,070
Physics	925
Biology and General Science	840
Modern and Ancient Languages	1,490
Total Technology	1,880
Design Technology	840
Information Technology	805
Business Studies	235
History	545
Geography	615
Physical Education	890
Art	320
Music	390
Religious Education	460
Social Studies/Citizenship	185
Other	210

Source: DfE letter to former TDA, January 2011

Bursary funding criteria have, however, recently changed to reflect the most up-to-date government priorities. In 2011/12, the distribution of bursaries came with the emphasis

that investment was being ‘rigorously’ targeted where it was most required – i.e. across STEM subjects, and modern foreign languages, in an attempt to attract high quality graduates into profession. Funding levels were as follows:

Table 3 Bursary funding for ITT 2011/12

Subject	Bursary amount offered
Physics Chemistry Engineering Mathematics	£9,000
Biology Combined/general science Modern foreign languages	£6,000

Source: DfE letter to former TDA, January 2011

However, the structures for funding have now been altered further (see Table 5):

“The priorities for recruitment to ITT courses continue to focus on subjects that are difficult to recruit to. This year those subjects include Mathematics, Physics, Chemistry, and Modern Foreign Languages. Added to this and in line with recent government announcements in the ITT strategy implementation plan, recruitment activities are focussing on increasing the degree quality of successful applicants to ITT. The bursaries available for trainees starting in September 2012 are again in line with these priorities” (TA JMC Update, February 2012)

Table 4 ITT bursary priorities for 2012/2013

		Physics, mathematics, chemistry, modern languages	Other priority secondary specialisms and primary	General science and non-priority secondary specialisms
Training bursary 2012/13	Trainee with first	£20,000 ¹⁷	£9000	£0
	2.1	£15,000	£5000	
	2.2	£12,000	£0	

Unlike in previous years, there are also now DfE targets set for ITT recruitment in the separate disciplines (except biology), rather than just for “Science” overall.

Encouragingly, indications show that targets in general science are now being surpassed, although the number of registrations onto physics and mathematics ITT remains below target by 9% and 1% respectively in 2011/2012.

Table 5 Science and mathematics ITT registrations against DfE targets - 2011/2012

	Mainstream & EBITT Registrations 2011/12	Predicted outcomes by July 2012	2011/12 DfE Target	Predicted contribution to DfE target as at 31/07/12 (%)
Science (total)	3159	2687	2100	121%
General science	347	3240	2835	111%
Biology	696	696	n/a	n/a
Chemistry	1272	1305	1070	119%
Physics	844	864	925	91%
Mathematics	2615	2687	2635	99%

(Source: TDA data February 2012)

¹⁷ Alongside ITT bursaries, teacher training scholarships to the value of £20,000 are also available for Physics teaching (offered by Institute of Physics from 2012/12) and Chemistry (offered by Institute of Chemistry from 2013/14). The number of scholarships available is limited: 100 from Institute of Physics and approximately 130 from Institute of Chemistry. To be eligible, candidates for the scholarships will have to demonstrate excellent subject knowledge (generally a 2:1 or first class degree). For further details, see: www.iop.org/news/11/nov/page_52700.html, or www.education.gov.uk/inthenews/inthenews/a00214709/new-scholarships-for-top-chemistry-grads-to-teach

Initial data for 2012/2013 suggests an improvement in physics, which is below target by just 3%. Achievement in chemistry is above target and 5% below target in mathematics (slightly more than was predicted in July 2012).

Table 6 Science and mathematics ITT recruitment against DfE targets - 2012/2013

	Recruitment numbers for 2012/2013	2011/12 DfE Target	Achievement to DfE target as at November 2012 (%)
Biology and general science	850	840	101%
Chemistry	1170	1070	109%
Physics	900	925	97%
Mathematics	2500	2635	95%

(Source: TA, Initial teacher training census 2012 summary)

In line with government priorities, the DfE has changed the way it sets targets to focus on the number of postgraduate trainees recruited with a 2:1 or above. These targets were published at the end of September 2012 and come into effect for entry to ITT in academic year 2013/2014. Targets for the recruitment to teacher training of high quality postgraduates in science and mathematics are as follows¹⁸:

- Mathematics: 1,480
- Chemistry: 535
- Physics: 555
- Biology: 360

The recruitment figures outlined in the table above are likely to be at least in part attributable to the packages of additional support being offered to trainee teachers in science and mathematics, such as the Premier Plus service and Schools Experience Programme (see section 3.4.2 on 'additional support'). Since the Physics with Mathematics scheme (see 3.4.2) recognises the synergies between the two subjects, this may help to boost the lower recruitment figures currently being achieved in these disciplines.

3.4 Updates for 2012

A large number of policy changes were included in the last literature review, so this final summary provides an update on other research findings which may provide insight for the support and development of SKE/pre-ITT courses beyond this evaluation.

¹⁸ www.education.gov.uk/schools/careers/traininganddevelopment/initial/a00214696/teacher-training-recruitment-targets

3.4.1 Teachers' Standards

The new Teachers' Standards came into effect from September 2012, replacing the Standards for Qualified Teacher Status (QTS) and the Core Professional Standards for teachers. The new Standards apply to all levels of the teaching workforce and performance and conduct will be assessed against the Standards through school appraisals. The Standards come in two parts: Part 1, Standards for Teaching and Part 2, Standards for Personal and Professional Conduct.¹⁹

The Standards for Teaching expect members of the teaching workforce to:

1. Set high expectations to inspire, motivate and challenge
2. Promote good progress and outcomes
3. Demonstrate good subject/curriculum knowledge
4. Plan and teach well-structured lessons
5. Respond to strengths and needs of all pupils
6. Make accurate and productive use of assessment
7. Manage pupil behaviour to create a good and safe learning environment
8. Fulfil wider professional responsibilities

Most pertinently for SKE provision, the third Standard regarding knowledge of subject and curriculum areas includes the specific requirement that:

Teachers must engage in continuing professional development (CPD), and demonstrate 'strong subject knowledge' that reflects a 'critical understanding of the developments in subject and curriculum areas'.

A specific reference to teaching early mathematics sets out that teachers must demonstrate 'understanding of appropriate teaching strategies' for these concepts. There are also clauses outlining the expectation that teachers will work towards 'improve teaching' itself, taking advice and feedback from colleagues, and working with other members of the workforce to ensure 'specialist support' is drawn upon where required and 'appropriate professional development' is undertaken.

Part 2 of the Standards, those for Personal and Professional Conduct, provides a definition of the behaviour and attitudes via a series of short statements that require teachers to uphold trust in the profession and maintain high standards of ethics and behaviour, within and outside schools²⁰. This covers being expected to:

- Treat pupils with dignity, with relationships based on mutual respect and observing appropriate boundaries.
- Have regard for the need to safeguard pupils' well-being.

¹⁹ A short summary of the Standards is provided but the full document can be obtained here: www.education.gov.uk/publications/eOrderingDownload/teachers%20standards.pdf

²⁰ DfE (2012), *Teachers' Standards*, p.10

- Show tolerance and respect for the rights of others.
- Uphold ‘fundamental British values’²¹.
- Ensure expression of personal beliefs does not exploit pupils’ vulnerability.

In terms of professional conduct, the Standards also outline requirements for teachers to respect and abide by the ‘ethos, policies and practices’ of the school in which they teach, including high levels of attendance and punctuality. They should also always act within the statutory frameworks that set out their ‘professional duties and responsibilities’²².

This second element to the Standards is significant given that alongside these steps are being taken not just to ensure professional teaching conduct but also to tackle poor behaviour across all school provision, with a call for teachers to be trained in adequate behaviour management techniques coming from the government’s behaviour tsar²³. Currently, student teachers cannot do work-based training, teaching practice, acquire QTS or work as an NQT in alternative provision such as Pupil Referral Units (PRUs). The recent report on *Improving Alternative Provision* has recommended changes to these rules: emerging actions will need to be monitored in order to ensure any implications for SKE are considered (i.e. teaching priority subjects in alternative settings)²⁴.

3.4.2 Additional support for science and mathematics teachers

In order to attract high quality graduates into teaching across all subjects, there have been recent expansions of School-Centred ITT (SCITT), and Teach First²⁵. In addition, the School Direct Training programme has been expanded to replace the Graduate Teacher programme (GTP), which will close. School Direct enables graduates (including those with three or more years’ career experience) to carry out their teacher training within schools. This scheme also provides more control to schools in terms of deciding the subjects in which they require trainee teachers, recruiting trainees and planning how their training will be carried out (this may be within one school or shared with other institutions). There is a commitment that the schools will employ the recruits as unqualified teachers for the duration of their training²⁶. The Teaching Agency will prioritise requests according to subject. For 2013/2014 highest priority will be given to: physics, mathematics, chemistry and foreign language teacher training²⁷.

²¹ These include democracy, the rule of law, individual liberty, mutual respect and tolerance for different faiths/beliefs – see *Teachers’ Standards*, p.5

²² DfE (2012), *Teachers’ Standards*, p.10

²³ See: www.bbc.co.uk/news/education-19048288

²⁴ Taylor, C (2012), *Improving Alternative Provision*, p.21

²⁵ See, for example: www.bbc.co.uk/news/education-18427512

²⁶ For further information on Schools Direct, see:

<http://www.education.gov.uk/schools/careers/traininganddevelopment/initial/b00205704/school-direct/schools>

²⁷ Teaching Agency (2012), *A guide to School Direct 2013-2014*, p.5

Despite these wider teacher recruitment programmes, science and mathematics remain high priority subjects for attracting recruits into ITT and apart from SKE, there are now three other schemes in place to support prospective mathematics and science trainee teachers:

1. Premier Plus.
2. Schools Experience Programme (SEP).
3. Physics with Mathematics.

These three schemes are summarised below.

Table 7 Support mechanisms/specialist routes available to ITT recruits in science and mathematics

Premier Plus	Schools Experience Programme (SEP)	Physics with Mathematics
<ul style="list-style-type: none"> • For prospective trainees in priority subjects including mathematics, physics, and chemistry • For recruits with a degree classification of 2:1 or higher • Intended to attract high achieving graduates by offering: one-to-one advice and guidance; access to SKE and the SEP; invites to attend exclusive events; regular news / advice / hints and links to resources; access to teaching advocates (experienced teachers able to answer questions/offer advice); Graduate Teacher Training Registry fee fully reimbursed 	<ul style="list-style-type: none"> • Offers classroom experience in a secondary school for up to 10 days • Available for those looking to teach priority subjects, including mathematics, physics, or chemistry • For recruits with a degree classification of 2:1 or higher • The first day involves the recruit observing teaching and pastoral activities, and being able to speak with teachers about the day-to-day job • Further days are focused on the teaching of the recruit's specialist subject, with practical activities (e.g. lesson planning, delivering part of a lesson, shadowing senior members of staff) 	<ul style="list-style-type: none"> • There is evidence that many science teachers would prefer to teach physics and mathematics • Furthermore, some mathematics teachers are supporting physics lessons in schools • Wider rollout therefore being planned, of the Physics with Mathematics PGCE programme to encourage potential teaching recruits to apply for training, and work across both disciplines • School training placements will provide teaching experience in both physics and mathematics

There have been over 3746 potential trainees engaged with **Premier Plus** and allocated to a Regional Advisor for 2011/12. Of these, 1000 had applied for and 793 had secured an ITT place.²⁸

For the **Schools Experience Programme** (2011/12), 518 schools were registered as willing to take part. Furthermore, the Teaching Information Line received 3044 requests from prospective ITT candidates wishing to go on the SEP.²⁹

The Teaching Agency census (November 2012) confirmed that 190 candidates had been recruited to **Physics with Mathematics** for academic year 2012/13. This was offered by 30 providers.³⁰

Although it is too early to suggest any direct impact on the supply and quality of teachers and improved pupil outcomes, there is evidence to suggest that such schemes could pay dividends, both for the teaching workforce and the pupils they work to inspire and motivate.

Despite a general increase in scientific interest within and across popular media (e.g. television documentaries from Professor Brian Cox), reports suggest that teacher support schemes have a lot to do with the sudden surge in pupil numbers. The Stimulating Physics Network (Institute of Physics) and Further Mathematics Support Programme (Mathematics in Education and Industry) are funded by the DfE and enable experienced teachers to pass on their knowledge and skills to other members of the workforce who are not specialists in physics or further mathematics and could therefore benefit from the 'booster' workshops and tutorials provided. Data released by the Institute of Physics for example, shows a 30% increase in the number of students taking up AS Physics over the past twelve months in the schools involved in the Stimulating Physics scheme³¹.

Nationally, there has been a slight rise in the proportion of GCSEs sat in England covering the separate science disciplines, most markedly in chemistry. The 'generalist science' GCSE has seen a clear increase. The proportion of mathematics GCSEs has however seen a fairly significant drop from just over 15% to less than 13%.

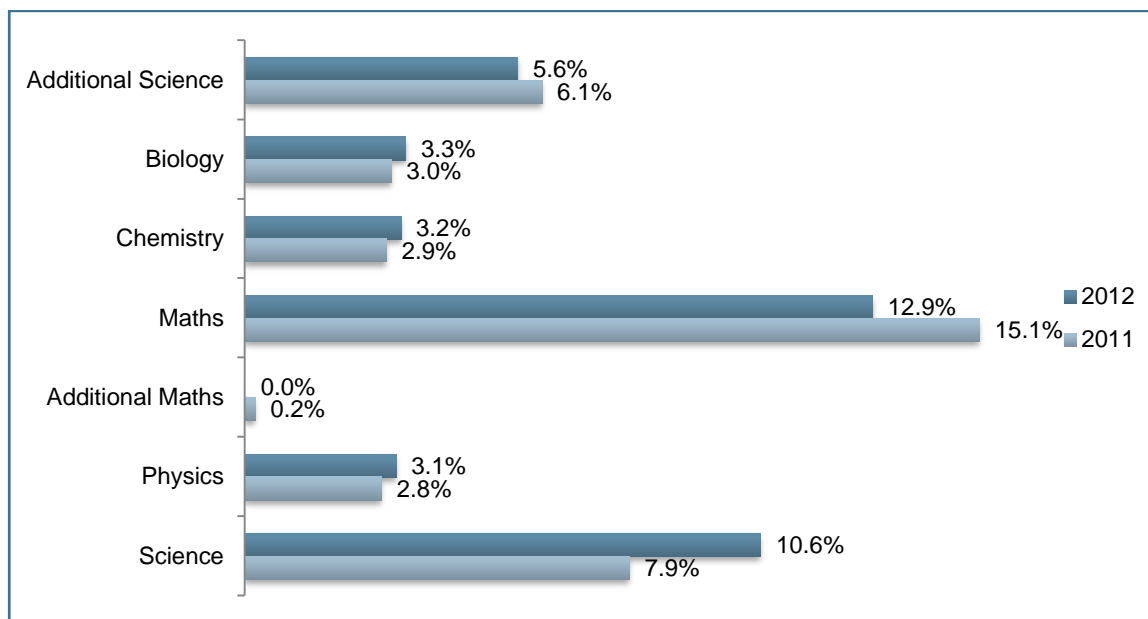
²⁸ Teaching Agency 2013, unpublished registration data.

²⁹ Teaching Agency 2013, unpublished registration data.

³⁰ Teaching Agency Census, November 2012.

³¹ See, for example, Institute of Physics: www.iop.org/news/12/aug/page_56802.html

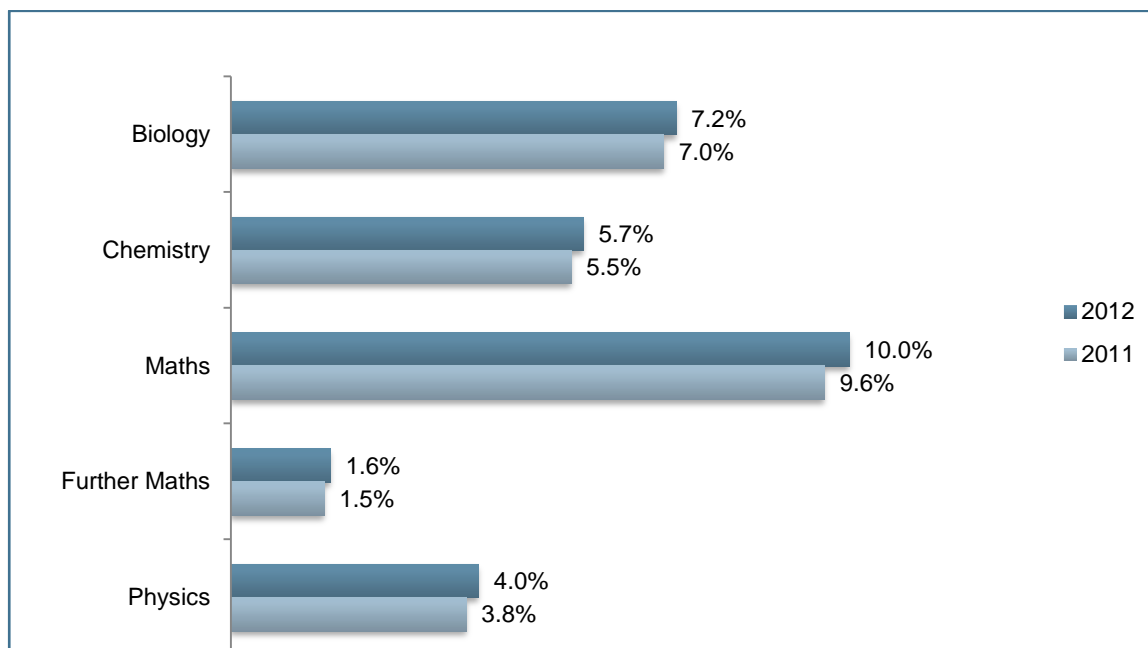
Figure 2 Science and mathematics subjects as a proportion of all GCSEs sat in England (2011-2012)



(Source: JCQ data)

The numbers of pupils taking science and mathematics at A-level has nonetheless risen for the last two years, showing an increasing trend for studying these subjects to higher levels.

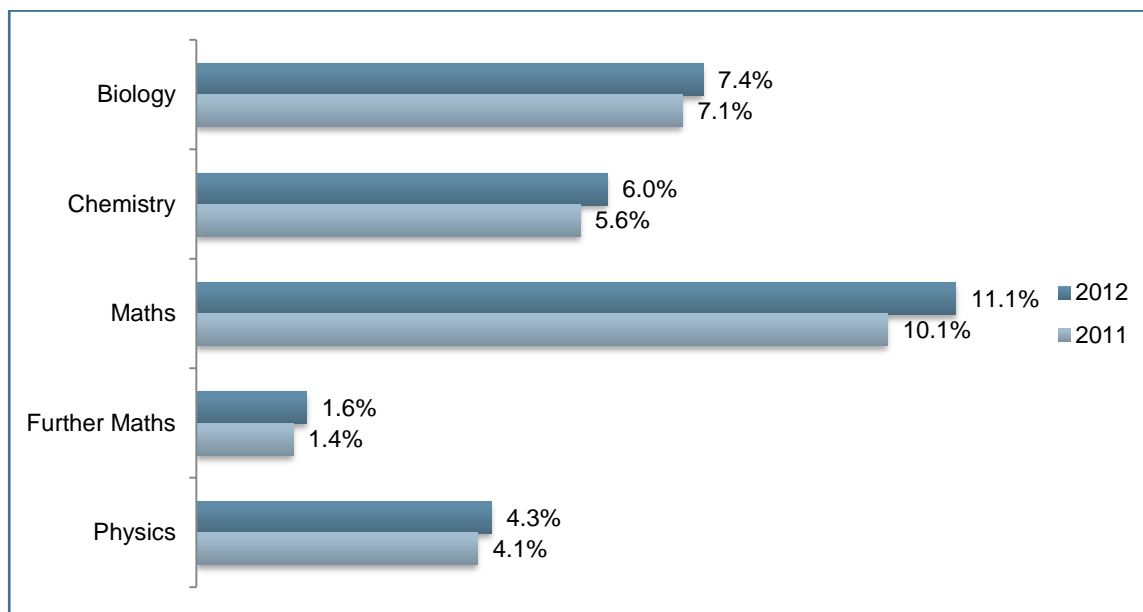
Figure 3 Science and mathematics subjects as a proportion of all A level examinations sat in England (2011-2012)



(Source: JCQ data)

The rising interest in mathematics and science is not just for full A levels. Across both A level (Figure 3) and AS level (Figure 4), there has been an increase in every science and mathematics discipline in relation to their proportion of the exams sat in England between 2010/11 and 2011/12.

Figure 4 Science and mathematics subjects as a proportion of all AS level examinations sat in England (2011-2012)



(Source: JCQ data)

To help support this increasing interest in science and mathematics subjects, anecdotal evidence suggests that fully qualified teachers also really appreciate the opportunities to share good practice and subject knowledge. For example, over this summer holiday (2012), science teachers networking with each other on the social media site Twitter arranged to meet together at the University of York to share ideas, resources, swap useful links and answer one another's questions. As one attendee reported: 'We took away new ideas, felt freshly enthused (just in time for September) and had reinforced professional relationships and friendships'³².

Although these courses and meetings have been designed for those already practicing in the teaching profession, pre-ITT subject knowledge courses have the potential to develop a similar outlook among those new into the profession.

³² See: www.guardian.co.uk/teacher-network/2012/aug/31/science-teacher-twitter-meeting

3.4.3 Wider research on SKE courses

Additional evaluative research into SKE has been undertaken with regards both mathematics and science and a summary of findings is presented below.

Mathematics Enhancement Course – University of London

Between 2008 and 2011, some small-scale evaluative research has been undertaken on the impact of pre-ITT development courses, specifically focusing on the ‘beliefs’ and ‘belief statements’ of those participating in what is called the Mathematics Enhancement Course (MEC), which is an SKE course delivered by the University of London. It is a six-month (24 week) programme offered to graduates without a mathematics degree but wishing to teach mathematics at secondary school level. The aim of the course is to ‘develop Pedagogical Content Knowledge...through a focus on Subject Matter Knowledge’³³.

- **Research question: Does participation in a mathematics SKE course prior to ITT change the beliefs of students in terms of how mathematics should be taught?**

Although changes in how SKE participants believe mathematics should be taught are only based on a small number of participants in the study over two years (20), there is indication that changes do take place among trainees over the course of SKE and these are towards a less didactic approach to teaching mathematics. As much as participants in the study suggested that text-book based exams were a necessary component to the subject, they also saw the potential for introducing more activities such as group work, collaborative projects and interactive discussions/teaching practices, so that concepts taught are applied in a more practical context³⁴.

- **Research question: How is ‘understanding mathematics in depth’ understood and interpreted by SKE students?**

The intention of the MEC course was that students understand mathematics ‘in-depth’ by the end of training and prior to teacher training. Eighteen interviews were conducted with trainees to investigate how they interpreted the concept of ‘in-depth’ mathematical knowledge. Results showed that ‘in-depth’ was generally interpreted to mean that not only would trainees know a ‘fact’ such as a mathematical formula, they would also know why and in what situations/contexts that formula could be usefully and practically applied. Learning methods of how to ‘engage with mathematics in extended ways’, and learning SKE content in a way that also helped trainees develop their own teaching practices (e.g.

³³ Clarke, J. (2011), 'Changes in the 'beliefs' of pre-ITE maths students on a 24-week Subject Knowledge Enhancement Course' in *Research in Secondary Teacher Education: A Periodical from the Cass School of Education*, Vol.1, No.1. April 2011, p.3

³⁴ Clarke, J. (2011), 'Changes in the 'beliefs' of pre-ITE maths students on a 24-week Subject Knowledge Enhancement Course' in *Research in Secondary Teacher Education: A Periodical from the Cass School of Education*, Vol.1, No.1. April 2011, p.6

peer/group activities) were also appreciated by trainees³⁵. These combined features of the mathematics SKE at University of London (applied learning of the subject alongside practical development of teaching skills) encouraged participants to feel they would have a 'leg-up in the PGCE'³⁶.

Acquisition of Science Subject Knowledge – Wellcome Trust

A study for the Wellcome Trust carried out by the University of Birmingham in late 2011 examined the acquisition of science subject knowledge and 'topic specific pedagogy by trainee science teachers'³⁷. The study looked at the qualifications of trainees and their intentions for higher education, the extent to which subject knowledge was addressed in one-year science ITT courses, the way in which trainees acquire and use subject knowledge/topic specific pedagogy and the extent to which subject specific areas of ITT courses address the perceived needs of the NQT year.

In terms of findings related to SKE specifically³⁸:

- SKE courses were perceived by trainees as being most useful where they were led by ITT staff, rather than academics within science departments.
- It was thought unrealistic to expect trainees to acquire all subject knowledge required, and subject specific pedagogy during one-year ITT courses, thereby supporting the case for attending an SKE course prior to ITT.
- Subject knowledge was most gained by SKEs through reference to material resources (and human resources for science-related pedagogy).
- During NQT, physics topics were a high priority when attending continued professional development courses.

3.5 Summary and conclusions

- There remains a chronic shortage of teachers in chemistry, mathematics and physics.
- SKE courses are part of a wider strategy to address this shortfall by offering the opportunity for candidates to develop their own knowledge and understanding prior to Initial Teacher Training.
- SKE courses, by their nature, focus on subject knowledge rather than teaching practice or processes. They attempt to ensure knowledge is appropriate, in terms of depth and breadth, to that required for teaching at secondary level.

³⁵ Adler, J., Hossain, S., Clarke, J., Stevenson, M., Grantham, B., Archer, R. (2009), 'Interpretations of, and orientations to, "understanding mathematics in depth": students in MEC programmes across institutions 'in Informal Proceedings of the British Society for Research into Learning Mathematics (BSRLM) Vol. 29 No. 3, November 2009, p.5

³⁶ Ibid., p.6

³⁷ Wellcome Trust (2011), Acquisition of Science Subject Knowledge and Pedagogy in Initial Teacher Training

³⁸ Ibid.

- In a series of reports over the last decade, NFER and Ofsted have reiterated the significance of retaining an appropriate balance between the scientific knowledge of a teacher, and their ability to impart that knowledge effectively as a teacher.
- Depending on a candidate's abilities, SKE courses last from 2 to 36 weeks prior to ITT, with recruitment figures remaining fairly steady with well over 2,000 candidates taking SKE in chemistry, mathematics and physics in 2010/2011 alone.
- Recruitment to ITT has surpassed targets set by the DfE in general sciences and chemistry, and is only just below target in mathematics and physics by 5% and 3% respectively.
- Teacher training bursaries now prioritise funding for high achieving graduates in priority subjects – chemistry, mathematics, physics and modern foreign languages.
- Members of the wider scientific community (e.g. SCORE) have acknowledged the potential of SKE courses to enable a more defined measurement of subject 'specialism' to come about, and have recommended SKE to become a mandatory requirement in assessing a candidate's ability pre- and/or post- ITT.
- Changes since the last literature review have seen the Teachers' Standards coming into effect, with specific criteria covering high quality subject and curriculum knowledge among members of the teaching workforce and appropriate professional development. The second part of the Standard sets out the levels of Professional Conduct to which teachers are expected to adhere.
- Additional support for trainee teachers (or prospective trainee teachers) in priority subjects of chemistry, mathematics, physics and modern foreign language now includes the Premier Plus service and the School Experience Programme. All of these support mechanisms have proved extremely popular in the first few months of their rollout.
- There is evidence to suggest that support mechanisms are beneficial not just for ITT recruits, but also for fully qualified teachers looking to enhance subject knowledge and share good practice.
- The results of small-scale wider research into the impact of SKE courses suggests that the courses do not just help develop subject knowledge, but also motivate trainee teachers to think more broadly about teaching practices (e.g. developing group work techniques), as well as learning how to apply subject knowledge to practical activities/concepts.
- Wider research for the Wellcome Trust suggests that one-year ITT courses in science do not provide adequate subject knowledge preparation, supporting the need for trainees to attend SKE courses. Those SKE courses attended by science trainees and led by ITT tutors rather than science academics were particularly appreciated. Nonetheless, physics knowledge remains a subject which teachers in their NQT year regard as a high priority for continuing professional development.

4. Methodology

The evaluation ran for three years and encompassed a literature review - updated each year, several annual surveys, telephone interviews with a range of respondents and case study interviews to track SKE students through their SKE course, teacher training and into their Newly Qualified Teacher (NQT) year.

4.1 Document review

In the first year of the evaluation, a comprehensive literature review relating to development and intended outcomes of the SKE course and policy drivers, was undertaken. The review aimed to provide the background context to the report:

- Identify key messages to inform evaluation criteria and the primary research.
- Ensure an understanding of the policy context and issues.
- Ensure the evaluation builds on existing knowledge and lessons.

A range of documents, reports, data and materials were reviewed from sources such as the Department for Education (DfE), the Teaching Agency, Ofsted, HM Treasury and research agencies. The findings of this review were summarised in the 2009/10 Annual report³⁹, providing information in relation to the wider policy context and background details across the themes of the evaluation. This document review was updated for the second annual report⁴⁰ to ensure that key changes in the policy and developments in the SKE course landscape were acknowledged.

This report provides a further updated version of the document review and includes:

- The wider policy context and an overview of relevant policy from 2006 to 2012, including the introduction of SKE courses and the importance of subject knowledge.
- Detail on SKE courses, numbers and profiles of trainees.
- Initial Teacher Training (ITT) recruitment, allocations and funding.
- 2012 updates such as new teacher standards and additional support for science and mathematics teachers.
- Insights from wider researcher on SKE courses.

The updated document review for 2011/12 is presented in chapter 3.

4.2 Student data

To collate perceptions and experiences of SKE students, a series of surveys were administered along with in-depth telephone interviews. It should be noted that for some surveys (particularly the End of Course survey) there were low responses and

³⁹ Training and Development Agency for Schools (2010) *Evaluation of Subject Knowledge Enhancement Courses Year 1 Annual Report – 2009/10*. Prepared by LSN.

⁴⁰ Training and Development Agency for Schools (2011) *Evaluation of Subject Knowledge Enhancement Courses Year 2 Annual Report – 2010/11*. Prepared by LSN.

therefore, when analysis is conducted across variables, conclusions drawn in relation to these should be treated with caution. Where data are presented in relation to different variables (e.g. SKE subject), key findings are presented and some data may be omitted from tables or figures (e.g. percentage of respondents who selected 'other' in response to a survey question). For further details of the data, refer to the accompanying technical report which provides the annual survey findings.

4.2.1 Beginning of SKE course survey and interviews

Each year of the evaluation has included an online survey of SKE students at the beginning of their SKE course to establish baseline data and identify key characteristics of SKE trainees.

The Beginning of Course survey aimed to explore:

- Profiles of SKE students including demographics, type of course and place of study.
- Previous experience/background and qualifications.
- Perceptions of and confidence in subject knowledge.
- Motivations for entering the teaching profession and reasons for choosing to teach their subject.
- Expectations of the course.
- Future career plans and aspirations.

The survey was administered through specialist survey software which generated a URL link to an online survey. This was disseminated to SKE students via institutions providing SKE courses. In previous years, the Beginning of Course survey was run twice to fit with timings of courses and different start dates. In the third and final year of the evaluation, due to changes in evaluation suppliers and timing issues, the Beginning of Course survey was administered only once from October to December 2011. As a consequence, response to this survey was lower than in previous years with 159 respondents from 19 institutions. Analysis of the survey data is provided in the accompanying Technical Report for 2011/12 and is summarised according to key evaluation criteria in this report.

Follow-up telephone interviews were conducted with 18 SKE students who participated in the survey. The interviews provided further insight into their experiences, confidence in their subject, and their motivations and aspirations. Qualitative data from the interviews have been analysed and findings are presented within this report according to the evaluation themes.

4.2.2 End of SKE course survey and interviews

Similar to years one and two of the evaluation, a survey was distributed to SKE students at the end of their course. This survey was designed to assess their experience of the course and perceptions in changes of their subject knowledge:

- Profiles of SKE students including demographics, type of course and place of study.
- Levels of subject knowledge and changes in this.
- Advantages and disadvantages of the course.
- Satisfaction levels.
- Perceptions on course content.
- Barriers to completing the course.
- Expectations for the PGCE course and preparation for teacher training
- Future career plans and aspirations.

The survey was designed, administered and analysed using similar approaches to the Beginning of Course survey. It was live from May to August 2012 and achieved 435 responses from 39 institutions delivering SKE courses.

The follow-up telephone interviews were carried out with 16 SKE students to collate evidence around overall experiences and how effective they felt it had been in developing their subject knowledge in preparation for their initial teacher training course. The interviews explored views and opinions of the SKE course, how effective the course had been in preparing trainees in their chosen subject and to specialise in teaching their subject in school and suggestions for improvements to the course.

4.2.3 Postgraduate Certificate in Education (PGCE) survey and interviews

The evaluation involves tracking changes in subject knowledge and confidence in specialist subjects through SKE and teacher training. As such, SKE cohorts from 2009/10 and 2010/11 were invited to take part in the surveys. For those in their teacher training year, an online survey was distributed via PGCE providers. The focus of this survey was to gather views from PGCE trainees, including those who had completed the SKE in the previous year and those who had not – traditional entry teacher trainees/subject graduates. It aimed to explore their views on the extent to which the trainees felt equipped to embark upon the PGCE course and:

- Profiles of PGCE students including demographics, type of course and place of study.
- Previous experience/background and qualifications.
- Motivations for entering the teaching profession and reasons for choosing to teach their subject.
- Levels of subject knowledge and changes in this.
- Comparison between SKE students and traditional entry teacher trainees.
- Perceptions on the SKE course content.
- Advantages and disadvantages of the SKE course.
- Impact of the course so far.
- Awareness of the SKE course.
- Future career plans and aspirations.

The PGCE survey ran between June and October 2012 and achieved 339 responses from 35 institutions. The final sample included 257 (76%) respondents who had previously completed an SKE course and 82 (24%) respondents who had not completed an SKE course. Analysis, therefore, focused on comparing respondents across these two cohorts in order to determine the impact the SKE course had on PGCE trainees.

A series of telephone interviews were held with 30 of the PGCE survey respondents, including 22 who had completed an SKE and 8 who had not. These explored motivations for choosing the SKE course and awareness of SKE courses, expectations of the course and levels of subject knowledge in relation to SKE/non SKE backgrounds, confidence to deliver the curriculum at different levels and differences between SKE students and traditional route teacher trainees.

4.2.4 Newly Qualified Teacher (NQT) survey and interviews

The final year of the evaluation included a survey of NQTs⁴¹ which focused further on the potential impact of SKE courses, it explored:

- Profiles of NQTs including demographics, subjects they were teaching and levels they were teaching to.
- Type of teaching role and school.
- Previous experience/background and qualifications.
- Type of SKE and PGCE course.
- Motivations for entering the teaching profession and reasons for choosing to teach their subject.
- Levels of subject knowledge and changes in this.
- Comparison between SKE students and traditional entry teacher trainees.
- Perceptions on the SKE course content.
- Advantages and disadvantages of the SKE course.
- Impact of the course on gaining employment, aspirations and performance as a teacher.
- Awareness of the SKE course.
- Future career plans and aspirations.

The NQT survey was administered through connections that PGCE course providers had maintained with previous SKE students. Some were able to forward the survey to their previous students, others used social media to contact them. The evaluation team also contacted those who we had details for from previous surveys and asked survey respondents to forward the survey details to their colleagues and contacts. The survey was live between July and October 2012, however, response was low even after considerable efforts had been made by the evaluation team to boost the

⁴¹ *The survey of NQTs is referred to as the NQT survey – this should not be confused with the annual national NQT survey conducted by the Teaching Agency.*

response rate. The survey achieved 206 responses representing 36 different higher education institutions.

Due to their being low response to the NQT survey, this had an impact on the number of in-depth interviews that could be completed with this cohort. Of a planned 40 interviews, 32 were completed with NQTs who had previously completed an SKE course.

The interviews were designed to focus on perceptions of how the SKE course had or had not impacted on performance in the PGCE and in the first year of teaching and how effective it had been in developing subject knowledge to a level that was deemed suitable.

4.2.5 SKE case studies

At the beginning of the evaluation, 20 SKE students agreed to participate in the case study research and therefore agreed to complete three telephone interviews over the course of their SKE and teacher training and early teaching careers. The aim of the case studies were to obtain crystallised evidence on trainees' perceptions of SKE training, and the extent to which the course has adequately prepared them for their PGCE and NQT in their respective subjects. The case studies allowed the evaluation team to track each student into their first year of teaching and to explore and understand their journey.

The first round of interviews was carried out with students in 2009/10 when they were studying an SKE course. This first round aimed to collect insight into the motivations for commencing teacher training, expectations for the SKE course, issues arising during their training, benefits and disadvantages, expectations for the PGCE course and future plans. The second round of interviews was carried out in June 2011 and the same students were contacted to gain in-depth insight into their situation now that they were undertaking a PGCE. Since the first round of interviews, three students dropped out for varying reasons including, that they no longer wanted to pursue a career in teaching or were no longer contactable. Three students studying similar subjects and at the same institutions as those who dropped out were recruited and extended interviews were carried out with them in order to collect data for the first and second round interviews. All of these students have been contacted and interviewed again in this third and final year (June 2012) with a focus on their experience of the NQT year, how the SKE course had contributed to and impacted on their teaching practice and performance, levels of subject knowledge and confidence to teach their subject.

The information gathered through these case studies has been analysed thematically following the evaluation criteria and used within this report. In addition, ten case studies have been developed, illustrating the experiences and journeys of SKE students over the last three years. These are presented in Appendix 1.

4.3 Tutor and colleague data

Forty in-depth interviews were also carried out during the third year of the evaluation with SKE tutors teaching SKE courses in chemistry, mathematics and physics. The interview schedule was designed to capture information particularly on:

- How SKE trainees were perceived by their tutors, their progression throughout the course and issues that had emerged in terms of training provision.
- How SKE candidates compare against traditional entry candidates.
- The balance of subject content in the course.
- Whether SKE courses equip trainees to become 'subject specialists'.
- Awareness and involvement of schools.
- The future of SKE courses, potential improvements and sustaining the supply and quality of teachers in specialist subjects.

In addition to interviewing NQTs, the final year of the evaluation included interviews with colleagues of NQTs. In total, 7 colleagues were interviewed, these were in roles such as Head of Department, Subject Mentor and Assistant Head Teacher. The interviews aimed to explore perspectives of those working alongside previous SKE students in terms of their awareness of SKE courses and perceived benefits, levels of subject knowledge, 'subject specialism' and differences between those who have competed and SKE course and traditional entry teacher trainees.

5. Profile of Participants

The third year of the evaluation collated responses from 1,139 survey respondents, 143 interviewees and 20 longitudinal case studies. A summary of the number of respondents over the three year evaluation is shown in the table below. Note that as the evaluation progressed through each year, targets for each data collection strand changed to allow a wider variety of respondents to be included towards the final year. Therefore, while some survey responses and number of interviews may have decreased towards year 3, others, such as tutors have increased and additional respondents have been included, such as NQTs and colleagues. This design allowed for an incremental approach to data collection where data and knowledge built along with the journey of SKE students through their SKE course, onto PGCE training and into their NQT year. Therefore, whilst the SKE surveys ran in each evaluation year, the PGCE survey was introduced in year 2 and the NQT survey⁴² in year 3.

Table 8 Overview of evaluation participants 2009-2012

Data collection strand	Year 1 (2009/10)	Year 2 (2010/11)	Year 3 (2011/12)
Beginning of Course survey	656	271	159
Beginning of Course interviews	50	23	18
End of Course survey	446	314	435
End of Course interviews	50	30	16
PGCE survey	-	442	339
PGCE interviews	-	50	30
NQT survey	-	-	206
NQT interviews	-	-	32
Tutor interviews	20	30	40
Colleague interviews	-	-	7
Case studies	20	20	20

5.1 Surveys

The sections below provide details of students responding to the four surveys in the third year of the evaluation, including demographics, study options, qualifications and

⁴² The survey of NQTs is referred to as the NQT survey – this should not be confused with the annual national NQT survey conducted by the Teaching Agency.

experience. The table below provides an overview of types of survey respondents, their main SKE subject area and the number of institutions each survey represented.

Table 9 Profile of survey respondents by SKE subject (2011/12)

Type of respondent	Chemistry	Mathematics	Physics	Total	Number of Institutions
Beginning of SKE Course	33	76	36	159 ¹	19
End of SKE Course	95	222	104	435 ²	39
PGCE	50	135	67	339 ³	35
NQT	18	118	51	206 ⁴	36

¹ BoC includes 13 'other' SKE subjects and 1 'no reply'

² EoC includes 14 'other' SKE subjects.

³ PGCE includes 5 'other' SKE subjects. PGCE survey respondents included 257 who had completed an SKE and 82 who had not.

⁴ NQT includes 19 'other' SKE subjects.

5.1.1 SKE student demographics

Respondents to the Beginning and End of Course surveys were more likely to be female and of lower age groups although a range of ages were represented in the samples.

Table 10 Comparison of survey participant demographics

	Beginning of Course survey	End of Course survey	PGCE survey	NQT survey
Gender	64% - female 37% - male	57% - female 43% - male	61% - female 39% - male	58% - female 42% - male
Ethnic group	87% - White 7% - Asian or Asian British	79% - White 11% - Asian or Asian British	84% -White 10% Asian or Asian British	86% - White 7% Asian or Asian British
Age	74% - below 35 26% - 35 and over	70% - below 35 30% - 35 and over	64% - below 35 26% - 35 and over	87% - below 35 34% - 35 and over

These proportions were found to be similar in previous years of the evaluation.

5.1.2 Course of study

Subject area

The Beginning of Course survey respondents represented a range of SKE subjects. Although the survey was sent to students via providers of a range of SKE courses, the focus was on obtaining responses from chemistry, mathematics and physics SKE students. Matching the profile of the SKE cohort as a whole, mathematics was the most popular subject (48%), followed by physics (23%) and chemistry (21%). This pattern was mirrored in the End of Course survey, as 51% were enrolled on mathematics, 24% on physics and 22% on chemistry. Across both surveys, a small number of responses were enrolled on other SKE courses such as design and technology and modern languages.

Similar patterns were also found in the PGCE and NQT survey responses where mathematics was the most popular subject, followed by chemistry and physics with similar proportions. Refer to the table below for further detail and the accompanying technical report.

There were only slight differences in the proportions of subjects represented in the sample across the three years of the evaluation. Note that SKE subject is used for Beginning and End of Course surveys and the NQT survey whilst PGCE subject is used for the PGCE survey since some respondents did not complete an SKE course.

Table 11 Comparison of survey responses by main subject 2009-2012

	Year 1 (2009/10)		Year 2 (2010/11)			Year 3 (2011/12)			
	BoC Pct.	EoC Pct.	BoC Pct.	EoC Pct.	PGCE Pct.	BoC Pct.	EoC Pct.	PGCE Pct.	NQT Pct.
Chemistry	21	17	15	16	*	21	22	22	9
Mathematics	59	53	57	53	53	48	51	51	58
Physics	16	18	18	20	*	23	24	18	25
Other	4	12	10	11	13	9	3	10	9

*35% of PGCE survey respondents in 2010/11 were recorded as studying science.

Analysis of SKE subject area and progression to PGCE and NQT stages revealed on the whole, students tend to remain with their principal subject. Indeed, over 90% of PGCE students said that they were studying the same subject for the PGCE as their SKE. When moving into teaching, over 80% claim to teach the same subject as they studied for their SKE. Further analysis of movement between subject areas is provided in the technical report for evaluation year 3.

Course length

In the first year of the evaluation, the sample targets were focused on gaining response from those on longer SKE courses (one year). This was widened for year three to capture experiences and issues from students on a range of courses, although longer courses were still most popular.

Table 12 Length of SKE course across all surveys 2011/12

BoC			EoC			PGCE		NQT	
Length of course	No.	Per cent	Length of course	No.	Per cent	No.	Per cent	No.	Per cent
16 weeks	-	-	Less than 1 month	38	8.7	66	25.7	66	32.0
20 weeks	-	-	1 to 3 months	28	6.4	11	4.3	20	9.7
24 weeks	-	-	4 to 6 months	201	46.2	88	34.2	61	29.6
28 weeks	19	12.1	Over 6 months	168	38.6	92	35.8	59	28.6
32 weeks	13	8.3							
36 weeks	125	79.6							

Respondents to the PGCE and NQT surveys represented a wider range of courses with over one-quarter having studied on short courses of less than one month in duration.

5.1.3 Respondent qualifications and experience

Several details were collated in each survey as to the qualifications held by respondents and their previous experience. These are summarised below, further details are provided in the technical report which accompanies this report.

Beginning of course survey

- Just over half (58%) of SKE Beginning of Course survey respondents said that they had an A level in their SKE subject.
- The majority of SKE students (94%) have a Bachelor Degree (regardless of the subject), with the highest proportion (36%) having studied biological sciences for their degree, 11% studied physical sciences, 9% studied business and administration and 7% studied law. Only 2% had a mathematical sciences degree.
- Mathematics SKE students seemingly entered SKE courses with the widest backgrounds (wider range of subjects studied at degree level previously).
- Nearly half of the respondents (47%) achieved a second class, second division (2:2) degree qualification, 40% achieved a second class, first division (2:1) and 11% achieved a first-class degree.
- Nearly half of the survey respondents (47%) considered themselves to have had a career previous to starting the SKE course, 54% (84) did not have a career. These

were in a range of industry sectors, including education (23%), professional, scientific and technical activities (21%) and financial and insurance activities (12%).

- The majority of respondents (81%) had some form of experience of working in the school environment - 26% had worked for a few weeks in a local school, 21% had worked as a teaching assistant and 3% had worked at a summer school. Just under one-fifth of respondents (19%) had not worked in a school environment before.

PGCE survey

- Just over three-quarters (78%) of the PGCE survey respondents said that they had an A level in the same subject as that which they are studying to teach.
- The proportion of students with an A level in their chosen subject is higher for those who had not previously completed an SKE course (92%) compared to those who had (74%).
- The vast majority hold a bachelor degree (96%) and similar proportions of previous SKE students and non-SKE students hold degrees. Common degree subjects were biological sciences (22%), physical sciences (21%) and mathematical sciences (14%).
- Nearly half of the respondents (44%) held a 2:1 degree classification. Overall, students were more likely to have achieved a second class degree. Those who had not completed an SKE were more likely to have achieved a first class degree - 22% compared to those who had completed an SKE (12%).
- Just under half (44%) of the PGCE students consider themselves to have had a career prior to their teacher training. Similar proportions of those who had completed an SKE or not said that they did have a career previously. The most common sectors for previous careers were professional, scientific and technical activities and financial and insurance activities

NQT survey

- Just over three-quarters (77%) of the NQT survey respondents said that they hold an A level in the subject they are now teaching.
- The majority of survey respondents (97%) also hold a bachelor degree. There were varied subjects taken for the undergraduate level study, such as biological sciences (18%), business and administrative studies (15%) and engineering and technology (13%).
- The majority of NQTs hold a second class degree of some kind (38% with a 2:1 and 37% with a 2:2). There are some with a first class degree (14%).
- Just over half (57%) said that they considered themselves to have had a career previous to starting teacher training. The most common industries were professional, scientific and technical activities (22%) and financial and insurance activities (15%).

5.2 Interviews

A total of 143 interviews were completed during the third year of the evaluation (2011/12) with students at the beginning and end of their SKE course, students who had moved onto teacher training and students who had moved into their first year of teaching. In addition, SKE course tutors and a small number of colleagues of NQTs were also interviewed.

Table 13 Profile of interview respondents according to SKE subject (2011/12)

Type of Respondent	Chemistry	Mathematics	Physics	Total
Beginning of SKE Course	5	7	6	18
End of SKE Course	5	6	5	16
PGCE	7	7	8	30*
NQT	3	13	13	32**
Tutor	17	15	8	40
Colleague	1	3	3	7

*PGCE interviewees included 22 who had completed an SKE and 8 who had not.

** The 3 remaining NQT interviews included 1 Design and Technology and 2 Modern Foreign Languages.

The profiles of interview respondents were varied as summarised in the table below.

Table 14 Profile of interview respondents - age and gender of prior SKE students (2011/12)

Age	Beginning of SKE Course		End of SKE Course		PGCE		NQT	
	Female	Male	Female	Male	Female	Male	Female	Male
Under 25	2	5	1	4	6	-	3	2
25-29	-	1	2	1	4	4	3	8
30-34	2	-	1	1	-	2	2	2
35-39	2	-	1	1	1	3	1	-
40-44	4	1	2	1	2	1	5	2
45-49	-	-	-	1	2	2	1	-
50-54	-	-	-	-	1	2	1	2
55 and over	1	-	-	-	-	-	-	-
Total	11	7	7	9	16	14	16	16

5.3 Case studies

Year 3 of the evaluation included interviews with 20 participants who had been interviewed in previous years to follow their progress into teaching. The table below provides an overview of their profiles. In year 2, three of the 20 case studies dropped out and were replaced by similar SKE students. These replacements were again interviewed in year three. The final column in the table below shows the evaluation years in which participants were interviewed.

Note that ten of these case studies have been provided in Appendix 1 as examples of SKE students' backgrounds, aspirations, experiences and journeys into teaching.

Table 15 Profile of case study participants (2011/12)

Case Study Profiles					
SKE Subject	Length	Institution	Gender	Age Band	Years
6 - Chemistry	36 weeks	Bradford College	Female	26-30	Yrs1-3
	12 weeks	Bradford College	Male	41-50	Yrs1-3
	24 weeks	Edge Hill University	Male	31-40	Yrs1-3
	36 weeks	Keele University	Female	20-25	Yrs1-3
	24 weeks	Keele University	Female	no age given	Yrs1-3
	24 weeks	University of Sussex	Male	20-25	Yrs1-3
1 - Design and Technology	36 weeks	University of Brighton	Male	41-50	Yrs1-3
9 - Mathematics	28 weeks	Bath Spa University	Female	31-40	Yrs1-3
	24 weeks	Edge Hill University	Male	41-50	Yrs 2&3
	36 weeks	Manchester Metropolitan University	Female	41-50	Yrs1-3
	28 weeks	Nottingham Trent University	Male	41-50	Yrs 2&3
	24 weeks	Roehampton University	Female	26-30	Yrs1-3
	14 weeks	University of Hull	Female	20-25	Yrs1-3
	24 weeks	University of Reading	Male	20-25	Yrs1-3
	36 weeks	University of Sunderland	Male	31-40	Yrs1-3
	36 weeks	University of Sunderland	Female	31-40	Yrs1-3
4 - Physics	16 weeks	Bradford College	Female	20-25	Yrs1-3
	26 weeks	Loughborough University	Female	20-25	Yrs1-3
	24 weeks	University of Southampton	Female	no age given	Yrs 2&3
	24 weeks	University of Southampton	Male	20-25	Yrs1-3

Yrs 2&3 – replacement case studies for 3 trainees that dropped out

6. Effectiveness of Preparing Trainees Sufficiently In the Subject Area

In different stages of the survey work, respondents were asked to rate their level of subject knowledge and confidence in their subject, to ascertain how this might change during the SKE course and beyond. This section of the report explores the changes in these areas and impact in relation to SKE students' next stage of teacher training beyond the SKE course. To ensure consistency and comparability across the evaluation, a standard measure was used which encompassed a rating scale of 1 to 10, with 1 representing the lowest level of subject knowledge (or confidence) and 10 representing the highest.

6.1 Changes in subject knowledge

At the beginning of their SKE course, of the 150 students responding, 41% gave a rating of 7 or above and 73% gave a rating of 5 or above. This suggests an average perceived level of subject knowledge which is similar to findings from year 2 where 50% of respondents rated their level of subject knowledge as 7 or above. Differences in perceived levels of subject knowledge across the three subject areas were minimal, slightly higher proportions (23%) rated 8 to 10 in chemistry compared to mathematics (17%) and physics (16%), suggesting that chemistry students were a little more sure of their subject. In the previous year of the evaluation, it was suggested that mathematics students indicated higher levels (7-10) of subject knowledge at the start of their SKE course although again, the differences were small.

As part of the assessment of change in subject knowledge, SKE students were asked to provide another rating using the same scale at the end of the course. A clear pattern has emerged, with an overwhelming majority of students rating the subject knowledge much higher by the end of the course - 94% of respondents rated 7 or above and 86% rated 8, 9 or 10.

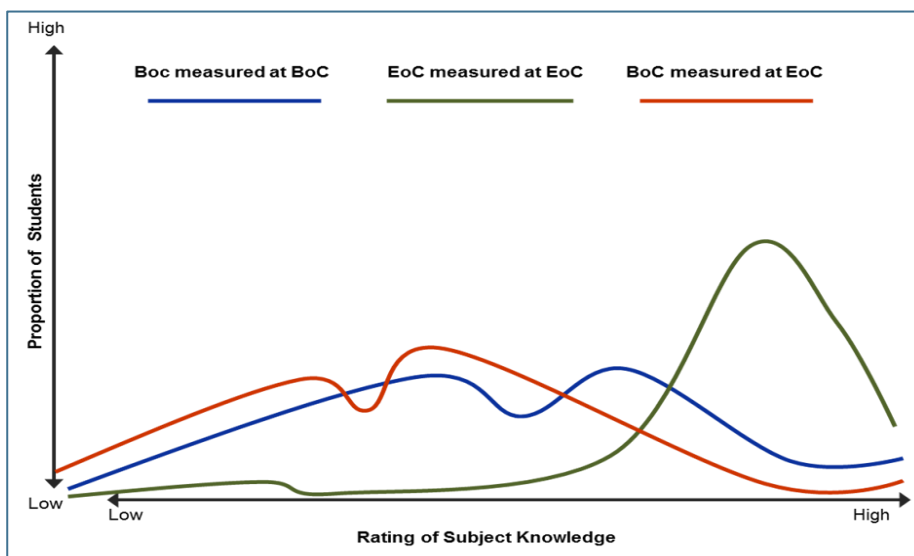
At the end of the course, students were asked to reflect back on their level of subject knowledge at the beginning of the course and provide a rating again. It appears that

Case Study: Adrian (20-25) Physics SKE student.

Adrian is teaching all three sciences up to GCSE level in his NQT year. He is currently teaching lower set pupils but feels confident in being able to teach up to key stage 4. Adrian is happy to consider himself as a subject specialist in physics, *'with physics it's there already; I have got a deep understanding of the subject that draws together all parts of the curriculum and I think that other teachers could consult me on it.'*

once students had been through the SKE course, their perceived level of subject knowledge at the beginning of the course was lower than they had previously indicated. This suggests that at the beginning of the SKE course, they thought their subject knowledge was around average but once they had been through the course, not only had their subject knowledge improved but also they thought that it was not as high as they had originally thought at the outset. Whereas at the beginning of the SKE course, 41% gave a rating of 7 or above for their level of subject knowledge, by the end of the course, their rating was just 16%. Indeed, nearly half of the End of Course survey respondents (49%) gave a rating of 4 or below. This pattern has been reflected across all three years of the evaluation.

Figure 6 Change in subject knowledge; beginning vs. end of course results - Beginning and End of Course surveys 2011/12



There is therefore a clear shift towards higher levels of subject knowledge towards the end of the SKE course and students have consistently provided feedback suggesting that the SKE course has positively enhanced their subject knowledge. As explained in the annual report for year 2 of the evaluation;

‘these differences are important, because the moderately high scores that students initially awarded themselves suggest that many students felt that they knew a lot more about their subject than they actually did.... We can only assume that once they had actually completed the course and had had their knowledge truly tested, they came to realise that in certain respects their entry level knowledge had been somewhat lacking. Thus, considering the extent of the shift in scores between the entry level scores provided retrospectively and the end point subject knowledge scores provided in the End of course survey, we can observe that as a result of completing the SKE, a notable number of

*students will begin the PGCE with a suitably higher level of subject knowledge which they can further build on during the PGCE year.*⁴³

Comparing the differences in perceived level of subject knowledge for students on shorter and longer courses, does not reveal any considerable differences. Whilst one might expect those on shorter SKE courses to have a higher starting point in terms of their subject knowledge, this was not clearly shown in the evaluation findings. There appears, however, to be a slight trend in this direction when comparing the results of the End of Course survey – slightly higher proportions of students on longer courses rated their subject knowledge as low at the beginning of the course and the reverse pattern is seen for those rating their subject knowledge as high. When rating subject knowledge at the end of the SKE course, as before, there were significant improvements observed in the ratings overall. The extent of change in subject knowledge through studying on the SKE course in relation to the length of SKE course cannot be clearly determined however since the ratings are based on perceptions at different course periods.

Table 16 Proportion (percentage) of SKE students rating their level of subject knowledge by length of SKE course - Beginning and End of Course surveys 2011/12

Rating (1-10)	Beginning of Course survey - current subject knowledge			End of Course survey - subject knowledge at the beginning				End of Course survey - subject knowledge at the end			
	28 weeks	32 weeks	36 weeks	less than 1 month	1 - 3 months	4 - 6 months	over 6 months	less than 1 month	1 - 3 months	4 - 6 months	over 6 months
Low (1-4)	11.1	53.9	27.4	34.2	50.0	48.7	52.9	2.6	3.6	1.0	1.2
Medium (5-7)	72.2	30.8	53.9	55.3	42.9	46.3	41.0	5.3	17.8	15.0	11.4
High (8-10)	16.7	15.4	18.9	10.6	7.1	5.0	6.0	92.1	78.6	84.1	87.5

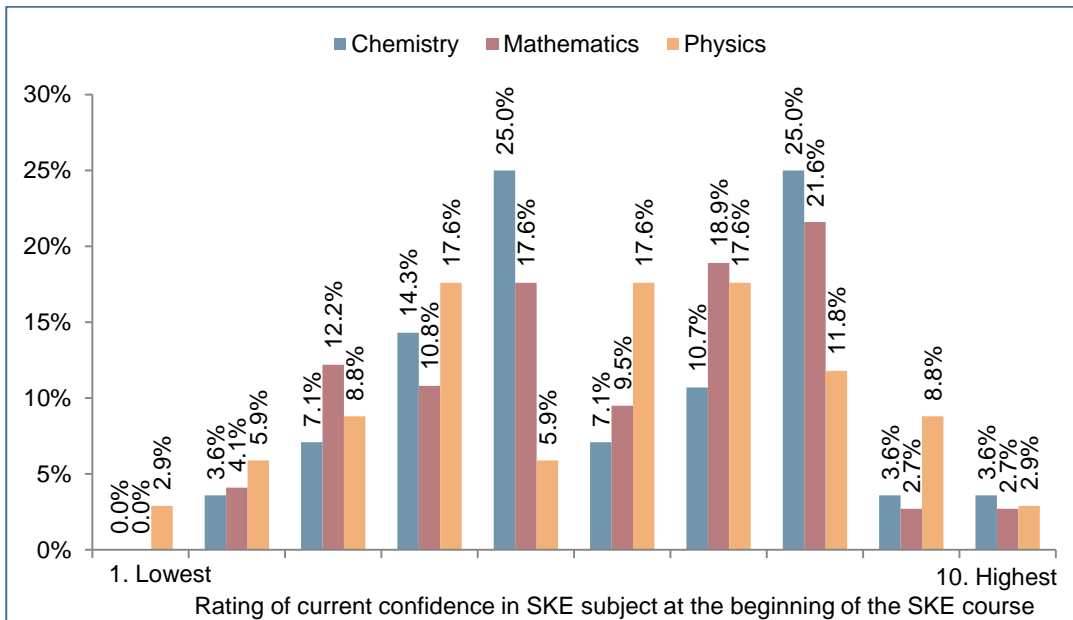
6.2 Confidence in the subject

To further understand the level of subject knowledge held by SKE students, they were asked to rate their confidence in their subject. This measure was taken through all the surveys, therefore following their progression from SKE to PGCE and NQT stages.

⁴³ LSN (2011) *Evaluation of Subject Knowledge Enhancement Courses Year 2 Annual Report - 2010/11*, TDA, p43.

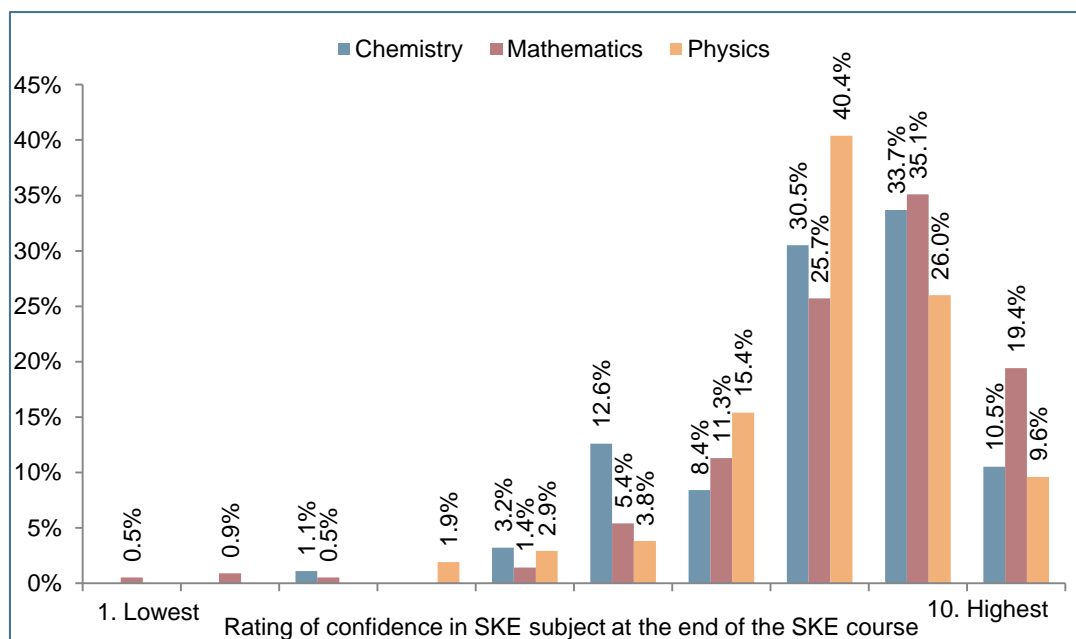
Of the Beginning of Course survey responses from 148 students, a similar pattern was found to level of subject knowledge in that nearly half of the students tended to rate their confidence in their subject at moderate to higher levels - 44% rate 7 or above and 72% (107) rate 5 or above.

Figure 7 Level of confidence in subject by SKE subject - Beginning of Course Survey 2011/12



This process was repeated in the End of Course survey to establish if there had been any perceived change in confidence in their chosen subject by completing the course. Of the 435 respondents answering this question, a majority (89%) rated their confidence at 7 or above (78% rated at 8, 9 or 10). There has therefore been a clear improvement in the perceived level of confidence in their chosen subject.

Figure 8 Level of confidence in subject by SKE subject - End of Course Survey 2011/12



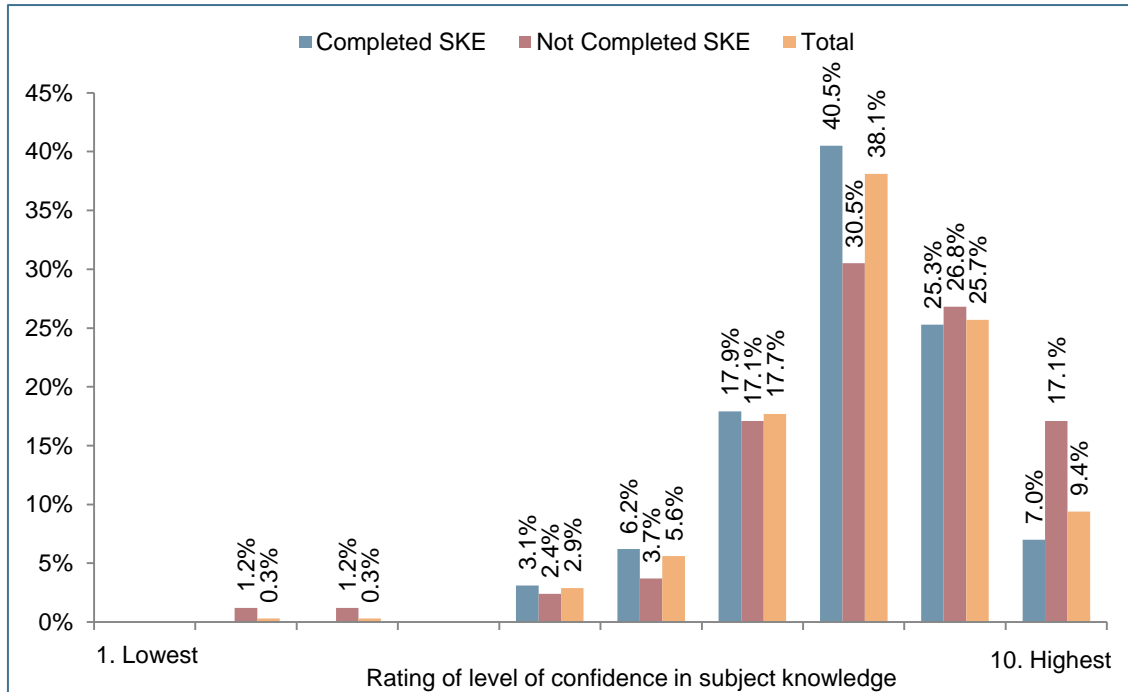
Indeed, 95% of End of Course survey respondents said that their confidence had changed since starting the SKE course and the majority stated that they had experienced a positive impact in terms of being more confident to teach the subject and to teach to a higher level, better understanding of the subject, ability to convey topics more clearly and confidence in the practical aspects of teaching the subject.

Once the SKE course is completed then, it appears that perceived levels of subject knowledge and confidence in the subject are dramatically enhanced. Of the End of Course interviewees, apart from one, all the students indicated that they felt confident or very confident in the subject – one had said getting good marks and positive feedback throughout the course had helped in boosting their confidence, whilst another said they had gained ‘much more of an understanding now and can explain Physics better, rather than reciting it from a text book which I have to say I have been doing. I have also realised where Physics fits into everyday things (Physics SKE student). Others said they had gained confidence:

- In standing in front of people as well as in their subject knowledge.
- In their understanding of mathematics and how topics link together: ‘*Not only has my subject knowledge increased with taking the SKE, I was a bit rusty before, but my understanding of maths and how the topics link together is much stronger now, which has improved my confidence to go on and teach*’ (Mathematics SKE student).

This also followed into teacher training where 91% of PCGE survey respondents rated their confidence at 7 or above.

Figure 9 Rating of confidence in subject knowledge of principal subject - PGCE Survey 2011/12

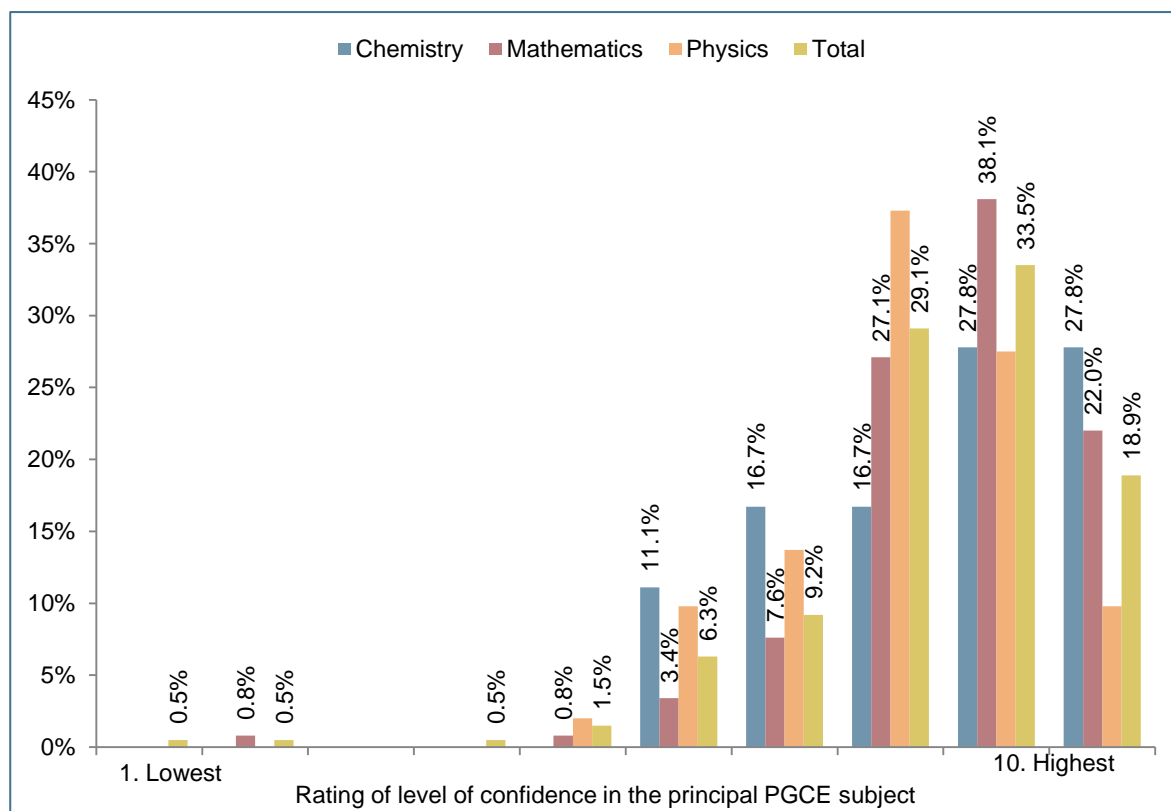


Furthermore, there were only slight differences in confidence between former SKE students and traditional entry teacher trainees. Whilst the proportions of these two types of respondents rating their confidence at 7 or above were similar, there were clear differences in some specific ratings. Higher proportions of former SKE students rated their confidence as 7 and higher proportions of traditional route teacher trainees rated their confidence as 10. This appears to mirror findings from previous years of the evaluation to some extent. In year 2, the survey of PGCE students suggested that those who had completed an SKE felt less confident in their subject compared to specialist degree graduates. However, this idea was then challenged in year 2 somewhat with other evidence and interview data, which suggested that confidence levels *‘eventually evened out as the course progressed’*.⁴⁴

When tracking students’ level of confidence into their first year of teaching, again high proportions were providing scores at the higher end of the scale - 91% rated their confidence at 7 or above and 82% rated it at 8, 9 or 10.

⁴⁴ LSN (2011) *Evaluation of Subject Knowledge Enhancement Courses Year 2 Annual Report - 2010/11*, TDA, p50.

Figure 10 NQTs' current level of confidence in the principal SKE subject - NQT Survey 2011/12



It seems therefore that the SKE course has enhanced perceived levels of confidence and this has been maintained into the NQT year.

Further exploration of subject knowledge and confidence to teach the subject is provided in section 7.

6.3 Preparation for teacher training

Many SKE tutors felt that the SKE course produces students who are better prepared to go on the PGCE – not just in terms of their subject knowledge but also in terms of their confidence, getting used to academic study, timekeeping and being organised and working with groups.

In determining how effective SKE courses have been in preparing trainees in their subject, a short sub-set of questions were posed during the surveys and interviews to ascertain how the SKE course might have contributed to students' progress in their teacher training.

During the End of Course survey, one particular question assessed students' perception of the level of subject knowledge they felt they would require to successfully complete the PGCE. Again they were asked to rate this level using the scale of 1 (low level of subject knowledge) to 10 (high level of subject knowledge). The findings illustrated that students clearly felt that high levels of subject knowledge

were required. Overall, 94% of the respondents rated the subject knowledge requirement as 7 or above. This fits with the findings above where at the end of their SKE course, 94% of respondents rated their subject knowledge at 7 or above and also with the high ratings of confidence in the subject at PGCE and NQT stages. It suggests therefore, that most students felt reasonably well prepared for the PGCE in terms of their subject knowledge. The majority of End of Course interviewees thought that the course had met their expectations in terms of the level and the subject content, with a couple of students indicating that they thought it had exceeded their expectations.

The SKE has exceeded my expectations and is a good grounding for the PGCE. For me the level was about right. The course covered all sciences to AS level and Physics to first year undergraduate level. It covered more content and to higher level than I expected but that was a good thing for me as I wanted to learn as much as possible.
(Physics SKE student).⁴⁵

The majority of the 16 SKE students interviewed at the end of their SKE course thought that they had sufficient knowledge to successfully move on to the PGCE course with just over half commenting that the SKE course had largely contributed to this:

The advantage of the SKE is we have just done GCSE and A level stuff so our subject knowledge is up to date and fresh in our minds.
(Physics SKE student).

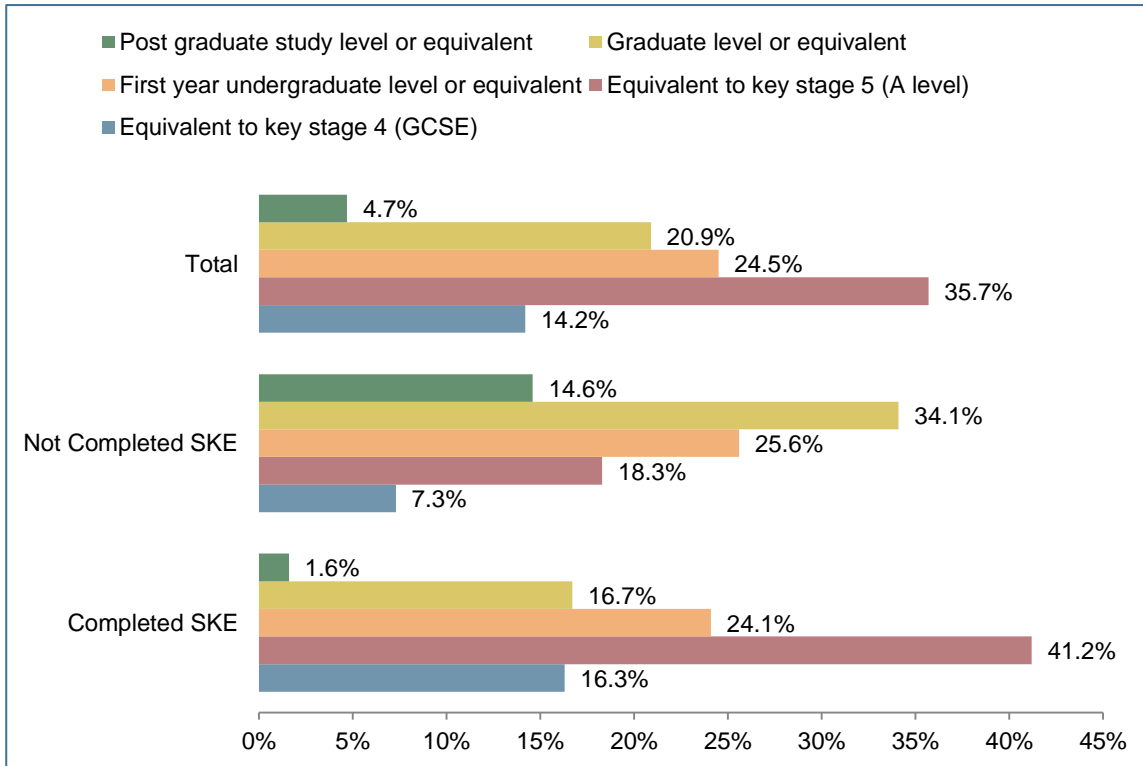
A small number of the students interviewed who were on shorter courses (up to 6 months) thought that there were gaps in the content or depth of content and commented that they used self-study to ensure they had sufficient subject knowledge.

6.3.1 Defining levels of subject knowledge and progress on teacher training

During their teacher training, most students (36%) defined their level of subject knowledge as equivalent to level 5 (A level) and when comparing former SKE students with traditional route teacher trainees, there is a marked difference here. Much higher proportions of former SKE students consider their subject knowledge to be to A level standards whereas traditional route teacher trainees (subject graduates) were much more likely to rate their subject knowledge as equivalent to graduate and postgraduate levels. These findings mirror those of the 2010/11 surveys.

⁴⁵ Note that science SKE courses are designed to provide specialist training in one science subject. However, some providers have opted to include other science subjects to some extent in their course content.

Figure 11 Definition of level of subject knowledge - PGCE Survey 2011/12



Nevertheless, overall levels of subject knowledge were perceived to be at level 5 (note that there were higher proportions of former SKE students completing the survey compared to traditional route candidates). When they reached their NQT year, respondents were of the same opinion, most (35%) thought that their subject knowledge was equivalent to key stage 5 (A level).

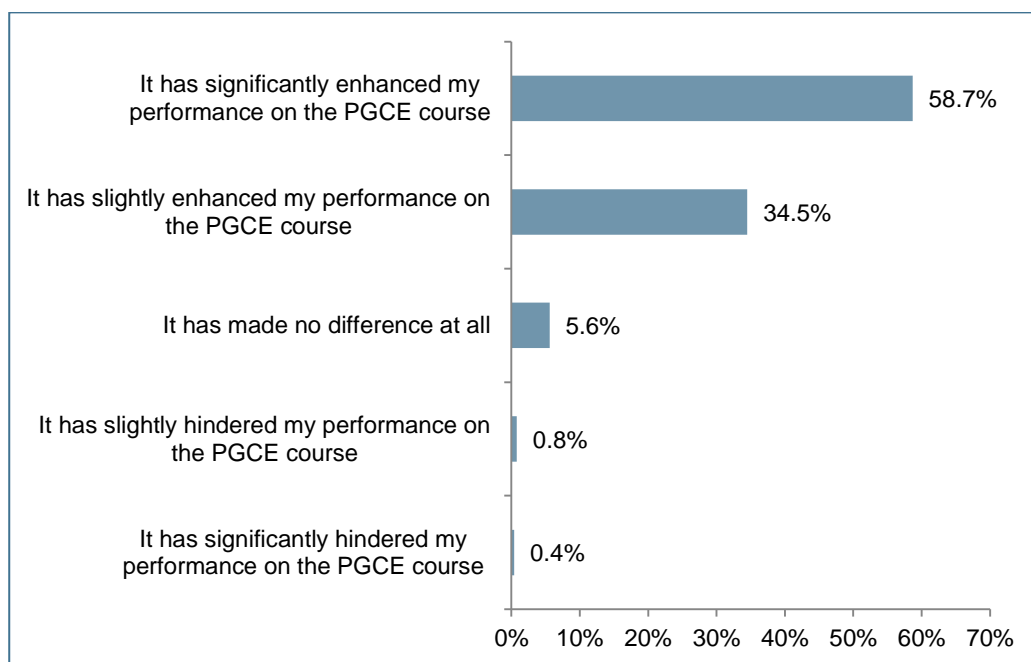
In terms of progress through the PGCE course, the majority (87%) of students felt that they were above average to some extent, compared to fellow students. Those from former SKE backgrounds seemed to rate their progress slightly higher than their subject graduates counterparts – 45% of former SKE students rated above average or well above average compared to 34% of traditional route teacher trainees.

Regarding subject knowledge, at teacher training stage, overall 85% of PGCE students considered their subject knowledge to be above average compared to their fellow students. This figure seems high since by definition, most students cannot be above average – it is perhaps due to the question being based on perception of students. There are differences here depending on whether students had completed an SKE or not. In line with findings from the previous evaluation year, just 48% of former SKE students rated their subject knowledge as above or well above average compared to 70% of traditional route teacher trainees (subject graduates). This suggests therefore that although those who had previously completed an SKE course perceived their performance to be higher than traditional route teacher trainees, they perceive their subject knowledge to be weaker in comparison to their colleagues.

Considering that SKE students are less likely to have a strong educational background in their specialist subject, these findings are not surprising. It must be recognised however, that the SKE course is not designed to equip students with graduate level subject knowledge. The emphasis is widening the pool of potential teacher trainees by equipping trainees with enough understanding and awareness of the subject to teach at key stages 3, 4 and 5. The SKE course therefore, provides the grounding on which students can build their knowledge and expertise to become effective teachers.

Over 93% of PGCE survey respondents said that the SKE course had slightly or significantly enhanced their performance on the PGCE (59%, felt that the SKE course had significantly enhanced their performance on the PGCE course). There did not appear a significant differentiation between responses to these questions according to SKE subject – although a slightly higher proportion (64%) of former mathematics SKE students felt that the SKE course had significantly enhanced their performance on the PGCE compared to former chemistry (59%) and physics (49%) SKE students.

Figure 12 How the SKE course has impacted on performance on the PGCE course - PGCE Survey 2011/12



Of those responding to the survey, it was suggested that their performance on the PGCE had been enhanced by the SKE course due to improved confidence in the subject, acquiring tips, ideas and resources, having confirmation of choosing a career in teaching, preparation for study and transition from a previous career. A small number also suggested however, that it could be improved by including more pedagogy in the content, more science content such as coverage of all three sciences (although these are not the original intention of SKE courses), more content to higher levels and more practical experience.

6.4 Previous qualifications

The above findings provide strong evidence to support the argument that the SKE is beneficial in improving subject specific knowledge and levels of confidence in the subject. However, questions continue to be raised about the limitations of former SKE students who do not have the minimum of an A level in their subject area. Many of these concerns relate specifically to their preparedness to tackle teaching at the various levels once they move onto their NQT year.

The Government's announcements about minimum qualifications required to receive a bursary and the more recent new Teaching Standards means that people now associate being an ideal trainee teacher candidate with possessing a high level of knowledge (to a graduate or equivalent level) in a strongly related subject. This is not always guaranteed in the case of those that have completed an SKE.

Findings from the PGCE survey highlighted that students who had not completed an SKE course prior to starting their PGCE were more likely to have had an A level in the subject of interest (92%) compared to those who had completed an SKE course (74%), which inevitably raises questions about the extent to which they are equipped to address higher level material.

What we've been able to determine through further probing is that those who are perceived to have potential to become excellent mathematics and science teachers don't all come from strong mathematical or science backgrounds; indeed having an A level in the subject is not necessarily a barometer of academic pedigree.

Traditionally, having an A level or higher qualification in a specific or related subject has been considered the main barometer for determining the suitability of a candidate to teach at secondary level. Indeed many SKE tutors commented that they do not accept students without A levels or equivalent although many institutions place just as much importance on how prospective SKE students do at the interview. Many tutors acknowledged that there were other very important attributes, '*we look at the student as a whole, their experiences, profession and previous qualifications.*' (Mathematics SKE Tutor).

It also became apparent therefore, through the evaluation that there was a willingness among some providers to accept students on the courses with no specific A level(s) in the subject in which they are hoping to specialise. Responses from the interviews with tutors suggest that for some an A level in the subject is no longer a specific requirement for an SKE course, as evidenced by interviews with former SKE PGCE students, where 11 of 22 interviewees in year three and 10 out of the 28 in year 2 were found not to possess an A Level in the subject when they enrolled on their SKE course.

There is some evidence to suggest that the different abilities and backgrounds of students had an impact on their learning:

I know everyone came in with an A level but a couple have struggled and that was usually because their degree was in an unrelated subject e.g. Graphics or Sports Science. Most, like myself had Engineering or Accountancy degrees so didn't struggle as much (Mathematics SKE student).

Others however, thought that this could be a positive experience as it allowed a range of abilities and for students to help each other:

There were mixed abilities but we were only a small group of 8 so we helped each other. If anyone was struggling someone in the group who was slightly stronger would always help and support. Doing this has also helped show me the different ways to deliver and teach the subject to other people – it was interesting to see how someone in the group could help you understand something that you might not quite have understood from the tutors delivery (Physics SKE student).

When discussing their confidence, a small number of NQTs, who had an A level in other subjects, were more confident than with their specialist subject which they may not have studied to A level prior to taking the SKE:

I have been teaching all three sciences. I am very confident with Chemistry and Biology as I have A levels and from my degree so I happy to teach up to A level. Obviously we didn't cover all aspects of GCSE on the SKE but my main gaps seem to be Physics and I am only confident to teach up to KS4 at the moment. (Science with physics specialism PGCE).

Indeed, as discussed in section 7, a clear finding is that many former SKE students, PGCE students and NQTs do not feel confident in their subject knowledge to be able to effectively teach at key stage 5 (A level). This could relate either to the wide ranging backgrounds of SKE students, lack of A level in their subject, the type of PGCE they are on (where some are not prepared for teaching to A level) or to the design, content and delivery of the SKE course itself.

6.5 Course content and delivery

During the second year of the evaluation, it became apparent that pedagogy was a significant issue for many SKE students. Indeed, many had made clear that they valued the inclusion of pedagogy in their SKE course content and that they felt learning how to teach the subject at this stage was particularly useful to them. Given that SKE courses were designed to enhance subject knowledge rather than pedagogical understanding, it was not clear to what extent pedagogy was being

covered within the SKE syllabus and the extent to which this was valued by students. In response, therefore, the third evaluation year encompassed a series of questions which explored the balance of learning the subject against learning how to teach the subject.

It became clear from the interviews with many SKE and former SKE students that pedagogy per se was not the issue and many SKE students felt that this would be covered by the PGCE course. They valued however, gaining an understanding at this early stage of how to teach specific topics in certain ways to pupils and how to use and demonstrate practical work in relation to their specialist subject. It was therefore, subject-related pedagogy that they valued (refer to Case Study 9, Claire, in Appendix 1 for an example of how this student valued and used the pedagogical content of her SKE course). Most of the students who were interviewed at the end of their course spoke in positive terms about the quality of teaching on their course; with some talking about the value of having tutors who had been teachers themselves as it enabled them to learn valuable tips about teaching.

There were various tutors and on the whole they were very good. Some were ex school teachers so from them we not only learnt the content but they were able to give us tips and hints on how to teach it. Others were more academic and were more university type lecture style; not tailored to us teaching the subject. (Physics SKE student)

Several surveys explored the current and what might be the appropriate balance of subject knowledge and subject-related pedagogy. On the whole however, it appears that most courses are fairly heavily balanced towards developing subject knowledge and pedagogy is a smaller aspect of the learning and that most students were content with this balance:

- Over half (57%) of End of Course survey respondents said that their course was split 80/20 towards learning the subject and just over one-fifth (22%) had courses with a 60/40 ratio towards learning the subject.
- Just under 42% of the PGCE students said that their SKE course was split 80/20 between learning subject knowledge and learning about teaching the subject. Another 24% said that it was split 60/40 towards learning subject knowledge.
- Most NQTs overall (40%), said that their course was split 80% learning the subject and 20% learning how to teach the subject. A further 25% (51) said that there was a split 60/40 towards learning the subject and 12% (25) said there was an equal balance between the two elements of learning.

Supporting this, many tutors noted how there is usually a small element of pedagogy at least, even if this is in terms of asking students to reflect on how they are teaching. Those with more pedagogical training were modelling good practice rather than having specific sessions. The tutors at most of the institutions were themselves ex-teachers or in one or two cases they used practising teachers, and therefore felt they were passing on their knowledge and tips of teaching skills. Although it is incongruent with the design of SKE

courses, a minority of institutions did provide specific sessions on pedagogy, whilst one institution spoke of a 50/50 split:

It would be a poor course if the emphasis was only subject knowledge; subject knowledge and teaching go hand in hand. So not only do students have to explain about maths in their work they are thinking about issues around teaching maths. We have separate maths education lessons which are purely about teaching maths. (Senior Lecturer, mathematics).

The above represents a minority view although it has become clear through the interviews with tutors that subject-related pedagogy does appear in the content of SKE courses to some extent. Almost all the tutors do refer to having some kind of learning about teaching the subject involved in the course which they either saw as implicit or explicit to their teaching and in some cases this was seen as unavoidable; many commented that learning about pedagogy was not necessarily a separate part of the course but that it was covered in the context of their teaching/how to teach or modelling good practice rather than direct teaching of pedagogy.

75% / 25% but they are not independent of each other. It is about learning subject knowledge; understanding subject knowledge and thinking about how they are taught. It is less about pedagogy but about how the subjects link together and the depth of the subject rather than the procedural way they may have already experienced in their previous learning. We model lessons all the time through an interactive approach. (Mathematics Tutor)

Where a small number of SKE respondents were not happy with the split between subject knowledge and subject-related pedagogy, their preferred ratios were around 60/40 or 50/50, therefore still including more elements of pedagogy in the course content. Only a small number felt that the content should be entirely based on developing subject knowledge.

The vast majority of respondents therefore, thought that the balance was adequate and this was because they had clear expectations that the SKE course was to provide them with the right level of subject knowledge first and foremost – and to provide that in preparation for the PGCE. Around three-quarters of the End of Course survey responses indicated that the PGCE was where they would be provided with instruction and knowledge on how to teach:

I didn't want too much "how to teach" content until I was confident with the physics. The majority of the course was learning physics, and the PGCE course is for learning how to teach it.

However, the majority valued learning some subject-related pedagogy;

We were taught the knowledge of the subject in such a way as to advise us how to pass on what we were learning in the future. This suited my style perfectly.

For me I knew a lot of how the maths works, the SKE course provided a deeper level of understanding to help me pass this knowledge onto the students. The methods of how to teach were really useful and taught the subject at the same time anyway.

I would have to say 50% - 50% between subject knowledge and how to teach as in the case of the Chemistry lessons we were getting tips all the time about how to teach – the course was definitely structured to teach us ways to teach the subject.

There were significant differences across institutions as to the pedagogical content of the course – wide variations with some receiving practically none – apart from the occasional ‘this is the best way to do this with year X pupils’ to those institutions who provided pedagogy as a significant component of the course.

It has also become clear through the research that there is some variation between students’ experiences depending on the institution and design and delivery of the course at the institution – with some institutions offering teaching theory/practice/some experience in schools etc. alongside subject knowledge whilst others focus almost entirely on subject knowledge. The length of the course of those who commented in the interviews did not appear to be significant in whether school experience was offered. Several students spoke of going into schools where they either gained experience of working with pupils or observed teaching in practice. The length varied from an hour a week to a five day placement.

There are indeed quite significant differences in the content and delivery of SKE courses. The interviews with students at the beginning of their SKE course highlighted some of these differences.

- There were clear differences with some accounts regarding course content, assessment and inclusion of teaching techniques and strategies. For example some science students, although signed on to a single science SKE course also covered other science subjects as the expectation is that they would have to teach general science in schools rather than single subjects. This was also mentioned by SKE students at the end of their course. The views of the SKE science students varied quite widely in terms of the course covering all three science subjects. There were those who found their course provided useful input and subject content on not only their specialist subject but also the other science subjects and in one or two instances additional support and subject content for subjects such as mathematics and ICT.

We will be doing some Physics towards the end of the course and we have touched on Biology if it was relevant to Chemistry. We need to have the 3 sciences as schools expect you to be able to teach them to key stage 3; then I might specialise in Chemistry at key stage 4 – it depends on the school. (SKE chemistry student).

- The above quote highlights how the student valued the inclusion of all three sciences in their SKE training and how this relates to their perceptions of school expectations. It must be noted that there is not an expectation that all NQTs will teach all three sciences, however, in practice whether NQTs teach one or more sciences, may depend on each individual school.
- A small number of students said that their course only covered their specialist subject with little or no reference to the other science subjects which they felt that they needed to become science teachers.
- Assessment varied widely across institutions with some students taking exams at the end of each term to others just having unmarked continuous formative assessment methods. Examples included portfolios, written assignments, practicals, coursework, reflective diaries, presentations, projects and examinations. This issue was reiterated by SKE students at the end of their course. A small number of students did criticise the assessment process and thought it could be improved and standardised by for example, improving the quality and frequency of feedback. Several students did comment, however, that they had found their assessments useful and good preparation for the PGCE. One student, who was given targets to meet throughout the course commented; *'I quite like targets, I achieved a better understanding as a result'*. (SKE mathematics student).
- There are also differences in contact time, some appear to have a significant component of online/distance learning whereas others more face to face/classroom learning.
- Several interviewees raised an issue in terms of the subject content of some courses in that it was designed to equip them to teach to GCSE but that they didn't feel confident to teach to A level.

6.6 Summary and conclusions

- Students' level of subject knowledge was rated significantly higher when asked at the beginning of the SKE course compared to reflecting back at the end of course. Students, therefore, appeared to overestimate what their level of subject knowledge was at the beginning which they then re-assessed once they had completed their SKE course. The majority of students also rated their level of knowledge as much higher on completing the course which demonstrates the impact of the course on positively enhancing their subject knowledge. This was reflected across all three years of the evaluation.
- Their levels of confidence in their specialist subject also rose considerably from the start to the end of the SKE course and the data suggests students experienced a positive impact in terms of being more confident to teach the subject and to teach to a higher level, better understanding of the subject, ability to convey topics more clearly and confidence in the practical aspects of teaching the subject.

- Completing an SKE course, therefore, appears to enhance levels of subject knowledge and confidence which then results in higher levels of confidence in terms of undertaking the PGCE course and first year in teaching, with 91% of NQTs rating their levels of confidence in their subject as a 7 or above.
- The majority of those completing the SKE course felt that high levels of subject knowledge were needed to successfully complete the PGCE; this fits with the ratings they gave of their own subject knowledge and suggests most students therefore felt reasonably well prepared for the PGCE in terms of their subject knowledge.
- Overall, most of the PGCE students defined their level of subject knowledge as at level 5; however there were differences in levels between SKE students compared to traditional route teacher trainees (subject graduates). The SKE students considered their subject knowledge to be at level 5 whereas subject graduates were more likely to rate it at graduate/postgraduate level. This relates to the findings from the interviews where several interviewees talked about subject graduates having higher levels of knowledge but that this was less relevant to the school context.
- The majority of students on the PGCE course (both SKE and non-SKE) thought that their progress was 'above average' compared to fellow students but SKE students rated their progress slightly higher than traditional route trainees (specialist subject graduates). Similarly the majority of PGCE students also rated their subject knowledge as above average compared to fellow students. However there was a marked difference between SKE and non-SKE students with just under half of former SKE students rating their subject knowledge as above or well above average compared to nearly three-quarters of traditional route teacher trainees (subject graduates).
- The balance between subject knowledge and pedagogy of most courses was heavily weighted towards subject knowledge with pedagogy a much smaller aspect; however students' preference would be for a more balanced ratio such as 60/40 or 50/50. The inclusion of pedagogy as part of the SKE course was seen by many students as particularly useful.
- The data also showed that there is some variation between institutions in terms of design and delivery of the SKE courses – with some offering more pedagogy and practical school-based experience and others focusing almost entirely on subject knowledge (in line with the design of the SKE programme). Whilst it was anticipated that pedagogy would primarily be covered on the PGCE course with the SKE course focusing on subject knowledge, what was particularly valued was subject-related pedagogy; how to teach specific subject-related topics and practical work. The extent to which subject-related pedagogy was integrated into the SKE course was varied across providers, however, many tutors and former SKE students noted that this was a useful inclusion, even if it was not explicitly covered.

7. Effectiveness in Equipping Trainees to Become Subject Specialists in Schools

The previous section of this report explored how effective SKE courses are in enhancing subject knowledge and how this has helped to prepare students for their teacher training. This chapter looks at the next stage of their journey and explores how effective SKE courses are in equipping trainees to teach their specialist subjects in schools.

7.1 Expectations and confidence to teach different key stages

When thinking ahead about future teaching careers, at the beginning of the SKE course, students seemed fairly confident in their ability to teach the subject. Over half of the respondents (55%) rated their confidence in teaching the subject at 7 or above. There were slight differences according to subject areas – slightly higher proportions of mathematics students rated at the lower end of the scale (1 to 4) and slightly lower proportions rated at the higher end of the scale (8 to 10), compared to chemistry and physics students, suggesting that mathematics students were less confident than their colleagues.

Previously at the teacher training stage, findings suggested that most former SKE students felt their level of subject knowledge was equivalent to level 5 (A level) and this was replicated in the NQT survey. In addition, when asked at the end of their SKE course, the majority (61%) of students said that they had learned the equivalent of key stage 5 (A level). Looking across the different SKE courses, there are higher proportions of mathematics SKE students who felt that they had learned their subject to the higher levels – 23% said that what they had learned was to first year undergraduate, graduate or postgraduate levels (compared to about 9% of chemistry and physics students). This level of learning seemed to meet the expectations of SKE students, as reported by 86% of the respondents.

Students therefore, have on the whole, expected to learn up to A level standards in their SKE course and have reported doing so. How therefore, does this relate to practising as a teacher? At teacher training stage, the overall pattern (see table

Case Study: Linda (31-40) Mathematics SKE student.

- Linda is currently an NQT teaching mathematics to GCSE and hopes to take on classes to A level in the near future...Linda considers herself to be a subject specialist in mathematics and is very passionate about teaching. She believes that the SKE course inspired her to be a better teacher, understand the subject on a deeper level and therefore, learn how to get children to engage more with mathematics too.

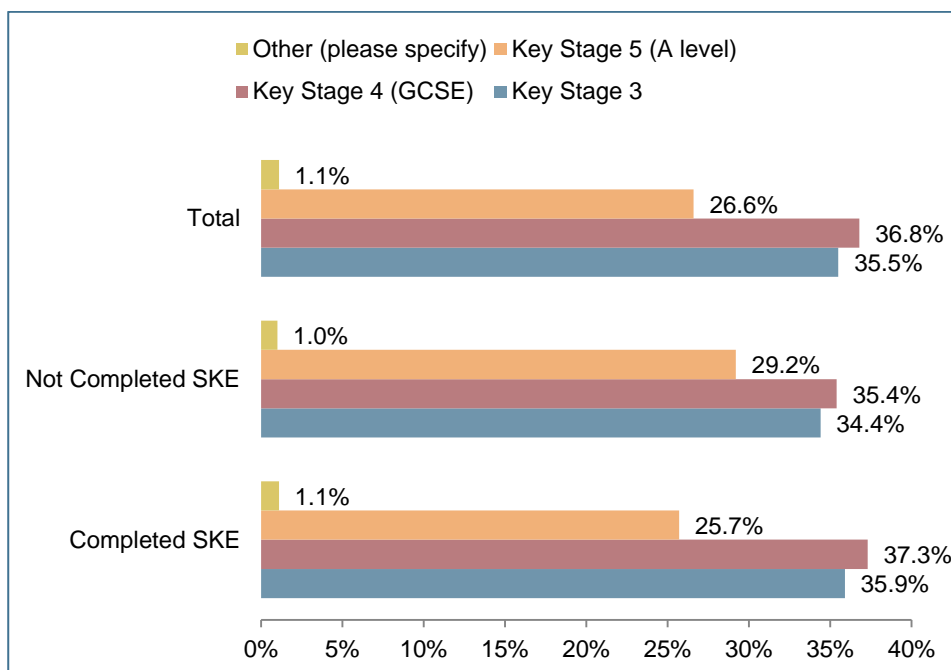
below) suggests that to teach to each key stage, most students felt that they needed subject knowledge which is a level higher than they would be teaching.

Table 17 Subject knowledge needed to teach to key stages 3, 4 and 5 - PGCE Survey 2011/12

Subject knowledge needed to teach principal subject at.....						
	Key stage 3		Key stage 4		Key stage 5	
	No.	Per cent	No.	Per cent	No.	Per cent
Equivalent to key stage 4 (GCSE)	185	54.6	46	13.6	N/A	N/A
Equivalent to key stage 5 (A level)	114	33.6	211	62.2	74	22.0
First year undergraduate level or equivalent	20	5.9	56	16.5	152	45.1
Graduate level or equivalent	14	4.1	19	5.6	100	29.7
Postgraduate study level or equivalent	6	1.8	7	2.1	11	3.3

Whilst they expected to be a level ahead of their pupils, most PGCE students expected to teach their chosen subject at key stage 4 and key stage 3 once they had completed their NQT year, although over one-quarter also expected to teach to key stage 5. The background of students (former SKE or not) didn't seem to make a great deal of difference to these expectations.

Figure 12 Expected levels to teach principal subject to once NQT year is completed - PGCE Survey 2011/12



The above findings were mirrored in the NQT survey. Overall, students most usually expected to teach their chosen subject at key stage 4 (39%) and key stage 3 (37%). Just under one-quarter of the responses to this question suggest that they also expected to teach to key stage 5 (23%).

Furthermore, PGCE students felt fairly confident to teach their subject to key stages 3 and 4 but less so at key stage 5. Over 90% of PGCE students were highly confident in their abilities at key stages 3 and 4 but this dropped to 39% at key stage 5 where they were more likely to display average confidence levels. One mathematics PGCE student who had completed an SKE course said *‘to teach maths A level I will need to get up to speed on topics – some aspects I’ll need to polish up, set my own revision timetable and get up to speed’*.

Table 18 Level of confidence to teach to key stages 3, 4 and 5 in the principal subject - PGCE Survey 2011/12

Level of confidence to teach at...							
		Completed SKE		Not Completed SKE		Total	
		No.	Per cent	No.	Per cent	No.	Per cent
Key Stage 3	Low Confidence						
	Medium Confidence	8	3.1	2	2.4	10	2.9
	High Confidence	249	96.9	80	97.6	329	97.1
Key Stage 4	Low Confidence						
	Medium Confidence	18	7.0	2	2.4	20	5.9
	High Confidence	239	93.0	80	97.6	319	94.1
Key Stage 5	Low Confidence	33	12.8	5	6.1	38	11.2
	Medium Confidence	134	52.1	36	43.9	170	50.1
	High Confidence	90	35.0	41	50.0	131	38.6

A similar situation was found with those at the NQT stage where 98% were highly confident to teach at key stage 3 and 89% were highly confident to teach their subject at key stage 4. At key stage 5, their confidence levels were more varied suggesting as with those at teacher training stage that they did not feel so well prepared to teach at this stage.

Table 19 NQTs level of confidence in subject knowledge to teach to key stages 3, 4 and 5 - NQT Survey 2011/12

Level of confidence to teach at...			
		No.	Per cent
Key Stage 3	Low Confidence	-	-
	Medium Confidence	5	2.4
	High Confidence	201	97.6
Key Stage 4 (GCSE)	Low Confidence	2	1.0
	Medium Confidence	21	10.2
	High Confidence	183	88.8
Key Stage 5 (A level)	Low Confidence	38	18.4
	Medium Confidence	79	38.3
	High Confidence	89	43.2

Reasons given were that they were confident, familiar with content and had experience of teaching at key stages 3 and 4, although some felt that key stage 4 was a little more demanding and may require some revision of particular topics.

I am confident with all the concepts involved in Physics at this level and I am able to break down these concepts in to simple manageable chunks for the pupils.

Lower confidence to teach their subject at key stage 5 was due to needing more practical experience and training at this level, lack of experience teaching to this level, lack of knowledge of certain topic areas and lack of educational background in the subject (not having a degree or A level).

As I do not have A level in my principal subject but have studied some parts of the subject to higher levels, I have a few gaps in my knowledge. This means I am less confident at teaching at A level at present, but this will come with time and repeated teaching of the subject matter

In the interviews with PGCE students, there were several comments which illustrated variation in confidence to teach all three science subjects with both former SKE and non-SKE students: *'I would not be confident to teach physics A level only up to GCSE – biology I would be confident to teach up to A level'* (PGCE non-SKE chemistry student).

Some spoke of doing extra work/preparation to get them fully prepared to teach. *'Quite confident up to GCSE, AS, A2 for physics – some of A2 I might have to brush*

up on' (former SKE PGCE chemistry student). A small number of students said that they would not be confident in teaching the practical sessions on some of the other science subjects and some noted that they felt less confident than in their main subject. Several were not expecting to teach any other subject but would be happy to teach subjects that they had previous careers in e.g. forensic science, ICT, electronics.

7.2 Key stages being taught and required levels of subject knowledge

Once in their first year of teaching, students generally were teaching to key stages 3 and 4. Taking mathematics as an example, most with mathematics as their principal subject were teaching to key stages 3 and 4, therefore, fitting with their expectations and the levels to which they had learned their subject (although they may not necessarily have learned their subject to the higher level than this). The NQT survey also found that many NQTs are teaching subjects other than their principal or 'specialist' subject and this generally is to key stages 3 and 4 although there are examples of some teaching to key stage 5.

In order to teach to these levels, NQTs were asked (as in previous surveys) to define the level of subject knowledge needed to teach to these levels. Again, as with teacher trainees (PGCE survey), they felt it necessary to be a level ahead of what they were teaching. Some (although small proportions) also considered two levels above to be appropriate – for example, 27% suggested that subject knowledge should be equivalent to key stage 5 in order to teach key stage 3.

Table 20 Subject knowledge needed to teach principal SKE subject to key stages 3, 4 and 5 - NQT Survey 2011/12

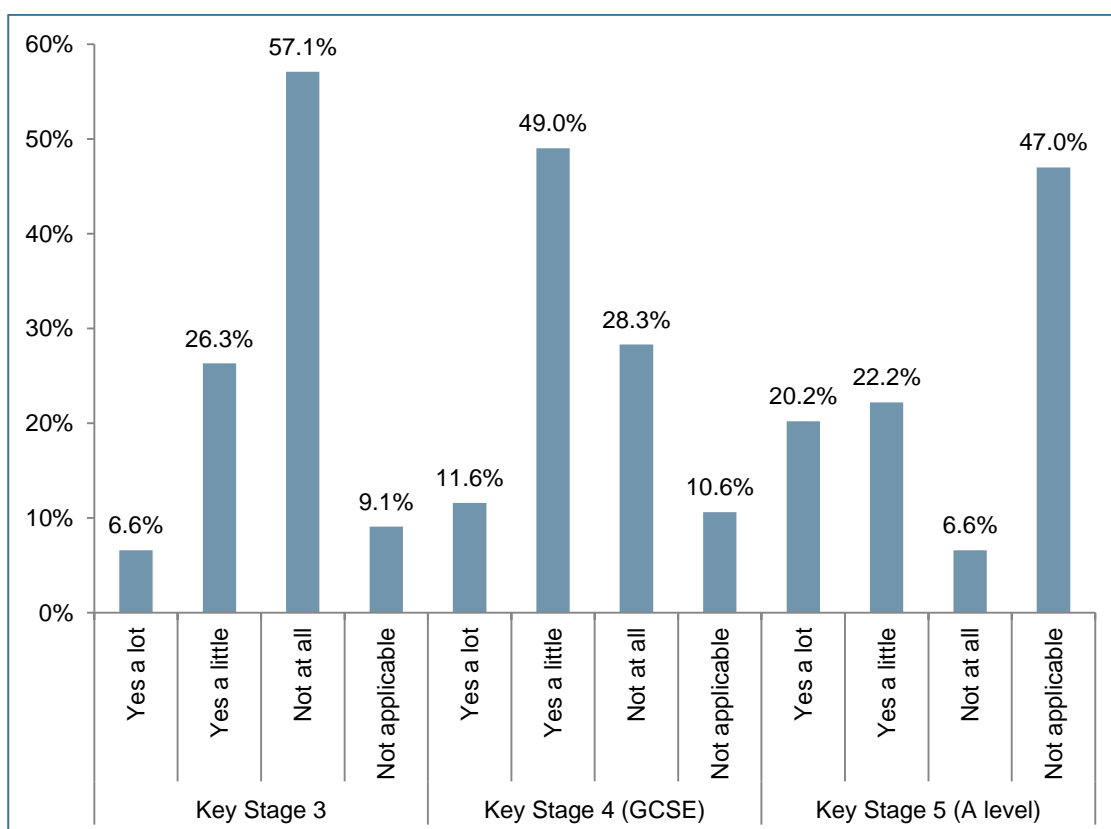
Subject knowledge needed to teach principal subject at.....						
	Key stage 3		Key stage 4		Key stage 5	
	No.	Per cent	No.	Per cent	No.	Per cent
Equivalent to key stage 4 (GCSE)	131	63.6	32	15.5	5	2.5
Equivalent to key stage 5 (A level)	55	26.7	140	68.0	51	25.6
First year undergraduate level or equivalent	11	5.3	22	10.7	83	41.7
Graduate level or equivalent	9	4.4	11	5.3	57	28.6
Postgraduate study level or equivalent	-	-	1	0.5	3	1.5

Exploring subject knowledge levels in the previous chapter and the level of subject knowledge required to teach to various key stages, it is clear that on the whole, most

SKE students felt confident and consider themselves to have subject knowledge to key stages 3 and 4. This however, may not meet with their requirements to be a level ahead of their pupils as many are now teaching to key stages 3 and 4 and some to key stage 5. In addition, their confidence is certainly weaker in relation to teaching their subject at key stage 5.

Further supporting the above, when NQTs were asked if they needed to further develop their subject knowledge to teach to each key stage, nearly 60% did not feel that this was necessary for key stage 3. At key stage 4, boosting subject knowledge appears to be more apparent as nearly half of respondents have found this to be necessary. These include a variety of NQTs, those who previously completed chemistry, mathematics and physics SKE courses (shorter and longer courses) with a variety of bachelor degree subjects and many of them also stated that they had an A level in the subject they now teach. Of those who stated that they needed to develop their subject knowledge 'a lot' (23 students identified), most (61%) were on shorter SKE courses lasting up to three months in duration and 30% were on SKE courses of four to six months; only 9% were on longer courses over six months. For key stage 5, most respondents have selected 'not applicable' which suggests that they do not teach to this level.

Figure 13 The extent to which NQTs have found it necessary to develop their subject knowledge - NQT Survey 2011/12



7.3 Are former SKE students ‘subject specialists’?

In response to findings from previous surveys and discussions within the STEM academic sector, an additional question was posed to NQTs which addressed the term ‘subject specialist’. Whilst there are varying opinions as to how to define a subject specialist, there was an opportunity in this survey to explore whether the NQTs who have been through an SKE course consider themselves to be a ‘subject specialist’. Of the respondents to the survey, two-thirds (67%) classed themselves as a ‘subject specialist’ and one-third (33%) did not. Across the different SKE courses it appears that those with a physics SKE background are less likely to class themselves as a ‘subject specialist’.

Table 21 Do NQTs class themselves as subject specialists? - NQT Survey 2011/12

Would you say you are a subject specialist?								
	Chemistry		Mathematics		Physics		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Yes	13	72.2	85	72.0	28	54.9	68	67.0
No	5	27.8	33	28.0	23	45.1	138	33.0

In the interviews, there were mixed views in terms of SKE students regarding themselves as being equipped to be a subject specialist having completed the SKE course. About half thought it did equip them to be a specialist although not all were confident to teach to A level:

Yes I am in terms of teaching Physics – my subject knowledge is sufficient to teach at secondary level and I would say that I am subject specialist at GCSE Physics (Physics SKE student).

I don’t think I am any worse than someone with a degree for teaching GCSE so I would say yes I am a specialist. At A level the kids would ask more advanced questions so I think someone with a degree would be better placed to teach them – and they would still be specialists (Mathematics SKE student).

Three of the science SKE students interviewed thought that they were not specialists in the subject that they had studied on the SKE but in the subject they had studied at degree level, such as biology.

In Chemistry no I wouldn’t. The SKE course gives you the opportunity to access your knowledge and pick up what you need to know. I think

the definition of Subject Specialist is someone who understands the subject knowledge to a depth not just to teach it but be able to explain it in a variety of ways and with different teaching methods. At the moment I would only be able to reach half the class but with the PGCE and then the NQT I might be. Having said that I could be a subject specialist in Biology as that is more in my background and what I want to teach. (Chemistry SKE student).

Of those students who didn't see themselves as a subject specialist they thought that they may develop into one with further experience:

I could talk about the GCSE and A level syllabuses and know what I was talking about but I wouldn't have the in-depth knowledge you need to be a specialist; maybe after a couple of years teaching practice I might be. (Chemistry SKE student).

Those on the PGCE course thought similar in that there were mixed views. Just over half of those interviewed, who were former SKE students, considered themselves to be subject specialists. Some science former SKE students indicated that they would be a specialist in their main subject but not a specialist in the other two science subjects they would be teaching. Others thought different:

I'm not a specialist I'm a teacher of maths, but not a specialist (Former SKE PGCE mathematics student)

I'd truthfully say I'm not a specialist as it's not my vocation, that's how I define it (Former SKE PGCE mathematics student).

To be a subject specialist you have to have a pure degree, spend years in research understand the application of that knowledge and have experience the subject in the real world (Former SKE PGCE chemistry student).

Of the non-SKE PGCE students interviewed, about half considered themselves to be subject specialists;

To be a subject specialist I would think it would have to be someone with a single honours degree in that subject (non-SKE chemistry student).

During discussions, some former SKE students talked of being a subject specialist in terms of having the depth of knowledge to teach the subject to appropriate levels. For many, it was not just the level of knowledge that was important, but the ability to teach the subject too.

I would say yes I am. It is about creating a depth of subject knowledge and having a great knowledge of application, whether you have a degree or not. Those with a degree will have the depth of subject knowledge but it will not be relevant to what they will be teaching in school and they won't have the knowledge of application that we covered on the SKE course (NQT mathematics).

This was supported by many tutors. Most of the tutors described the students as being equipped to be subject specialists once they had completed their SKE courses and to have gained sufficient knowledge in their subject specialism to teach at a higher level than needed. They defined it in terms of not just their subject knowledge but in relation to their ability to teach it and at the right level in school. One tutor provides a definition of what she/he understands by the term in relation to their students:

I am on the General Council of the ATM and we recognise them as subject specialists. We teach them to think like Mathematicians; it is not about having a degree in maths it is about having the depth of subject knowledge and applying different skills to solve problems (Senior Lecturer, mathematics).

Most of the tutors thought that the SKE students compared favourably with traditional entry trainees once they had completed their course:

SKE students are significantly better mathematicians than those with a degree. We get people with a good maths degree whose maths in my view is very poor but by the time they have been teaching for a couple of years it levels out, but I would say they are specialists if they have studied to the level required to teach in secondary schools (Senior Lecturer, mathematics).

In addition to NQTs classing themselves as 'subject specialists', the majority (74%) of NQTs also felt that their colleagues would also class them as 'subject specialists'. This was confirmed by the small number of NQT colleague interviewees. One colleague reported that it was impossible to have a Physicist, Chemist and Biologist in each school, therefore they looked upon their NQT as a subject specialist, *'I have reserves about calling them that but in reality it is an interest in the subject that leads the way'*.

Another respondent felt that it was more important for the NQTs to be a good teacher rather than have someone with a first degree in a relevant subject and went on to add that, *'we have to view them as subject specialists as we are trying to have a specialist in each of the sciences at Yr. 10'*.

For a small number of respondents being considered a subject specialist depends of the length of previous training in the subject along with their previous background and qualifications; *'a two week SKE course is not going to turn out subject specialists unless they have a lot of the subject in their degree and used it in their career'*.

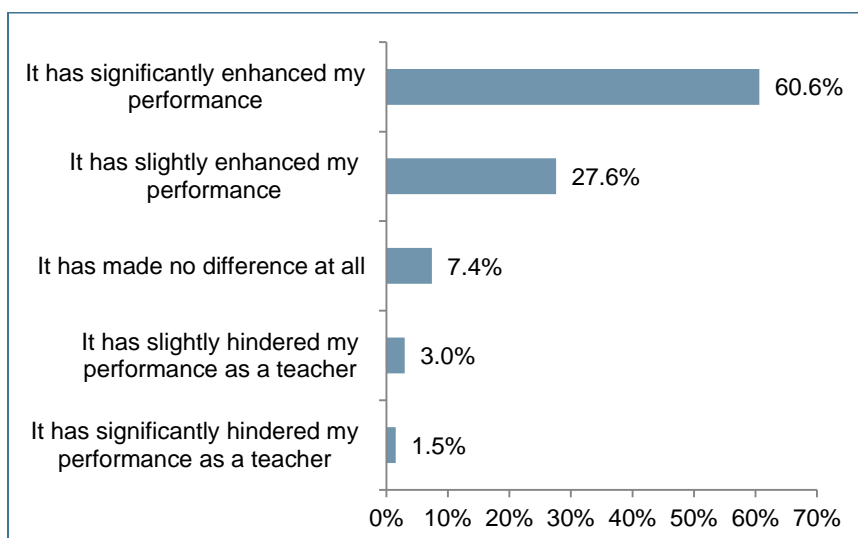
One respondent whose NQT teaches at key stage 3 agreed that they consider them to be a subject specialist, *'because of the SKE course they have confidence in their subject, are competent in getting that knowledge across and understood in the classroom that to me is a subject specialist'*.

Generally therefore, many teacher trainees class themselves as subject specialists because they feel they have the level of subject knowledge and confidence in their abilities to be able to teach to required levels. When discussing subject specialism they tend to relate this to their subject knowledge and ability to teach the subject rather than having subject knowledge per se. They are therefore referring to having specialist subject knowledge for teaching their subject. Many tutors have expressed similar opinions, suggesting that the subject knowledge is used in an applied manner – what could therefore be referred to as 'applied subject specialism'. Some students thought differently however, in that subject specialism relates to greater breadth and depth of subject knowledge enabling them to teach at higher levels and dealing with more complex concepts. This is in line with the more traditional sense of subject specialism which relates to specialist degree graduate knowledge and is therefore differentiated from applied subject knowledge required for teaching.

7.4 Satisfaction and impact for those in teaching positions

NQTs have reported clear advantages to completing the SKE course, such as updating subject knowledge, increasing confidence in the subject and allowing time to focus on the subject. Much smaller proportions could identify disadvantages, such as additional time and costs involved in training (such as travel costs and costs of materials). Overall, however, there was overwhelming satisfaction with the SKE course and 99% of NQTs were pleased that they had completed it (just 3 were not pleased). Nearly two-thirds (61%) of NQTs said that the SKE course had significantly enhanced their performance as a teacher and 88% said that it had either slightly or significantly enhanced their performance.

Figure 14 Impact of SKE courses on NQTs' performance as a teacher - NQT Survey 2011/12



Overall, NQTs seem to be satisfied with their SKE experience and with how it has prepared them for teaching their specialist subject. In addition, 71% of NQTs also thought that there was no other way that the SKE course could have helped to better prepare them for teaching. A smaller proportion (29%, 60) said there were ways that the SKE course could have better prepared them for teaching. Their suggestions were:

- Spending more time on higher levels such as key stage 5 (also a small number suggested focusing on basic knowledge for keys stages 3 and 4).
- Covering the three sciences to some extent rather than one.
- Covering pedagogy and how to teach particular topics.
- More practical experience and more time in the school environment.
- Including ways to explain concepts, particularly to pupils with additional needs.

When NQTs were interviewed, more than half thought that they were well enough prepared for the first year in teaching but many referred to needing more preparation and support in particular with management of behavioural issues which they didn't feel had been covered sufficiently in their training. Several said they were prepared and confident with their subject knowledge but would have liked more preparation with issues such as marking, lesson planning and how to manage the first two weeks in school:

NQTs provided their responses to questions around the extent of impact that the SKE courses might have more generally. There were four key themes for NQTs to consider and rate impact against. These are summarised below.

- **How quickly they gained employment as a teacher** – although most (55%) rated impact as neutral, there were 41% who felt that SKE courses had had a positive impact (slight or significant positive impact)
- **The type of role they took** – as above, most (52%) were neutral on this. Another 43% however, felt that the SKE course had helped them to gain the type of role that they were now in (slight or significant positive impact)
- **Their aspirations and goals** – responses were more evenly spread between no impact (37%), slight positive impact (36%) and significant positive impact (24%).
- **The extent to which they were achieving their aspiration and goals** – most NQTs felt that the SKE course was having a slight or significant positive impact on the extent to which they are achieving their goals (67%).

Overall, it seems that SKE courses have had a positive impact on a range of outcomes after completing teacher training. Indeed, the majority of Beginning of Course students spoke positively about their experience of doing an SKE course in terms of being much better equipped with better level of subject knowledge and for some ideas and strategies of how to teach the subject in the classroom. There was

an overwhelming sense that having done the course would place them in a much better position for going on to a PGCE, and some felt they would be better placed than those who had studied the subject at degree level - as their knowledge would be more grounded and applicable to school level. They thought that the SKE course provided:

- Familiarity with the syllabus and curriculum.
- Subject knowledge - the right content and level.
- Practical experience in the classroom and experience with pupils.
- A network of people in a similar position.

Section 9 explores further the impact on those in teaching positions.

7.5 Summary and conclusions

- At the PGCE stage, the majority of students felt that in order to teach effectively they needed to be equipped with a level of subject knowledge at least one level higher than they would be expected to teach. Most PGCE students thought that they would be expected to teach to key stage 3 and key stage 4 once they had completed their NQT year although a quarter thought they would be expected to teach to key stage 5. This was similar to that of NQTs' expectations for teaching once they had completed their training. These were regardless of background of students.
- In terms of levels of confidence, the majority of PGCE students felt confident to teach to key stage 3 and key stage 4 but less so to key stage 5.
- This was mirrored at the NQT stage although at key stage 5 their responses were more varied.
- Factors that helped their confidence included familiarity with content and experience of teaching at key stage 3 and key stage 4. Reasons given for lower confidence levels were the need for more practical/teaching experience and training at this level, lack of knowledge on specific topics or not having enough grounding in the subject (i.e. no specialist degree or A level) which presented them with gaps in their knowledge.
- Most NQTs were teaching to key stage 3 and key stage 4 which fitted with their expectations and levels that they had trained for; and most NQTs thought that they should be at least one level ahead with a small proportion indicating the need to be two levels ahead in order to teach effectively.
- In terms of developing their subject knowledge further, just under two-thirds of NQTs did not consider it necessary to boost their knowledge to teach at key stage 3 but nearly half of all respondents thought they needed to do so for key stage 4. This can be an indication about their levels of confidence in knowing their subject as well as the need for greater depth of knowledge.
- Two-thirds of NQTs who completed an SKE course considered themselves to be subject specialists with those coming from a physics SKE background the least

likely to do so. The majority also thought that their colleagues would class them as such. Indeed, many SKE students, PGCE students, NQTs and tutors considered former SKE students to be subject specialists, however, they defined this term in relation to having the depth of subject knowledge to be able to teach at various levels in schools. Others had alternative views in that subject specialists were those with greater depth and breadth of subject knowledge such as specialist subject graduates.

- There was overwhelming satisfaction with the SKE course - 99% of NQTs indicated that they were pleased that they had completed the course and two-thirds specifying that it had significantly enhanced their performance as a teacher. The advantages included the opportunity to update subject knowledge, boost confidence in the subject and to have time to focus on the subject. There were also a few disadvantages raised but by a much smaller number of students, including the impact of having additional costs of the time and money spent (e.g. on materials and travel) whilst attending the course.
- The NQTs were asked to provide suggestions for improving the SKE course; these included more focus on the different levels (i.e. some specified that they would have liked the opportunity to cover more subject knowledge at a higher level, key stage 5; more input on all three sciences; more pedagogy and practical experience in the school environment; and more instruction and guidance on difficult concepts, particularly for those with additional needs.

8. SKE vs. Traditional Entry Teacher Trainees

One of the objectives of the evaluation was to investigate any differences between traditional entry and SKE candidates during all stages of becoming a teacher. In previous chapters, comparisons have been made between former SKE students and traditional route teacher trainees in terms of their confidence in their specialist subject, levels of subject knowledge and preparation for the PGCE and teaching careers. In summary:

- Former SKE students and traditional route teacher trainees, at the PGCE stage, rated their levels of confidence in their subject very similarly. There were only slight differences in some specific ratings. Higher proportions of former SKE students rated their confidence as 7 and higher proportions of traditional route teacher trainees rated their confidence as 10, suggesting that there may be a tendency for former SKE students to be a little less confident in their subject knowledge.
- At NQT stage, traditional route teacher trainees were more likely to rate their confidence to teach their specialist subject at higher levels than former SKE students. This pattern is especially noticeable when considering how confident they felt to teach to key stage 5.
- Just 48% of former SKE students rated their subject knowledge as above or well above average compared to 70% of subject graduates. This suggests therefore that those who had previously completed an SKE course perceived their subject knowledge to be weaker in comparison to their colleagues.
- Most former SKE students, during their teacher training, felt their level of subject knowledge was equivalent to level 5 (A level) and when comparing former SKE students with traditional route teacher trainees, there is a marked difference. Much higher proportions of former SKE students considered their subject knowledge to be to A level standard whereas traditional route teacher trainees (subject graduates) were much more likely to rate their subject knowledge as equivalent to graduate and postgraduate levels. This is in line with findings from years 1 and 2 of the evaluation.
- Those from former SKE backgrounds seemed to rate their progress slightly higher than their subject graduate counterparts – 45% of former SKE students rated their

Case Study: Peter (20-25) Chemistry SKE student.

- Peter's PGCE course focused on secondary science with a chemistry specialism (11-18) – he felt that after the SKE course, he was more prepared to teach than some of the candidates who had gone straight onto their PGCE after graduating from university. He felt that SKE gave the '*context*' of teaching the subject, which then helped when developing practical teaching skills on

progress as above average or well above average compared to 34% of traditional route teacher trainees.

- Most PGCE students expected to teach their chosen subject at key stage 4 and key stage 3 once they had completed their NQT year, although over one-quarter also expected to teach to key stage 5. The background of students (former SKE or not) didn't seem to make a great deal of difference to these expectations.

Respondents to the surveys and interviews were specifically asked to consider the differences between former SKE students and those who had entered teacher training after completing specialist degrees. There were two key areas that were considered; levels of subject knowledge and preparedness for the PGCE. These are explored below.

8.1 Comparing subject knowledge

The End of Course, PGCE and NQT surveys asked respondents to consider if there were any differences in subject knowledge between students who have completed an SKE course and those who enter teacher training with a specialist degree (traditional route teacher trainees). This was an open response question and respondents were free to offer any comments or thoughts. Similar questions were asked in the interviews with all types of respondents. The findings of these questions very closely mirrored findings of the first and second years of this evaluation and as such the following provides an insightful summary across the three years:

- SKE respondents thought that they had **up-to-date subject knowledge which is more relevant to the school curriculum** and which enabled to better relate/explain/understand pupils' needs and understand misconceptions or areas children struggle with.
- A significant proportion of SKE students acknowledged that **those with a specialist degree had more subject knowledge but that this did not always translate into knowing the basics**. They thought they may be better equipped to teach to a higher level although may find it difficult to 'dumb down', whereas the SKE students are better at the level to be taught in schools.
- Around a third of SKE students interviewed thought that **those with a degree would have a more in-depth grasp of subject knowledge which may equip them to be more able to teach to A level**; and also in terms of stretching children and potentially in answering more difficult complex questions – however some thought that some of this knowledge maybe '*surplus to what's required in schools*'. One student commented, *Clearly a student with a specialist degree should be more knowledgeable and experienced in the subject than a student with just an SKE course qualification. This would not necessarily make the student with a specialist degree a better teacher. However, if all other things are taken to be equal, the student with a specialist degree should be better able to prepare the content of lessons, stretch more able pupils, and generally share broader insights and contexts to motivate pupils. I think SKE students may well have a lower level*

of subject knowledge than someone with a degree in maths. However, they will potentially have a much greater depth of GCSE subject knowledge and be able to answer all the little 'why' questions from students.

- The majority of End of Course respondents thought that they were **better prepared for the PGCE as a result of completing the SKE course** but they thought that the degree students were likely to be more confident in their subject knowledge as they had studied in greater detail.
- PGCE students who had completed an SKE course felt they were equipped with **better subject knowledge** compared to those with a specialist degree in terms of having a wider range of topics relevant to the school curriculum and which was up-to-date, having a better understanding of misconceptions and the topic areas that pupils could struggle with, understanding the topics/learning from the pupils' perspective, having knowledge which enables them to pitch at the right level and having the knowledge to teach all three sciences in school.
- PGCE students felt that **those with a specialist degree had greater depth and breadth of subject knowledge** which in turn can help when answering complex questions; also in terms of being confident in teaching at key stage 5 and A level. They also felt that traditional route teacher trainees (subject graduates) had a better grasp of underlying principles and complex concepts of subject; *SKE students know 'how to' whereas graduates know the 'why' as well.*

In line with the above findings from the survey, most of the SKE End of Course interviewees thought that having completed the SKE course they would compare favourably with students on the PGCE with a specialist degree (as an example, refer to Case Study 2, Ellie, in Appendix 1). They gave the following factors to justify their responses:

- They had the advantage of having 'real life prior experience' having been in industry or previous employment which they saw as bringing wider experience to teaching through everyday life examples.
- Several students thought that having a specialist degree did provide students with a more in-depth and deeper knowledge of the subject but that it may not necessarily be relevant to teaching the school curriculum whereas the SKE students' knowledge equipped them to do that.
- Some of the students thought that due to their having recently learned and sometimes struggled with new concepts and subject knowledge, this gave them an empathy with the pupils and they would understand pupils' difficulties and be better able to support them in their learning because of it.

The survey findings were supported by interviews with a range of other respondents (e.g. PGCE students, NQTs and NQT colleagues), in that many felt that whilst SKE students might have subject knowledge that is relevant to the school context, it was acknowledged that traditional route teacher trainees were likely to have deeper and broader subject knowledge which is suited to teaching to higher levels.

[SKE students] do not have as much depth of subject knowledge as someone with a specialist degree but at key stage 3 and key stage 4 we would be comparable' (Former SKE chemistry PGCE student).

In addition, one NQT colleague mentioned that because many SKEs had a previous career, this enabled them to hone their people and communication skills and through the SKE course were able to refresh their subject knowledge and access a route into teaching.

Tutors thought that former SKE students were well prepared in terms of subject knowledge; the curriculum would be fresh in their minds and with their experience on the SKE they had observed their tutors' teaching skills and were likely to be aware of newer methods and different approaches to teaching. There was a general view that the subject knowledge of the SKE students was more related to school-level subject knowledge rather than at a higher level related to a degree in the subject. Most tutors thought there was little difference between the two sets of students in terms of knowledge of how to teach the subject, although they acknowledged that the SKE students may have a greater awareness of newer methods and approaches and a better understanding of concepts.

8.2 Comparing preparedness for the PGCE

The majority of End of SKE Course and PGCE survey respondents thought that completing an SKE course made students better prepared than specialist degree students for the PGCE – common reasons for this are presented below. Some of these reasons relate to the design and delivery of courses, for example, where students gain practical or school experience or gain experience in subject-related pedagogy – aspects of delivery that do not feature in the original design of the SKE programme overall:

- SKE being a **step towards a PGCE** as it includes developing subject knowledge and practical work. *We have just been taught it in really imaginative ways so have lots of ideas to hand. Also we have done some peer-teaching and worked several days in school so have lots of experience. The practical experiences also included: Spending time doing school observations; conducting practical experiments (lab work).*
- Being **better prepared for what to expect on the PGCE and its demands**. *SKE course students have a clearer idea of what the PGCE course is going to be and can take advantage of the summer studying, revising and organising resources.... I think students who have done the SKE course will have a greater awareness of the demands that are going to be put on them in the PGCE year*
- **Familiarity with content** and practical's and doing laboratory work and familiarity with the curriculum, exam syllabuses etc.
- **Gaining experience of a range of teaching methods**, how to teach/pedagogy which provided them with the ability to break topics down, understanding

misconceptions that pupils may have and what they may struggle with – understanding from the pupils’ perspectives.

- Gaining more **insight into workings of a school**.
- Having a **wider grasp of science subjects** and coverage of more than one subject.
- Building up a **bank of resources** and materials.
- Being **familiar with the tutors, the institution**, style of working, writing academic essays/assignments, putting together portfolios, receiving feedback. Being more prepared for academic work.
- **Sharing of ideas and experiences** with other students and establishing a student support network/peer support (refer to Case Study 7, Bridget for an example of how a support network can be helpful).
- Having **previous life experiences** and being committed to teaching as a career. *Most SKE students come to teaching after several years' life experience while for many graduates teaching is just the next logical step immediately after university. I think a lot of SKE students will have thought a good deal more about whether teaching is actually their vocation.*

Case Study 6, Suzie (refer to Appendix 1) illustrates how an SKE student can value how an SKE course can prepare them for PGCE training. However, several respondents thought that specialist degree students were advantaged and more prepared in planning lessons and teaching to higher levels such as key stage 5 due to their greater depth of subject knowledge and confidence in their subject.

Whilst there were differences identified between the two routes into teaching during the surveys and interviews, several of the PGCE and NQT interviewees did not consider there to be significant differences, particularly in terms of gaining employment, although a few commented that they thought it was easier for those with degrees as they may have more confidence in their subject and more in-depth knowledge.

Most SKE tutors interviewed thought that the SKE students were better prepared at the start of the PGCE compared to traditional entry trainee teachers. This was noted in terms of being more confident, having the advantage of having the subject ‘fresh in their minds’ and relevant to the curriculum, having current experience of the academic environment and submitting academic work, keeping a portfolio, a clear understanding of what level is required to teach in classroom, and experience in schools and of the curriculum (refer to Case Study 8, Adrian, for further details). However, the predominant view was that if there were any differences that they tended to even themselves out during the year and that there was no difference when it came to gaining employment. *‘SKEs start off by being stronger but as the year progresses it evens out but I would say that some of our very best students are SKE’* (Mathematics tutor).

SKE and PGCE as an integrated course

Whilst most former SKE students felt that some kind of subject knowledge enhancement would be of benefit to most students, there was no consensus of opinion that completing an SKE course before a PGCE should be compulsory for all – particularly for those who already had a degree in the subject or previous relevant experience. Some thought it might even put people off applying to go into teaching if it was compulsory. Of those who did think the integration of the two courses to be a good idea, they thought there were clear benefits which everyone would gain from such as being better prepared for the PGCE including refreshing subject knowledge, knowledge of the curriculum, increasing confidence and developing a support network.

Of the non-SKE students about half thought combining the two courses would be useful but thought it should remain optional. They also thought that additional costs of training (materials, travel costs etc.) and the extra time would be an issue even if they were able to gain from it.

Several tutors commented that having the two courses combined had been how the early version of SKE had started out at their institution as part of a two year PGCE. However, they had concerns in terms of having an extended PGCE now and were in favour of more flexibility; they thought that degree students would see it as not necessary and would be put off by the financial implications of doing two years.

8.3 Summary and conclusions

- Whilst there was little difference in terms of levels of confidence in their subject at the PGCE stage, at NQT stage traditional route teacher trainees were more likely to rate their confidence at higher levels especially for teaching at key stage 5.
- Nearly half of former SKE students considered their subject knowledge as above or well above average for the PGCE compared to nearly two-thirds of traditional route trainees. In terms of levels of knowledge there is a marked difference with former SKE students indicating their level of knowledge was more likely to be at level 5 compared to traditional route trainees who were more likely to rate their knowledge as graduate or postgraduate.
- A third of SKE students thought that the more in-depth and higher level subject knowledge that traditional route trainees held could better equip them to teach at A level. However, when comparing subject knowledge, the SKE respondents thought that their knowledge was likely to be more up-to-date and relevant to the school curriculum than their traditional route counterparts.
- At the end of the SKE course, the majority of SKE respondents thought they would be better prepared for the PGCE course than traditional route students but that the latter would have more confidence in their subject knowledge.
- Those from the SKE route rated their progress on the PGCE higher than traditional route trainees.

- Most PGCE students expected to teach their chosen subject to either key stage 3 and/or key stage 4 once they had completed their NQT year. There was little difference between the two sets of trainees.
- PGCE students who had previously taken an SKE course felt that, compared to traditional route trainees, they would have better and more relevant subject knowledge as they would have knowledge of the curriculum and a better understanding of misconceptions and topic areas that pupils struggle with, the ability to pitch at the right level and ability to teach all three sciences in school.
- PGCE students thought that those with a specialist degree would have greater depth and breadth of knowledge which would help with answering complex questions, teaching to a higher level and they would have a better grasp of complex concepts and underlying principles.
- The majority of respondents from the SKE courses and PGCE courses thought that completing an SKE course helped to better prepare students for their teacher training. The main reasons provided were that they would be more prepared for the demands of the PGCE course; more familiar with the curriculum, doing practical sessions and laboratory work; have some experience of teaching methods and insight into school practices; build up a bank of resources; build a network of support and be familiar with the institution and tutors and style of working; and have a wider grasp of the three science subjects taught in schools.

9. Meeting the Targets for Mathematics and Science Teaching in Schools

This section of the report explores the final evaluation criterion of how effective SKE courses are in meeting targets for mathematics and science teaching in schools. Whilst the evaluation has progressed, there have been a number of changes within teacher training and education policy. While the 2014 targets might not necessarily be driving policy work directly, there remains an ambition to ensure that the best chemistry, mathematics and physics teachers enter classrooms, of sufficient quality and quantity. Therefore, this evaluation has continued to include the objective around supply of teachers. The analysis has however, broadened to include a wider range of issues that relate to how the SKE course might contribute to the improved supply and quality of future science and mathematics teachers. This chapter therefore, explores the following issues:

- Advantages and disadvantages of the SKE course and satisfaction levels.
- Motivations for teaching, choosing the specialist subject and SKE course.
- Career aspirations of students and whether these have changed as a result of the SKE course.
- Enhancing employment prospects and gaining a teaching post.
- Awareness and perception of SKE courses.

9.1 Advantages and disadvantages of the SKE course and satisfaction levels

Those who had been through the SKE course could clearly see many advantages to completing the course. Indeed, when presented with a list of potential advantages, all were popular responses. As can be seen in the table below, common advantages were seen to be around improving subject knowledge and confidence in the subject. Note that the percentages in the table below appear low because respondents could select as many advantages as they preferred.

Case study: Bridget (26-30) Chemistry SKE student.

Bridget has always been interested in teaching as a career...Bridget has a degree in geology and an A level in chemistry. Her first career was as an engineer in a geo-technical company but when she had the chance to take redundancy she did so, which then enabled her to pursue her ambition in teaching. Bridget was offered the SKE course when she went for her PGCE interview; it was suggested as it had been twelve years since she did her A level. She felt it would have been more difficult to do a PGCE without the SKE course and could have put her off the PGCE completely.

Table 22 Top 2 advantages of completing the SKE course - BoC, PGCE, NQT surveys 2011/12

Beginning of SKE Course	PGCE	NQT
Better prepared for the PGCE (16%)	Increasing subject confidence (14%)	Updated subject knowledge (14%)
Adequate subject knowledge to teach to GCSE level (16%)	Updating subject knowledge (13%)	Increased subject confidence (14%)

In terms of disadvantages, a significant proportion (around half of all survey respondents) felt that there were no disadvantages to completing the SKE course. Where disadvantages were mentioned, these related mainly to additional time and costs (such as travel costs and costs of buying study materials) involved in training and the workload involved.

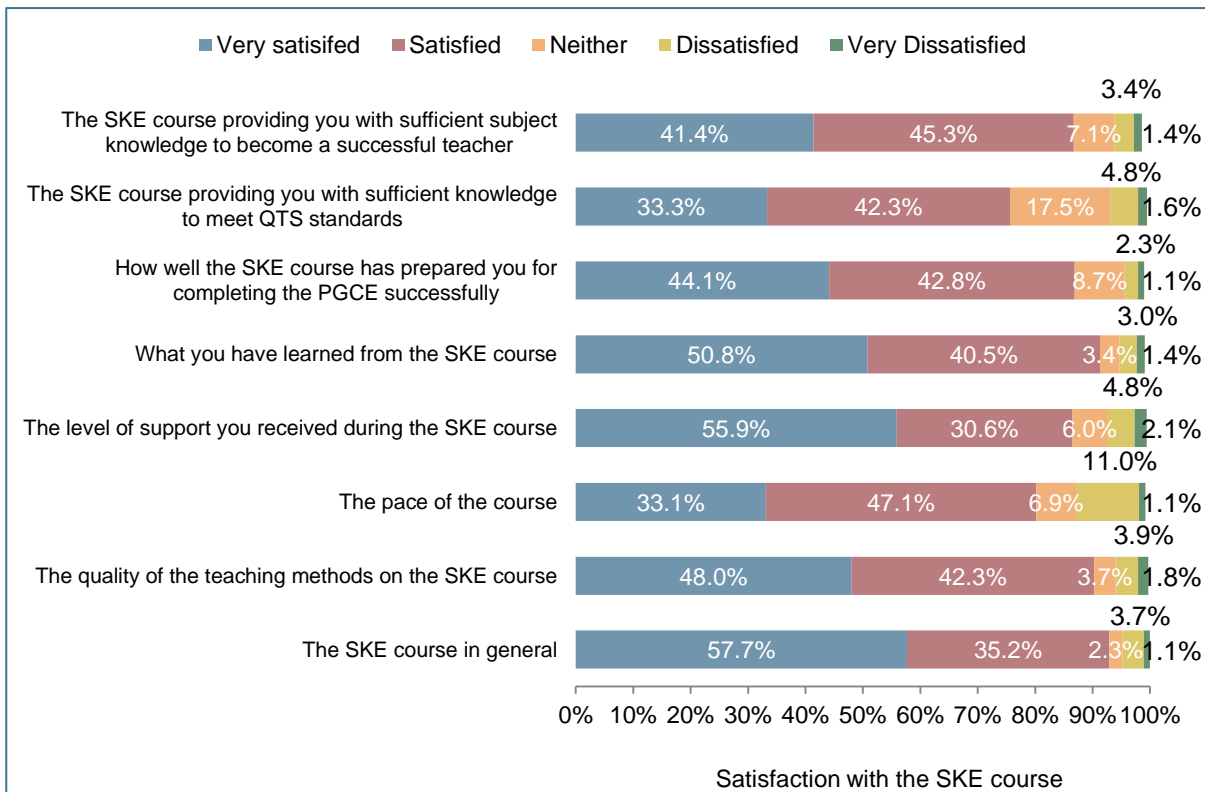
Even though some disadvantages were mentioned, a significant proportion of respondents were clear that the SKE course was a worthwhile experience:

- 98% of SKE students felt that completing the SKE course was a worthwhile experience.
- 97% of PGCE students said that they were pleased they had completed an SKE.
- 99% of NQTs stated that they were pleased they had completed the SKE course. Only 3 respondents were not pleased.

Supporting the above findings, there were also high levels of satisfaction with the SKE course - 93% of students at the end of their SKE course were either very satisfied or satisfied with the SKE course in general:

- 90% were very satisfied or satisfied with the quality of teaching methods.
- 80% were very satisfied or satisfied with the pace of the course.
- 87% were very satisfied or satisfied with the level of support received.
- 91% were very satisfied or satisfied with what they had learned from the course.
- 87% were very satisfied or satisfied with how well the course had prepared them for completing the PGCE successfully.
- 76% were very satisfied or satisfied with being provided with sufficient knowledge to meet QTS standards.
- 87% were very satisfied or satisfied with being provided with sufficient subject knowledge to become a successful teacher.

Figure 15 Overall satisfaction with the SKE course - End of Course Survey 2011/12



Given that there were many perceived advantages of the SKE course and that the majority who had been through the course thought that it was a worthwhile experience, it is interesting to consider whether the SKE course might have been useful for others. Of the 80 PGCE students surveyed, the majority (70%) said that they did not complete an SKE course because they had already studied their PGCE degree subject to degree level and did not need any subject knowledge enhancement and therefore, two-thirds of these PGCE students felt that it would not have been a worthwhile experience. The majority of respondents felt that their subject knowledge was sufficient either because they had previous qualifications in the subject, experience in industry or had recently finished training/education in school.

I feel this would have been a waste of time for me as I had just completed A Levels and a degree in the subject I wanted to teach so had proved my ability in the subject.

However, a further 39% would have liked to have had the opportunity to complete an SKE course and this was due to the:

- Need to refresh subject knowledge or gain more in-depth knowledge.
- Length of time since being in secondary education.
- Lack of familiarity with GCSE and A level curriculum.
- Benefit of gaining more confidence.
- Need to become familiar with the process of learning again.

- Benefit of having more practical experience in the classroom.

The students who felt that they would have liked the opportunity to take an SKE course were asked whether they felt at a disadvantage. Only slightly higher proportions felt that they were not at a disadvantage. From the interviews with PGCE students who had not completed an SKE course, six out of 8 students commented on how the SKE might have helped them:

- Not in subject knowledge but in *'putting it into context; being able to look at the curriculum and see how it is being taught which I would have found useful'* (Non-SKE PGCE science with chemistry student).
- *'Learning more about particular aspects of the subject e.g. mechanics in maths – some of the A level content'* (Non-SKE PGCE mathematics student).
- Learning more of the curriculum content *'would have helped me with key stage 5 as they covered this – and I wouldn't have struggled at it then'* (Non-SKE PGCE mathematics student).
- In terms of confidence: *'it would have given me more confidence and quicker to deliver my own subject – it would have been like a refresher for me, especially on the A level side, I think I would have been able to hit the ground running far quicker – I was probably more nervous'* (Non-SKE PGCE mathematics student).

9.2 Barriers to enrolment and completion of the SKE course

Although for those completing the SKE course, it seems to have been a positive experience, there were a number of barriers and issues highlighted. The most common barriers which students thought might prevent them from enrolling on the SKE course were thought to be the introduction of course fees (39%) and a reduced bursary (37%). This suggests that enrolment on SKE course may reduce if potential students were faced with the costs of training. By the end of the SKE course, most students (85%) felt that they had not experienced any barriers to completing the course. Of the small proportion who had experienced barriers, 22% noted barriers in relation to support they had received during the course and 15% had noted barriers in relation to funding. Whilst this is open to interpretation, the interviews suggest that this is additional costs of being in training rather than the course costs themselves. Nearly 27% (25) had selected other barriers. Of these, a number of suggestions were made as to what might act as a barrier:

- Workload and fitting the course in with other commitments (e.g. full-time and part-time work).
- Family issues (caring for children and elderly relatives).
- Personal issues such as confidence and communication skills.
- Organisation and timing of courses and lack of clarity on expectations of the course (e.g. assessments).
- Limited formal teaching/contact time and limited time/experience in schools.

In the interviews, the Beginning of Course students spoke positively of their experience and of having no difficulties or barriers in getting on to the SKE course; a small number of students did refer to the following as barriers:

- For two students it was receiving appropriate additional learning support and reasonable adjustments – which resulted in one student leaving and the second having failed their first exams was worried about being made to leave the course.
- One student who got a third for their degree was told they wouldn't be able to have a bursary which would have a serious impact on their financial situation; another had a degree equivalent and had not qualified for a bursary.
- One student spoke about their offer of a place on the SKE course being conditional just in case the provider did not receive the funding/bursaries.

9.3 Motivations for teaching, choosing the specialist subject and SKE course

There were similar reasons cited for choosing teaching as a career across all of the surveys. Most common was the desire to 'make a difference to young people'. This reason stands out well above others as the most popular reason selected during the surveys although it is followed by 'enjoyment of working with young people', 'fulfilment in a second career' and 'always wanted to be a teacher'. These findings replicate findings from the previous evaluation years.

Table 23: Top 3 reasons for choosing a career in teaching – BoC, PGCE and NQT surveys 2011/12

Beginning of SKE Course	PGCE	NQT
To make a difference to young people (30%)	To make a difference to young people (43%)	To make a difference to young people (41%)
For fulfilment in a second career and for the opportunity to influence young minds (28%)	Enjoyment of working with young people (22%)	Enjoyment of working with young people (20%)
Always wanted to be a teacher (19%)	Always wanted to be a teacher (16%)	Fulfilment in a second career (19%)

Beginning of Course interview participants came across as very motivated and indicated that their decision-making had been clearly thought out. These were some factors mentioned:

- The majority of interview participants said that teaching was something they had always been interested in.
- It was a career change for the many; for some it was the timing that differed, sometimes triggered by life events, e.g. redundancy, having children.
- Experience in schools; some had voluntary experience with children, not necessarily in schools, some had working experience in schools – and for some

they had gained some experience prior to making a decision or just to prepare them.

- Several respondents had family members who were in the teaching profession, *I was an accountant but it was not for me; my whole family are teachers, I have been exposed to teaching all my life.*
- Enjoyed working with children; wanted to make a difference.
- ‘Recession-proof’; the impact of the recession influenced some – a guaranteed job, pay and conditions and benefits, were attractive to a number, as was fitting in with family commitments.

In terms of choosing a specific subject to specialise in, again, two common reasons were cited through all the surveys. These were ‘enjoyment of the subject’ and ‘to pass on enthusiasm for the subject to young people’. Although enjoyment of the subject was the most popular response overall within the Beginning of Course survey, looking across the subjects, it was not the highest reason on the list for chemistry and physics students. Having better job prospects seemed to be more important to those on physics SKE courses and for chemistry students, it seems that this subject was a second option as they could not teach their degree subject. The reasons for choosing a particular subject were similar across those who had completed an SKE course and those who had not (PGCE survey). The interviews with Beginning of Course students showed a mix of responses, there were some students who had initially wanted a particular route but had had to re-think for variety of reasons, as stated below.

- For some there was no choice – for some, the course they wanted (PGCE) was full; some had wanted to complete a biology PGCE but were discouraged either because the course was full or because they were advised that career prospects would be better if they chose a different subject.
- It was seen as pathway to getting to be a science teacher – do a second science subject but would equip them better for teaching.
- Always enjoyed the subject and/or did it previously at A level.
- Because it was a shortage subject, they were responding to need and would therefore be more employable and have better prospects.

There appears to be two main reasons suggested by SKE students for enrolling on the SKE course itself. Almost half of the Beginning of Course students (46) noted that it was a condition of their PGCE place and just under one-quarter (24%) felt that their subject knowledge was not sufficient. Technically there should be one main reason for enrolment on SKE courses since the protocols are such that PGCE providers should refer potential students onto SKE courses as a condition of their teacher training place. It is assumed therefore, that other reasons provided by students related to why they accepted the condition or considered it to be a good idea. When comparing across the SKE subjects, similar reasons were provided and their prevalence in the responses (order according to proportion of responses) were similar too. The interviews with Beginning of Course candidates supported this, of the 18 students interviewed, their reasons for enrolling on the SKE course were:

- To top-up/enhance existing subject knowledge/gain more in-depth knowledge, up-to-date knowledge (particularly those who had been out of education for some time).
- It was a condition/pre-requisite of PGCE (the majority said this even though they had other reasons).
- They were advised by PGCE tutors that it would be a good route in to teaching.
- It was seen as a good 'stepping stone' to being a better teacher.

9.4 Career aspirations of students

During all of the surveys and interviews, respondents were asked to consider what their career aspirations might be.

At the beginning of the course, students' aspirations related mainly to middle management positions – 44% aspired to become a head of department. In addition, 36% planned to become a subject teacher in a well-run department and a fair proportion (16%) aspired to become a head teacher.

A similar question was posed at the end of the course although it was split to allow an opportunity to look at short term and longer term goals. It seems that in the short term students are focusing on teaching their subject - in the next 5 years, students hope to specialise in teaching one or more subjects (35%), become a head of department (28%) and specialise in teaching one subject (23). Indeed, when interviewed, most of the students had short-term plans in terms of completing their PGCE course, gaining QTS status and their goal of becoming a 'good teacher'. Very few students had longer-term plans in place – of those that did they talked in terms of perhaps becoming a head of year or head of department. The surveys therefore expressly asked students to think about longer term career plans.

In the longer term, their goals have changed to more senior roles – in the next 10 years, students hope to become a head of department (34%) become a deputy of head teacher (26%) and become a head of year (17%). Most students (76%) stated that their career aspirations had not changed during the SKE course. Of those who thought their aspirations had changed, their aspirations had been consolidated or revised in the following ways:

- Consolidating their motivation to be a teacher and familiarity with school functions and teaching roles.
- Remain in teaching roles rather than managerial ambitions.
- Influenced/inspired by other teachers.
- Change in focus/level/subject.
- Passion for the subject.

PGCE students' aspirations were similar to those found at the end of the SKE course, suggesting that their aspirations had not changed during teacher training. Indeed,

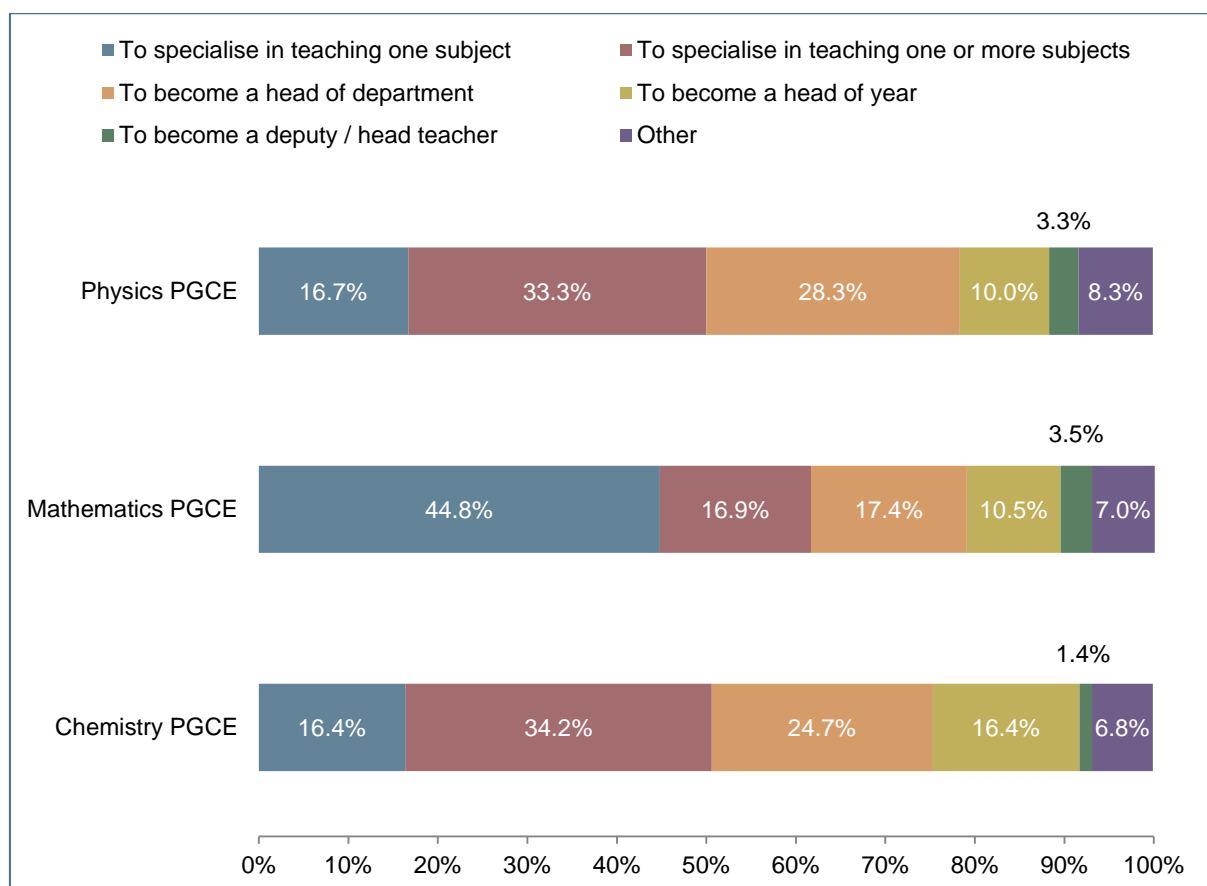
two-thirds stated that their goals had not changed. Of the one-third who had changed their aspirations, this was due to their having completed their PGCE training which had allowed them to gain more experience and understanding of teaching roles within schools.

I didn't realise I thought it was quite tough to move up but now I've realised that there are many opportunities so more of a chance' (Non-SKE PGCE mathematics student).

In the next 5 years, PGCE students were mainly focused on specialising to teach their chosen subject (31%) or two subjects (25%). About one-fifth (21%) aimed to become a head of department. In the next 10 years, career goals were more varied, with more students aspiring to reach management roles such as head of department (25%), head of year (17%) and deputy head/head teacher (13%).

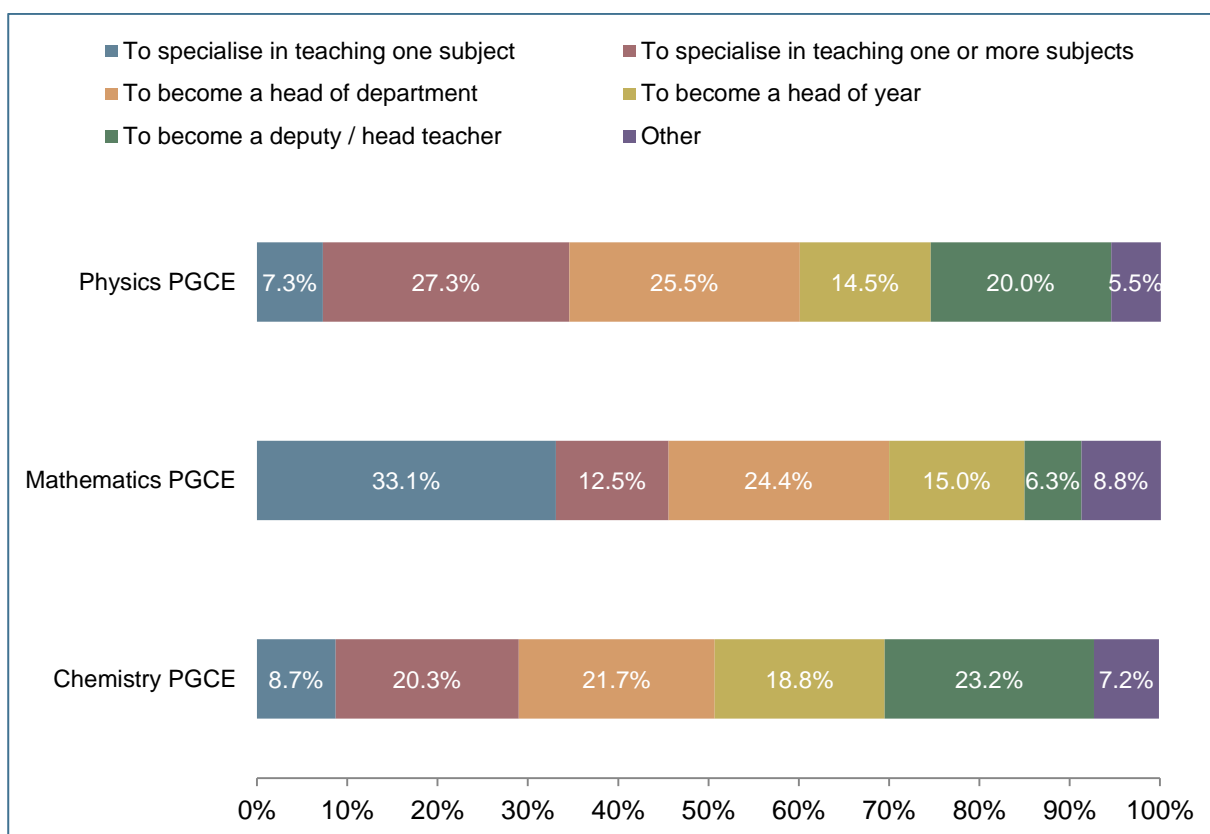
Comparing career aspirations across the subject that PGCE students are training to teach, it appears that much greater proportions (45%) of those training in mathematics are aiming to specialise in teaching one subject and are much less concerned with specialising in teaching more than one subject or managerial/leadership positions. Those training to teach physics or chemistry are more likely to aim to specialise in teaching one or more subjects and to become a head of department.

Figure 16 Career aspirations in the next 5 years by PGCE subject - PGCE survey



Considering longer term goals across the different subject areas that PGCE students are training in, these appear to be much more varied although those training in mathematics are still more likely to aim to specialise in teaching one subject (33%). Some of these students however, also aim to become a head of department (24%). It is notable that fewer mathematics PGCE students (13%) aspire to specialise in teaching more than one subject whilst this is still common among chemistry and physics students. Looking to aspirations in leadership, much higher proportions of chemistry and physics PGCE students aspire to positions of deputy or head teacher within 10 years. Across the three subjects, similar proportions of students aspire to middle management type roles (such as head of department).

Figure 17 Career aspirations in the next 10 years by PGCE subject - PGCE survey



As with previous teacher training stages, the most common aspirations of NQTs for the next 5 years were, to specialise in teaching one subject (30%) and to become a head of department (24%). Another 18% aimed to specialise in teaching one or more subjects.

I want to teach maths to the best of my ability, I don't want to go into management (NQT mathematics).

*I just want to carry on teaching; I have done the management bit in my career.
The work life balance becomes more important as you get older (NQT physics).*

In the shorter term therefore, most NQTs were focusing on their teaching responsibilities. In the next 10 years, the most common goals were to become a head of department (32%) and to become a deputy/head teacher (26%), therefore suggesting that in the longer term, NQTs were considering leadership roles.

Comparing across the different SKE subjects, in the next 5 years, former mathematics and physics SKE students are more likely to aspire to specialise in teaching one subject and former physics SKE students are more likely than those from other SKE courses to aim to specialise in teaching one or more subjects. Note that there are low counts for this question from former SKE chemistry students.

Only a small proportion of NQTs said that their career aspirations had changed since starting their NQT year. These changes were in terms of having higher aspirations to progress and reach leadership roles, due to NQTs now having more confidence and feeling more ambitious, wanting to have wider impact on young people. A small number had changed their mind from wanting to become a head teacher as they preferred to focus on pastoral duties.

9.5 Enhancing employment prospects and gaining a teaching post

This section explores the extent to which those who have been through SKE courses have been able to gain a teaching post, the nature of that post and their role. It goes some way to exploring how well former SKE students have done in entering the teaching profession and being able to specialise in teaching their subject since these relate the overall aims of the SKE programme.

9.5.1 Meeting the objectives of the SKE programme

In relation to this, SKE tutors were able to provide two key factors as the overall purpose of SKE courses:

- To produce the right number of teachers to address the shortage of specialist teachers in mathematics and science; they noted that there was a lack of teachers coming through the traditional route i.e. with a degree in the subject. *'It's to get more specialists in the classrooms'*. (Tutor fellow, physics).
- To get the subject knowledge up to date and address gaps in knowledge of the students who had applied for PGCE but without the required knowledge to go straight on to a PGCE; *'[The SKE] allows you to get people with lots of ability to teach, then give them the subject knowledge up to required level. Physics graduates haven't got communication skills that are needed in the classroom.'*

SKE students have communication skills not subject skills – which we can give them. (Senior Lecturer, Physics).

Almost all of the tutor interviewees thought that the overall purpose of the initiative was being achieved. Many thought that the SKE courses were helping to sustain the supply and quality of teachers required and some thought that there would be considerable difficulties in trying to recruit from traditional backgrounds if there was no SKE. The majority also thought that the cohort of students who come through this route have sometimes additional qualities which enhances their ability to become good teachers. One tutor commented that:

Some of the best teachers come from people who have struggled themselves at some point with mathematics and are therefore more sympathetic and able to relate to those they are teaching (Mathematics Tutor).

At an early stage of their teacher training, most End of Course interviewees were positive about the impact that having attended the SKE course would have on their future with the benefits seen as being helpful in gaining employment and equipping them to teach effectively:

All the skills I have learned from the lab workwithout the SKE I wouldn't even think of applying to be a chemistry teacher...'

Stepping stone to being an effective subject specialist

Helped me get a job by showing I was motivated to update my subject knowledge and learn as much as I can to hopefully make me a better teacher.

Half of NQTs interviewed identified positive impact of the SKE course in terms of:

- Gaining their first teaching post and in helping to achieve their career goals.
- Gaining confidence and opening the door to teaching: *I wouldn't have had the confidence to teach A level without the SKE.*
- Developing a passion for the subject and being better able to deliver a lesson on the PGCE.
- Several students said that their placement schools had subsequently offered them posts.
- Their subject knowledge was *'fresh and current'*.

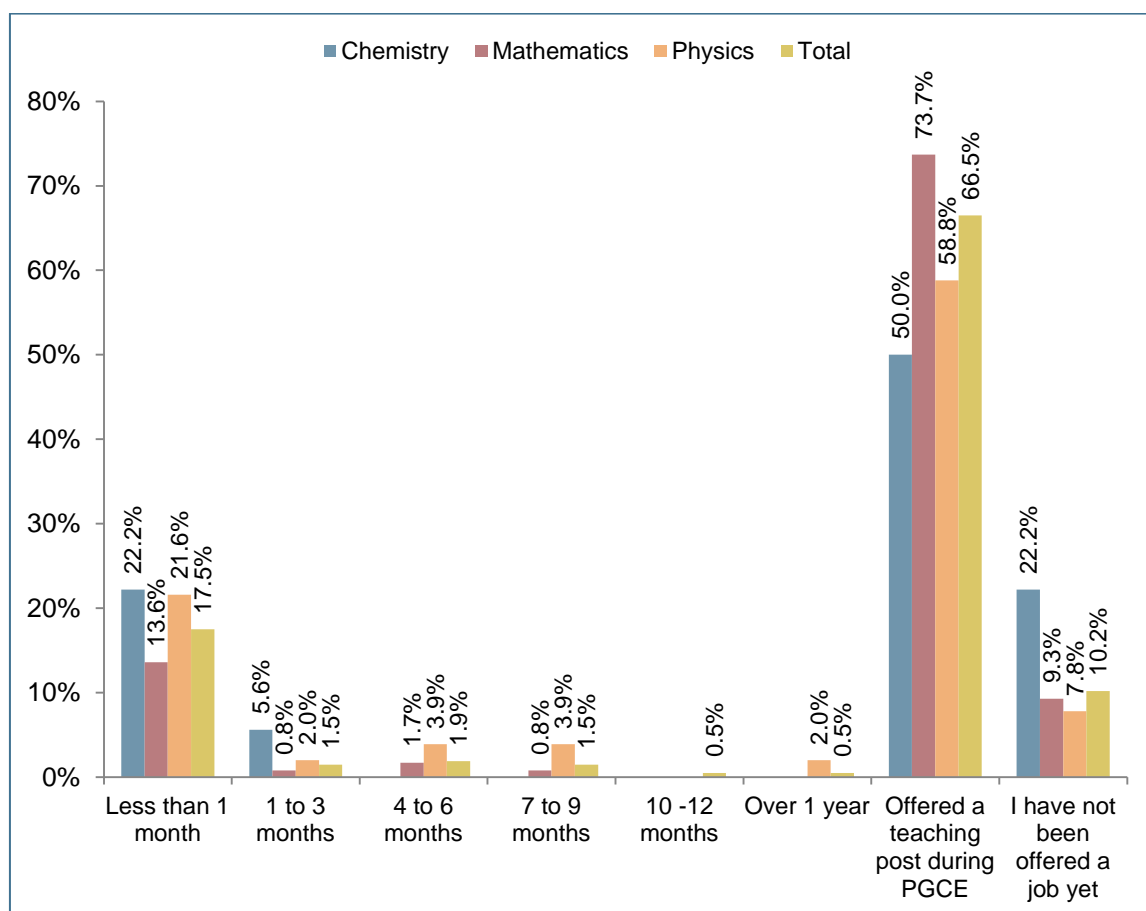
However, one PGCE student in an interview explained how some former SKE students had struggled to find employment, *'a couple of them had struggled when applying for jobs because they didn't have a maths degree or A level maths on paper so they don't look as employable so they were at a disadvantage'* (Non-SKE PGCE mathematics student).

In the main though, struggling to find employment doesn't seem to have been an issue for most former SKE students. Overall, two-thirds (67%) of NQTs said that they were offered their teaching post before completing their PGCE. For others who were

not offered a job at this time, most (18%) had secured a teaching post within one month after completion of their PGCE course. Much smaller proportions had taken between 1 and 12 months to secure their post whilst 10% said that they had not yet been offered a position. Indeed, many former SKE students have noted how they felt the SKE had helped them to gain employment:

SKE has had a positive impact I don't think I would have got my position in my school without it – I don't think I would have got a really good report from my phase 2 school – was teaching across the spectrum, it was really useful, was a great course. (Former SKE PGCE physics student).

Figure 18 Time taken to secure a teaching post since completing the PGCE - NQT Survey 2011/12



9.5.2 The NQT role and performance as a teacher

Most NQTs have taken full-time posts (83%), only 4% said that their role was part-time. Having secured a teaching role, many of these NQTs were based in an academy (40%) and 19% said that they were based in a grant maintained school. A relatively reasonable proportion were working in specialist schools (15%).

The majority (54%) of NQTs are teaching mathematics as their principal subject which fits with the profile of the sample and SKE cohorts more generally. The second

most popular subject NQTs are teaching is general science (14%) and then physics (10%). Only 5% said that they teach chemistry as their principal subject.

Table 24 Principal subject that NQTs are teaching - NQT Survey 2011/12

Principal subject being taught		
	No.	Per cent
Mathematics	112	54.4
General Science	28	13.6
Physics	21	10.2
Other	20	9.7
Chemistry	10	4.9
Biology	8	3.9
Design and Technology	6	2.9
Religious Education	1	0.5

Looking across the subjects that NQTs trained in for the SKE, it appears that nearly all who said that they were former mathematics SKE students (95%) are now teaching mathematics as their principal subject. The other 5% selected 'other' subjects. Those who were physics SKE students now teach a range of subjects as their principal subject - most teach general science (39%), closely followed by physics (37%) and then biology (10%) and chemistry (10%). A similar pattern is found when considering former chemistry SKE students - these are now mainly teaching general science (44%), followed by chemistry (28%), biology (17%) and physics (11%).

When asked directly about the subject they teach, 82% of NQTs said that they now teach the same subject as their principal SKE subject (irrespective of key stage they teach to) - all mathematics SKE students now teach mathematics and some physics and chemistry SKE students have gone on to teach different subjects. Generally, NQTs are teaching their principal subject to key stages 3 and 4. Just over one-quarter of NQTs in the survey are teaching mathematics to key stages 3 and 4, only 9% teach to key stage 5. Physics was a principal subject taught to key stages 3 and 4 by just 1.8% of NQTs. These figures are low in some cases since the question was split across a range of potential principal subjects and three key stages. There are clear indications, however, that many NQTs are teaching a wide range of secondary subjects as well as their SKE subject, mathematics being popular here.

Former SKE students have therefore, on the whole, been able to quickly secure a full-time teaching post and are teaching the same subject as they studied for their SKE, alongside a wide range of other subjects. This success is complimented by the apparent satisfaction that NQTs had with their first year in teaching - 85% of NQTs were either satisfied or very satisfied with their NQT year. Just 4% were dissatisfied or very dissatisfied.

Furthermore, many End of Course students thought that completing the SKE course had a positive impact on their future teaching approach. The main benefits were identified as:

- Confidence, understanding and empathy with pupils having been through the experience of learning and struggling with new topic areas.
- Learning new teaching approaches and different learning styles (although this is not within the overall design of the SKE programme).
- Learning how to include and conduct practical sessions.
- Learning how to present topics simply and clearly, being aware of misconceptions attached to science and making sure pupils understand.
- Gathering ideas and resources e.g. worksheets and presentations – and learning from tutors' different teaching styles.
- Gaining inspiration, enthusiasm and motivation from SKE tutors.

PGCE students had similar positive feedback:

Having gone over the curriculum – ideas of what to teach and new topics, sharing different ways of how to teach and subject knowledge' (Former SKE PGCE mathematics student)

Most importantly it has built up my confidence in the subject. (Former SKE PGCE physics student).

Huge bank of ideas and activities and good working knowledge of how maths is being taught these days (Former SKE PGCE mathematics student).

Also, NQTs could identify several ways in which the SKE course has had an impact on their performance as a teacher:

- Improved confidence in subject knowledge was the most common response.
- Getting into the mode of teaching and making a better teacher: *I would say it has as we were taught the way things should be taught – to look out for misconceptions – the how, the why and other ways of approaching the topic to make it better understood (NQT physics).*
- Learning from tutors who were experienced teachers and being able to reflect on one's own practice: *I think it has made me a more reflective teacher – I can look at a lesson and think was it good or bad, what would I change? – you are more inclined to do that after the SKE (NQT mathematics).*

- Better at delivery – use of resources and notes.
- Can talk more around the subject and ‘*how to think mathematically*’.
- Practical experience including classroom experience, presentations and use of whiteboard etc.

9.6 Awareness and perception of SKE courses

9.6.1 Awareness of SKE courses

Whilst the findings so far have indicated many positives to SKE courses, it has been unclear to date how well informed potential employers and colleagues may be of SKE courses and what they might offer to NQTs and schools as a result. This awareness and understanding of SKE courses could contribute significantly to how effective SKE courses are in helping to supply mathematics and science teachers. If schools are unaware of such courses, which are designed to enhance subject knowledge and allow teacher trainees to specialise in a subject which they have limited previous training in, then it could be limiting their pool of potential employees. To this end, several interviews and the PGCE and NQT surveys explored perceived awareness of SKE courses.

Even at the SKE stage of their teacher training, several students expressed concerns about schools perhaps not understanding what SKE is and that schools may judge them on their degree and not consider them equipped to be a teacher in their SKE subject. One student commented:

It has surprised me but I don't think many schools really understand what SKE is all about. At interview I hope I will be able to explain it but I think the TA need to do more to raise understanding. (Mathematics SKE student).

Some tutors also expressed concern about how schools view the SKE at job interview stage and whether they choose someone with a degree in the subject over someone with an SKE. There was a range of views about how aware schools were; some tutors thought that there was some awareness within their partner schools but that some schools didn't understand it well. One or two tutors commented specifically about independent and selective schools as being a potential issue. There was a concern that these schools would be reluctant to have SKE students on their PGCE placements requesting traditional route teacher trainees (subject graduates) instead.

It varies from school to school. The partner schools which have taken our trainees, PGCE students, and given them jobs, are very much aware and appreciate the students' capabilities. They are not bothered about a degree; they are more concerned about how they teach in the classroom. It can differ with Independent Schools, where they are more protective, as parents don't want to be paying for their children to be taught by someone without a degree. (Senior Lecturer, mathematics).

One tutor said that their partner schools,

'know what to expect from SKE students – they are very confident with the quality of trainees'. However, 'for schools with no experience of SKE students they probably don't understand what kind of qualification these students have got. From the feedback from the students after interview, they get a lot of probing whether or not they have enough subject knowledge – schools are not quite clued in, they are an 'unknown quantity' – it's a lack of knowledge'. (Chemistry/physics Tutor).

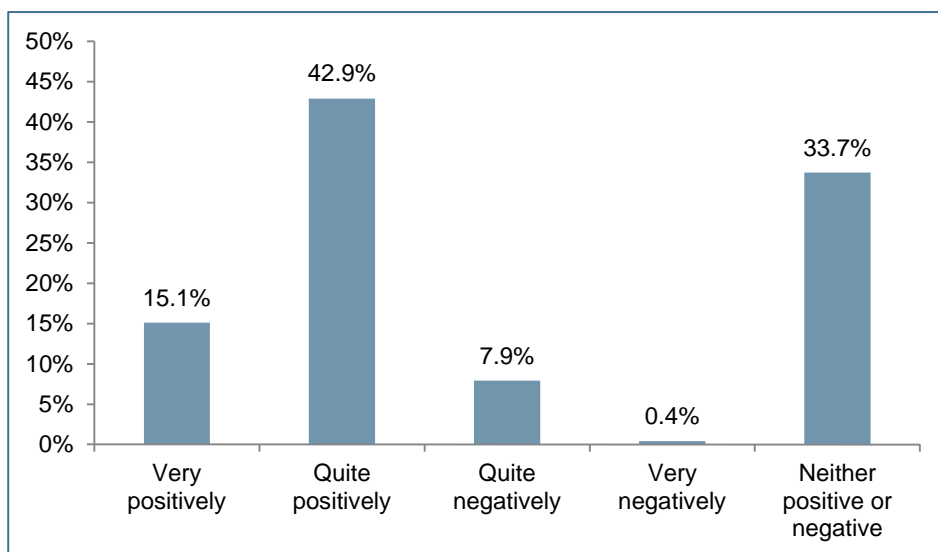
Former SKE teacher trainees and NQTs mainly felt that schools had some awareness of SKE courses (average of 58%), just over one-quarter (28%) felt that they were very aware and 14% felt that schools were not aware at all of SKE courses. This suggests that there is limited awareness across the school sector, although it should be noted that this is the perception of former SKE students themselves. Having said that, when interviewing NQT colleagues as part of this evaluation, there were several of the small sample who were not aware of SKE courses, even though one of their colleagues had been through the programme.

It is useful to note here that of the 80 PGCE students surveyed who had not completed an SKE, 77% were aware of SKE courses and said that they 'know what SKE courses are'. A further 20% said that they had heard of SKE courses but did not know much about them and just 4% had not heard of them at all. Similarly, three quarters of the non-SKE PGCE students who were interviewed had heard of the SKE course with a couple of them suggesting that it would have been useful to have had the opportunity to go onto it but, the majority thought it unnecessary with the experience and qualifications that they already had.

9.6.2 Perception of SKE courses and students

In terms of school perception of former SKE students, there were mixed opinions – while 43% of the PGCE students felt that schools thought quite positively about SKE students, another 34% felt that they did not have an opinion either way. A smaller proportion (15%) thought that schools perceived former SKE students very positively.

Figure 19 School perception of SKE students - PGCE Survey 2011/12



A small number of PGCE interviewees didn't think that schools were aware of SKE courses but mentioned that once they had explained it to the schools, they were very positive:

No they're not, I was quite surprised – it has been of great value to me trying to get a job - I have had to explain in interviews that I've done this course which actually prepares you to teach current curriculum up to A level and once they knew I was prepared for the curriculum they saw it as great value – the head of course had no idea what it did – most schools didn't have a clue but were very positive when they realised what it was. (Former SKE PGCE mathematics student).

Positive towards it, they initially didn't know what it was so I did have to tell them but when I told them what it involved they loved it – I don't think schools know what it means but once they do know they are very positive when informed. (Former SKE PGCE physics student).

A small number of PGCE students indicated that schools should be better informed about the SKE courses and their value (for an example, refer to Case Study 1, David, in Appendix 1); one student suggested it should be accredited in some way to enhance its status within schools. There were several students who had thought that this had an impact on schools when recruiting:

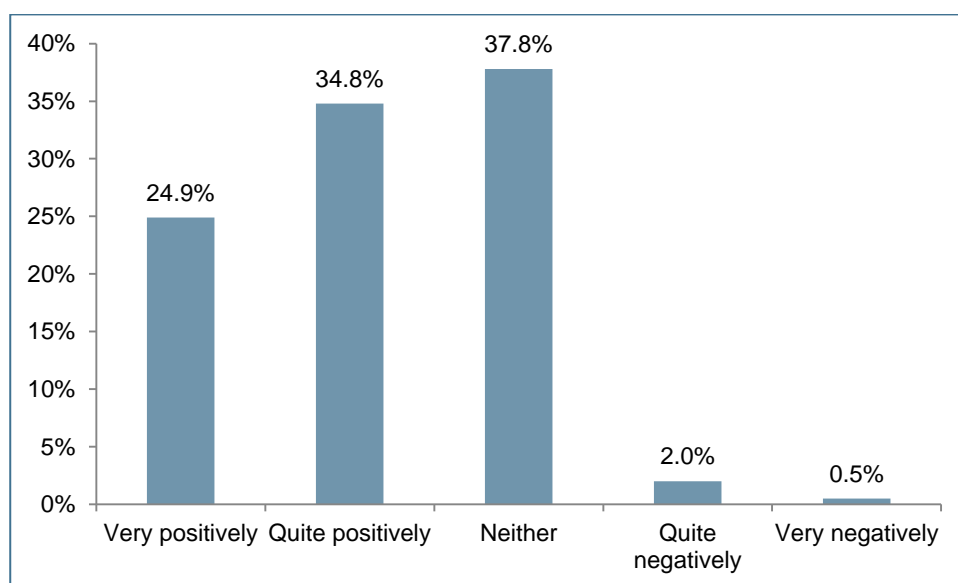
The second school that I was in had a job advertised which required applicants to have a degree in maths. At the end of my placement the teachers said that it was a shame that the governors thought that way as I would have been very good at the job.

I think it should be marketed as a positive recognised qualification – my phase 2 school didn't know what it was and when I have gone for interviews didn't know

what it was and had to explain what it was and what it qualified me for. Some used it to say you're not a physicist but then you argue but I'm a science teacher I know how to teach physics (Former SKE PGCE physics student).

The picture was similar when perception of former SKE students was discussed with NQTs - 60% of NQTs considered that they were very positively or quite positively regarded by schools. However, the most common response (38%) was 'neither' suggesting that schools do not have an opinion either way. It is notable that very few NQTs felt that schools have a negative opinion of SKE students.

Figure 20 NQT views on how schools perceive SKE students - NQT Survey 2011/12



9.7 Summary and conclusions

- NQTs could identify many advantages of the SKE course; the most common were improving subject knowledge and increased confidence in the subject. There were few disadvantages but these included additional time and money spent (e.g. on materials and travel) and size of the workload.
- Almost all respondents were positive about the SKE course and valued it as worthwhile. There were high levels of satisfaction particularly in terms of teaching methods, pace and content of the course, level of support, and usefulness in preparation for completing the PGCE. The majority also considered that it provided them with sufficient knowledge to become a successful teacher.
- The majority of PGCE students who had not completed an SKE thought it would not have been worthwhile to enrol on the SKE course as they had sufficient subject knowledge, experience or had recently finished education. However, a third thought that they would have benefited in terms of being able to refresh their subject knowledge; gain familiarity with the curriculum and practical experience in schools; gain more confidence; and get into the process of learning again. There

was no real consensus as to whether not having taken an SKE made them feel at a disadvantage.

- Most SKE students did not face any barriers on the course, but of those that did, quality of support and funding were mentioned, the interviews suggested this was in relation to additional costs of training rather than course costs/fees. Other barriers included workload, fitting work into other commitments, confidence, communication skills, organisation and timing of courses, lack of clarity on expectations of the course, limited formal contact time and lack of experience in schools. Potential barriers included the introduction of course fees and reduction of bursaries, both of which it was suggested would lead to a reduction in applicants.
- The most common motivation for choosing teaching as a career across all surveys was the desire to 'make a difference to young people'. This is followed by 'enjoyment of working with young people', 'fulfilment in a second career' and 'always wanted to be a teacher'. These findings replicate findings from the previous evaluation years.
- When choosing a specific subject to specialise in, across all surveys, the two main reasons given were 'enjoyment of the subject' and 'to pass on enthusiasm for the subject to young people'. Having better job prospects seemed to be most important for those on physics SKE and for chemistry students, it seems it was their second choice subject as they were unable to teach their degree subject.
- Career aspirations at the beginning of the SKE course related mainly to middle management with nearly half aspiring to become a head of department. At the end of the course, short-term goals were focused on teaching their subject with a view to specialise in teaching in one or more subjects within five years and to become a head of department. Longer term goals had changed somewhat and included more senior roles such as deputy head teacher or head of year. Most students stated that their career aspirations had not changed during the SKE course.
- The aspirations of PGCE students and NQTs are similar to the SKE students although those in mathematics are more likely to aim to specialise in teaching one subject with about a quarter aiming to become a head of department. Much higher proportions of chemistry and physics PGCE students aspired to positions of deputy or head teacher within 10 years. In the shorter term most NQTs were focusing on their teaching responsibilities.
- Comparing across subjects, in the next 5 years, NQTs who were former mathematics SKE students were more likely to aspire to specialise in teaching one subject and former physics SKE students were more likely to specialise in teaching one or more subjects. Note that there are low counts for this question from former SKE chemistry students.
- Changes in aspirations were in terms of having higher aspirations to progress and reach leadership roles, due to having more confidence, feeling more ambitious and wanting to have wider impact on young people. A small number had changed

their mind from wanting to become a head teacher as they preferred to focus on pastoral duties.

- Former SKE students have, on the whole, moved quickly into full-time employment, teaching the same subject that they studied for their SKE. Just over two-thirds of NQTs were offered teaching posts before completing their training and the majority were full-time posts. Just over half were teaching mathematics as their principal subject; followed by general sciences and then physics. Only 5% were teaching chemistry as their principal subject. In general they taught their main subject to key stages 3 and 4.
- This is complemented by the apparent satisfaction that NQTs had with their first year in teaching – with 85% saying they were satisfied and only 4% expressing some kind of dissatisfaction.
- In terms of awareness of SKE courses, most former SKE teacher trainees and NQTs felt that schools had some awareness of SKE courses but it was limited.
- There were mixed opinions about the perception of former SKE students – just under half of the PGCE students felt that schools were quite positive about SKE students, about a third felt that they did not have an opinion either way. A smaller proportion thought that schools perceived former SKE students very positively.
- A small number of PGCE students indicated that schools should be better informed about the SKE courses and their value; one student suggested that the SKE should be accredited in some way to enhance its status within schools. There were several students and tutors who had thought that this had an impact on schools in terms of recruitment.

10. Conclusions and Recommendations

Whilst there have been considerable changes in the political landscape during the lifetime of this evaluation, the supply and quality of teachers, particularly in mathematics and science subjects, remains at the forefront of government policy. As a result, SKE courses continue to be an important element of wider strategy to address the shortfall in supply and quality of these teachers.

This evaluation, therefore, has been designed to explore; how effective SKE courses are in preparing trainees sufficiently in their specialist subject areas, how effective SKE courses are in equipping trainees to become subject specialists in schools, any differences between traditional entry and SKE candidates during all stages of becoming a teacher and how effective SKE courses are in helping to meet targets for mathematics and science teaching in schools. Overall summaries of findings and conclusions in relation to these are provided below. They relate to all years of the evaluation since findings were consistent across the three years.

10.1 Effectiveness of preparing trainees sufficiently in subject area

A key objective of the evaluation was to explore how effective SKE courses are in preparing teacher trainees sufficiently in their specialist subject area.

The evidence gathered in year 3 of the evaluation supports the findings from the previous two years: SKE courses provide trainees with a high level of subject knowledge and confidence in the subject and a firm foundation and preparation for their PGCE training. Although the majority of students commence SKE courses with a perception of having a reasonable level of subject knowledge in their subject of study, it is clear that after completing the SKE course, trainees recognise that they over-estimated their levels of understanding of their subject. Overall, however, by the end of the SKE course, students thought that their subject knowledge had improved significantly.

During the PGCE year, the SKE students considered their subject knowledge to be at a lower level (level 5) than traditional route teacher trainees (subject graduates) who were more likely to rate it at graduate/postgraduate level. This is supported by findings from the interviews where several interviewees talked about subject graduates having higher levels of knowledge which would aid them to teach to higher levels and deal with more complex concepts and questions. They also felt however, that the knowledge that subject graduates might have could be less relevant to the school context. This would indicate that SKE courses currently being delivered in some institutions, whilst being effective in providing relevant and useful subject knowledge for trainees, might not be providing sufficiently high levels of subject knowledge that some teacher trainees suggest they might require.

The content of SKE courses was an important consideration for trainees. They viewed the balance between subject knowledge and pedagogy of most SKE courses as being heavily weighted towards subject knowledge, with pedagogy being a much smaller aspect. However, students' preference would be for a more balanced ratio such as 60/40 or 50/50. The inclusion of subject-related pedagogy was seen by many students as particularly useful. Many former SKE students and SKE tutors highlighted the need to involve subject-related pedagogy in SKE course content, even if it was not explicitly covered. Current and former SKE students certainly valued the practical experience they gained from the courses and having examples and tips on how to teach their subject.

10.2 Effectiveness in equipping trainees to become subject specialists in schools

A second objective of the evaluation explored the effectiveness of SKE courses in equipping teacher trainees to become subject specialists in schools.

Students at both PGCE and NQT stages felt that in order to teach effectively they needed to have a level of subject knowledge at least one level higher than they would be expected to teach; this would enable them to have increased confidence in their knowledge and make them more effective in their teaching. The majority of PGCE students and NQTs said they felt highly confident to teach to key stage 3 and 4 but less so to key stage 5. Being familiar with the content and teaching experience at key stage 3 and key stage 4 were of significant benefit in terms of building their confidence to teach; however some students who felt they did not have sufficient knowledge on specific topics or sufficient grounding in the subject, noted the lack of a subject degree or A level in the subject and that this did present some gaps in their knowledge.

Most NQTs were teaching to key stage 3 and key stage 4 which fitted with their expectations and the levels that they had trained for; and most thought, to be properly equipped in terms of subject knowledge, that they should be at least one level ahead with a small proportion indicating the need to be two levels ahead in order to teach effectively. This could indicate a lack of confidence in knowing their subject sufficiently. However, some students did note that having a level above better equipped them to answer more complex or challenging questions from pupils. In terms of the need to develop their subject knowledge further, nearly half of NQTs thought they may do so in order to teach key stage 4. This again could also be an indication about levels of confidence in knowing their subject knowledge as well as the need for greater depth of knowledge.

Many NQTs who had completed an SKE course came to regard themselves as subject specialists in their principal subject but interestingly those with physics SKE background were less likely to do so. The majority of these also thought that their colleagues would class them as such. When discussing the term 'subject specialist', current and former SKE students and some tutors tend to relate this to their subject knowledge and ability to teach the subject rather than having subject knowledge per se. They are therefore referring to having specialist subject knowledge for teaching their subject. Some referred

to a subject specialist as having greater depth and breadth of subject knowledge - recognised as graduate level understanding.

Almost all the NQTs in the sample were pleased that they had completed an SKE course, and didn't consider it could really be improved upon; most thought it had significantly enhanced their performance as a teacher. Of the small number of improvements suggested these were for: more focus on different levels (i.e. some wanted higher level knowledge, key stage 5, whilst one or two would have liked more on lower levels such as key stage 3); more input on all three sciences; more pedagogy and practical experience in school environment; and more instruction and guidance on concepts, particularly for those with additional needs.

10.3 Comparing SKE and traditional entry teacher trainees

This objective focuses on comparing the progress and development of those who have been through an SKE course with those who entered teacher training after graduating with a degree in their specialist subject. Whilst all respondents were asked to compare these two routes into teaching, the PGCE survey and interview responses were particularly important here since they included former SKE students on PGCE courses and traditional route PGCE students (subject graduates).

Nearly half of SKE students considered their subject knowledge as above or well above average for the PGCE course compared to nearly two-thirds of traditional route trainees. Their level of knowledge differed from traditional route trainees, with the latter more likely to rate their knowledge as graduate or postgraduate compared to SKE students rating it at level 5 (A level).

However, when comparing subject knowledge the SKE respondents thought that their knowledge was likely to be more up-to-date and relevant to the school curriculum than their traditional route counterparts, which in turn would help them to relate to pupils and better equip them to understand their needs. They felt they would be better equipped than traditional route trainees to be able to break down the subject for pupils, and to understand misconceptions and the difficulties pupils faced often having experience of them on the SKE course. The SKE course had provided them with the ability to pitch at the right level, and in addition, many science SKE students had had the advantage of refreshing their knowledge across more than one science.

Both the SKE and PGCE students (both former SKE students and subject graduates) thought that those with a specialist degree would have greater depth and breadth of knowledge which would help with answering complex questions, teaching to a higher level and would have a better grasp of complex concepts and underlying principles. Whilst the SKE course did help students in terms of building their confidence in the subject, at the NQT stage traditional route teacher trainees were more likely to rate their confidence at higher levels especially at key stage 5.

In terms of preparing students for the PGCE course, the SKE is considered to be ideal preparation. The majority of PGCE respondents thought former SKE students would be better prepared to do the PGCE course than traditional route students although they did think that the latter would have more confidence in their subject knowledge. The main reasons were that they would be more prepared for the demands of the PGCE course; more familiar with the curriculum, have experience of conducting practicals and laboratory work; have experience of teaching methods and insight into school practices; have built up a bank of resources; have built a network of support and be familiar with the institution and tutors and style of working; and have a wider grasp of the three science subjects taught in schools.

10.4 Meeting the targets for mathematics and science teaching in schools

The final objective of the evaluation explored whether SKE courses are able to support recruitment of teachers to mathematics and science subjects.

Almost all respondents were positive about the value of the SKE course especially in terms of enabling them to go on to a teaching career in mathematics or the sciences in schools. Many respondents said that without the course that they would not have been able to realise their ambitions to teach. The main factors that the NQTs valued were the relevance and usefulness of the teaching methods, pace and content of the course, level of support, and preparation for completing the PGCE. The majority also considered that it provided them with sufficient knowledge to become a successful teacher.

The majority of PGCE students who had not completed an SKE thought they did not need to complete one but this was not because they thought it had no value but that they already had sufficient knowledge, experience or had recently finished education. However, a third of those without an SKE background did think that they would have benefited in terms of being able to refresh their subject knowledge, gain familiarity with the curriculum and practical experience in schools, gain more confidence and get into the process of learning again.

Most SKE students thought that the SKE course went well and there were few issues, those mentioned included the quality of support, being able to cope with the workload, fitting work into other commitments, confidence, communication skills, organisation and timing of courses, lack of clarity on expectations of the course and limited formal contact time. Potential barriers included the introduction of course fees and reduction of bursaries, both of which it was suggested would lead to a reduction in applicants.

Most trainees came into teaching because they wanted to teach rather than for economic reasons; they wanted to 'make a difference' and said it was because they 'enjoyed working with young people'. These findings replicate findings from the previous evaluation years. For many SKE students this was their second career and the SKE gave them the opportunity to realise it. This partly explains the two main reasons given for

enrolling on an SKE course which were that it was a condition of their PGCE (which is a requirement within the SKE regulations) and they felt that their subject knowledge was not sufficient. For those for whom it was a second career it was often a substantial amount of time since they had been in education. When choosing a specific subject to specialise in, across all surveys, the two main reasons given were 'enjoyment of the subject' and 'to pass on enthusiasm for the subject to young people'. Having better job prospects was also referred to and some were aware of the initiative to recruit and increase the number of teachers in mathematics and the sciences.

Career aspirations whilst on the SKE and PGCE courses were similar and did not change significantly; they related mainly to middle management with nearly half aspiring to become a head of department. At the end of the course their short-term goals were to focus on teaching their subject with a view to specialise in teaching in one or more subjects within five years and become a head of department. Longer term goals included more senior roles such as deputy head teacher, head of year.

The aspirations of NQTs were similar although those in mathematics are more likely to aim to specialise in teaching one subject with about a quarter aiming to become a head of department. Much higher proportions of chemistry and physics PGCE students aspire to positions of deputy or head teacher within 10 years. In the shorter term most NQTs were focusing on their teaching responsibilities. Changes in aspirations were in terms of having higher aspirations to progress and reach leadership roles, due to having more confidence, feeling more ambitious and wanting to have wider impact on young people. A small number had changed their mind from wanting to become a head teacher as they preferred to focus on pastoral duties.

Former SKE students have, on the whole, moved quickly into full-time employment, teaching the same subject that they studied their SKE in. Just over two-thirds of NQTs were offered teaching posts before completing their training and the majority were full-time posts. Just over half were teaching mathematics as their principal subject; followed by general sciences and then physics. Only 5% taught chemistry as their principal subject. In general they taught their main subject to key stages 3 and 4. This is complemented by the apparent satisfaction that NQTs had with their first year in teaching – with a high proportion saying they were satisfied and only a very small minority expressing some kind of dissatisfaction.

SKE courses have been very successful, on the whole, in preparing students to move into new careers as science and mathematics teachers with sufficient subject knowledge suited to the school curriculum and the ability to teach with confidence to at least key stages 3 and 4.

Despite the success of the SKE courses to date in preparing successful and well-equipped graduates, it appears that there remain issues in terms of awareness of SKE courses, particularly in schools. Most former SKE teacher trainees and NQTs felt that schools had some awareness of SKE courses but it was limited. A small number of

PGCE students thought that schools should be better informed about the SKE courses and their value. There were several students who thought that this had an impact on schools in terms of recruitment. A similar finding emerged when interviewing colleagues of NQTs; it emerged there were several who were not aware of SKE courses, even though one of their colleagues had been through the programme.

However, just under half of the PGCE students did think that schools were on the whole positive about SKE students and just over half of NQTs considered that they were very positively or quite positively regarded by schools. The most common response, by more than a third of NQTs was that they thought schools did not have an opinion either way. This may be indicative of the lack of awareness of the SKE course rather than simply not having an opinion.

Finally, another issue raised by tutors was the notification of their institution's allocation of places in relation to being able to plan and recruit SKE students. Tutors mentioned that they often didn't know in good time how many places that they would be allocated by the Teaching Agency which made recruitment of students difficult.

10.5 Concluding comments and recommendations

Meeting objective 1: Effectiveness of preparing trainees sufficiently in subject

Overall the SKE course has been very successful in preparing trainees sufficiently in terms of their subject knowledge and in building their confidence in their specialist subject which in turn provides them with good preparation for the PGCE course and for teaching. This has been achieved through a variety of methods including delivery of school-relevant subject knowledge, subject-related pedagogy (although not within the original aim of the SKE programme) and practical experience. Below are some recommendations relating to maintaining and improving the high standard and quality of SKE courses.

- More consistency in the content, design and delivery of SKE courses is required across institutions as there were considerable variations between institutions; and possibly to include more school-related experience, relevant pedagogy and opportunities for practical work, particularly in the science subjects. Although not in line with the overarching objectives of the SKE initiative, students valued learning how to teach their subject as well as enhancing their subject knowledge. In addition there is a need to ensure the same quality across different delivery modes i.e. online as well as institution-based; sufficient formal contact time, sufficient and appropriate assessment as there was considerable variation between institutions in terms of mode and frequency of assessment.
 - **Recommendation: The Teaching Agency to consult with SKE providers to explore the variations in content, design and delivery**

with a view to developing guidance around the structure of SKE courses whilst retaining flexibility at institution level. This would improve the coherence and consistency across institutions which would in turn help to ensure high quality provision for all SKE students.

- **Recommendation:** The Teaching Agency to review the current format of SKE courses and the value of including subject-related pedagogy to a greater extent in relation to current regulations of the SKE programme.
- There should be consideration of the levels that trainees are likely to teach i.e. perhaps more emphasis on key stage 5 to help to build their confidence in this area.
 - **Recommendation:** SKE providers, when designing content of SKE courses, to consider including more emphasis on key stages 4 and 5 to help build trainees' confidence at these levels.
- It is important to consider the value of including input of more than one science subject since trainees have said that they are often expected to cover more than one science when qualified. This does not fit with the purpose of SKE course but many students and tutors see the value of some inclusion of more than one science.
 - **Recommendation:** The Teaching Agency to review and consider how coverage of more than one science could be achieved to some extent within the design of SKE programme.
- There is a need to ensure that trainees are recruited on to the right length of course for their needs and that there is consistency in recruitment with some flexibility in entry requirements across institutions to meet trainees' individual needs.
 - **Recommendation:** The Teaching Agency to work with SKE providers to ensure that there is an appropriate and consistent recruitment process for SKE students.
 - **Recommendation:** SKE providers to be encouraged to work collaboratively with other local SKE providers to ensure that students are recruited to the appropriate course for their needs e.g. in terms of length and subject area.

Meeting objective 2: Effectiveness in equipping trainees to become subject specialists in schools

The SKE course has been successful in enhancing subject knowledge to a level that is sufficient to teach to in school. Many students and SKE tutors class former SKE students as subject specialists although the definition often relates to having the subject

knowledge to teach to various levels. However, NQTs have identified gaps in their knowledge which needs to be addressed.

- **Recommendation: The Teaching Agency to provide guidance to schools to encourage schools to provide newly qualified teachers with further training in terms of Continuing Professional Development (CPD) to further enhance subject knowledge and confidence to enable them teach to required levels.**

Recommendations made previously for meeting objective 1 are also relevant to objective 2.

Meeting objective 3: Comparing SKE and traditional entry teacher trainees

When comparing the SKE route with the traditional entry route, the SKE trainees compare favourably as they are on a par with their traditional entry counterparts to teach at key stages 3 and 4. However, this is not the case with key stage 5 where traditional entry trainees appear to have an advantage in terms of their breadth and depth of subject knowledge. This makes the latter more suited to teaching at a higher level and more able to cope with complex questions.

SKE trainees tended to fare better in other ways including a better understanding of the school curriculum; their knowledge can be more school-focused and they can have a better knowledge of the topics that children find difficult.

The gaps in knowledge and confidence between traditional route and SKE students are covered by recommendations under objectives 1 and 2.

- **Recommendation: SKE providers to build on support networks developed through their SKE courses and to ensure continued support (including academic support) into PGCE stages.**

Meeting objective 4: Meeting the targets for mathematics and science teaching in schools

The SKE courses have proved successful in providing committed, highly motivated teachers from a range of backgrounds with what were perceived to be, the right attributes, which has therefore, helped to go some way to filling the gap in the shortages of teachers in mathematics and the sciences. There is value however, in reviewing marketing and promotion of SKE courses with a local strategy for teacher recruitment which assesses and meets local need. There is a requirement to aid recruitment practices as some SKE trainees indicated that there was a need to explain the purpose and value of the SKE course to prospective employers who had little or no knowledge of this.

- **Recommendation:** SKE providers to liaise with local agencies to look at demand for specialist subject teachers and whether this fits with the numbers that are training locally on the SKE courses.
- **Recommendation:** The Teaching Agency to provide appropriate information to schools to raise awareness of the value and purpose of the SKE courses with the aim of supporting recruitment of former SKE trainees into teaching.
- **Recommendation:** The Teaching Agency to review the process and timing of allocation of SKE places to institutions, to assist with providing sufficient time for recruiting of students.

11. Appendix 1: Case Studies

1. Trainee: David (41-50) Mathematics SKE student.

David is currently an NQT teaching mathematics to GCSE and is a form tutor. He was unable to get a permanent teaching job straight after finishing his PGCE and so worked as a supply teacher for a few months before finding his current position. He feels that the period of time spent doing supply work helped to give him further insight into how different schools work and clarify what he wanted to do. He does not regard himself as a mathematics subject specialist as his main subject at university was history. However, David thinks that *'having subject knowledge and being able to deliver that knowledge in the classroom is a different thing altogether'*. He thinks that the SKE course had a positive impact on his ability to become a teacher since it had been a long time since he had taken his own GCSEs, and David found SKE useful as a refresher for subject knowledge.

Background: David holds a BA in history with American literature and is also currently studying for an MA in educational leadership and management. He previously started a PhD but did not complete it and instead took a job with a national newspaper group where he was an Associate Director for 20 years. After being made redundant he carried out some cover supervision work at a local comprehensive school and having helped in the mathematics department, realised he really enjoyed teaching the subject. In addition, his industrial experience covered work with spreadsheets, statistics, data analysis, revenues and budgets in a way that he thought *'could bring maths to life for the kids. I can use my career as examples; put it into context for them.'*

David's teacher training experience.

The SKE course: David took a 28 week mathematics SKE course. He thinks that the SKE made him *'more aware of learning styles, because I suppose now I have been able to recognise my own learning style a lot better'*. Further to this, the SKE pushed David to move beyond his own comfort zone in a way that school pupils are expected to do *'lesson after lesson'*, and allowed him to build an empathy with this part of being a learner. David believes that the SKE also enabled him to look at problems from different angles so that he could teach the subject in a range of ways. One of the main benefits for David is that SKE *'gave me a clearly defined path of where I needed to go to be a teacher...without the SKE I don't think I would have entered teaching'*. This being said, David thinks that SKE courses need to have more recognition in schools and that schools need to better understand how much of a subject's curriculum is actually covered on an SKE course so as to benefit those candidates who may not have a qualification (such as A level or degree) in the subject to put onto their CV.

PGCE course: David undertook a joint Graduate Teacher Programme (GTP) and PGCE in mathematics. He had originally thought that he would want to teach up to A level, but has realised through the PGCE and subsequent teaching that he enjoys teaching lower

ability pupils where he feels he is *'teaching rather than explaining'*. He thinks that the SKE gave him ideas of how to teach subjects that he has since been able to implement in the classroom.

Future plans: David is still not sure about his future career plans. He wants to complete his MA study and may return to university to complete his Doctorate. However, he also thinks that his previous career gives him *'some unique skills not normally required by teachers – personnel, budgets'* and these would be beneficial to bring together with his teaching experience for him to become part of a school management team.

2. Trainee: Ellie (20-25) Physics SKE student.

Ellie currently works as an NQT teaching three sciences to GCSE. She secured the post whilst still on the PGCE. She really enjoys teaching and being able to apply her own style of teaching. Ellie says that she feels confident to teach up to key stage 4 but admits she still has to read up on certain topics sometimes before a lesson. Ellie thought that taking the SKE helped with both enhancing her subject knowledge and providing her with some tips and ideas of how to teach. As a result of her training Ellie now regards herself as a subject specialist in the three sciences but not specifically in physics.

Background: Prior to qualifying as a teacher, Ellie completed her degree in environment management in 2006; she then went on to work as a Teaching Assistant (TA) in science in a secondary school. She decided to go into teaching as she had enjoyed being a TA and thought teaching a good career to go into. (Ellie had A levels in biology, chemistry and geography and AS in history). Ellie applied to do a combined science/general science PGCE and was advised to take an SKE physics course prior to entry on to the PGCE as her knowledge in physics was weak; she was happy to do this as it had been nine years since she studied physics.

Ellie's teacher training experience.

The SKE course: Ellie took the six month physics SKE course as it allowed her more time to learn. She thought that the overall purpose of the SKE was to improve her subject knowledge and confidence in physics and expected to be able to learn how to teach to GCSE and possibly A level. On the course Ellie studied modules and lab work with undergraduates which she found challenging at times; partly due to not having studied A level in physics or mathematics – particularly the latter but the institution did have a mathematics support centre which she found very beneficial. Ellie found the SKE course included a bit of how to teach and felt the hands-on practical work really useful. Overall Ellie thought that the SKE course prepared her well for the PGCE and had a positive impact in terms of confidence and how to teach once she took up her first post.

Ellie thought that although the route she took differed from those with a degree in the subject, she didn't think it necessarily gave them a distinct advantage as whilst they would know the subject in more detail, she thought they may not have sufficient

knowledge to teach across all three sciences. Ellie thought that the SKE course had helped her to not only learn the subject in terms of the school curriculum but also to have a better understanding to equip her to explain the subject when in the classroom: *'When I'm trying to explain a topic I can think back six months to when I had to try and understand it and I can make it easier for them to understand, so that will definitely help'*. Ellie took a combined science/general science PGCE 11-16 at her local institution. Her expectations of the PGCE were that she would learn more about how to teach and not about the subject knowledge.

Future plans: Whilst on the SKE course Ellie said her future plans were to *'just be a subject teacher'*. However, now in her NQT year she is re-shaping her plans and admits she would like to progress into middle management, in some kind of pastoral role, perhaps head of year within the next 10 years.

3. Trainee: Linda (31-40) Mathematics SKE student.

Linda is currently an NQT teaching mathematics to GCSE and hopes to take on classes to A level in the near future. She secured the position during her PGCE year. Linda had always wanted to be a teacher but decided to work in industry first so that when she came to teach she would have some *'life experience'* in order to relate the subject to the world of work. Linda considers herself to be a subject specialist in mathematics and is very passionate about teaching. She believes that the SKE course inspired her to be a better teacher, understand the subject on a deeper level and therefore, learn how to get children to engage more with mathematics too. She found the first few weeks of her NQT very challenging but now that she has learned how to better control a whole class she is enjoying her teaching a lot more.

Background: Prior to qualifying as a teacher, Linda worked as an engineer – she holds a degree in engineering systems – and then stayed at home whilst her children were young. During this time she volunteered in her children's primary school 4-5 days per week for several years, with the last two years concentrating on assisting mathematics teaching in years 5 and 6, giving extra support to those struggling, and also those pupils identified as Gifted and Talented. As she hadn't studied mathematics A level for a long time, she took a mathematics SKE course before the PGCE. *'I want kids to enjoy maths, I want them to realise that it is not scary. I never liked my maths teacher at school so perhaps that reflects on the way I approach the subject with children now'*.

Linda's teacher training experience.

The SKE course: Linda took the six month mathematics SKE course. Although she had good subject knowledge from her engineering career she was a little *'rusty'* in areas, and some of the curriculum was new to her since she hadn't covered A level subjects for such a long time. She found the SKE course to be a *'brilliant balance'* between developing and refreshing subject knowledge as well as learning a few techniques of how to put that knowledge into teaching practice. She thinks that the most beneficial aspects of SKE

were developing the ability to be more *'hands on'* when teaching, and *'how to explain things from different angles and be able to prove it'*. Linda also believes that she started to look for teaching jobs a lot earlier than she would have done without completing the SKE. It gave her the confidence in her knowledge and ability during interviews and she has taken on a class with higher ability at GCSE – a teaching role not usually given to new teachers in her school.

PGCE course: Linda's PGCE course focused on middle years teaching, specialising in mathematics. Linda felt much more prepared for her PGCE after completing SKE than she thinks she would have done otherwise. *'You were being taught how to teach it as well – you were the pupil and you could see what worked and what didn't'*. This meant that she felt confident to stand in front of a class and teach mathematics during her PGCE.

Future plans: Linda says that she just wants *'to be a good teacher'*, and apart from this does not have *'big plans'* for her career. She enjoys the challenges of teaching and even though teaching groups of children can be *'difficult'* she has learned ways to keep control of the class, and she thinks that the SKE helped her engage with pupils rather than working straight from text books.

4. Trainee: Peter (20-25) Chemistry SKE student.

Peter currently works as an NQT teaching three sciences to GCSE and A level chemistry and environmental science. He is also a form tutor and runs after-school clubs. He secured his current post whilst still on his PGCE. He is really enjoying teaching, particularly as he has been able to learn how to teach science in more engaging and exciting ways. He thinks that the SKE course gave him the confidence to do this, as it not only refreshed his subject knowledge but the SKE tutor gave examples of how scientific concepts could be taught using practical tools rather than resorting to *'chalk and talk'*. Peter considers himself a subject specialist, especially in environmental science and the school have asked him to rewrite schemes of work for science as a result.

Background: Prior to qualifying as a teacher, Peter worked in academic research and this included a small amount of lecturing. His first degree was in environmental science and geography and he also completed a diploma in business management at the same time. Following this, he studied for a PhD in environmental chemistry having realised that he loved chemistry, a subject he had previously not enjoyed at school. This new-found enjoyment of the subject led him to move into teaching: *'I wanted to get children to love chemistry a bit earlier so that they don't have the same uphill struggle that I had'*.

Peter's teacher training experience.

The SKE course: Peter took the six month chemistry SKE course. His subject knowledge was already quite specialised because of his academic career and the SKE helped him to switch to *'curriculum level'* again and get into *'the right frame of mind'* for teaching and exciting children about science. *'The SKE is not judgemental it opens the*

door to teach science, it is about being excited by science; it is for people with the potential to be great teachers'. Peter thinks that the SKE course gave him the confidence in his subject knowledge to apply for a job that taught chemistry to A level, which he probably would have not gone for otherwise. His subject knowledge has also enabled him to save time on lesson planning and he also built up a good repository of teaching resources and references during the SKE that have proved useful. Peter would have liked to complete a physics SKE course to refresh his subject knowledge as well as chemistry, but the funding was no longer available for him at the end of his chemistry SKE.

PGCE course: Peter's PGCE course focused on secondary science with a chemistry specialism (11-18) – he felt that after the SKE course, he was more prepared to teach than some of the candidates who had gone straight onto their PGCE after graduating from university. He felt that SKE gave the '*context*' of teaching the subject, which then helped when developing practical teaching skills on the PGCE placement. When helping pupils he noted, '*I have been able to draw from what I did on the SKE*'.

Future plans: Peter initially thought that he would like to become the head of a school science department, but he knows that this would require a lot more paperwork and responsibility and for the time being would rather stay teaching the same subjects as he does currently.

5. Trainee: Robert (41-50) Design and Technology SKE student.

Robert is currently an NQT teaching design and technology (D&T) to key stage 3 and GCSE graphics. He mentors a group of 11-16 year olds, providing them with pastoral care. Finding a full-time position following the PGCE was challenging for Robert as there was not a shortage of D&T teachers by the time he had completed his training. He was able to obtain temporary positions as a supply teacher that counted two-thirds towards his NQT, and having gained a position providing maternity cover for another year will enable him to be fully qualified. This latter position will mean that he will teach D&T up to AS level and art to key stage 4. He regards himself as a subject specialist because of prior qualifications, industry experience and the SKE, which he thinks has also proved to prospective employers that he is willing to continue to develop his own subject knowledge throughout his teaching career.

Background: Robert holds a degree in graphic design and worked as a graphic designer and studio manager for local newspapers for over 20 years but had always thought about becoming a teacher, especially when he stopped enjoying his job. The responsibility of family commitments made it difficult to change careers, but when he was made redundant he took the opportunity to retrain as a teacher: '*I really enjoyed working with children and encouraging creativity was my main interest*'.

Robert's teacher training experience.

The SKE course: Robert took a 36 week design and technology SKE course, specialising in resistant materials (rather than food technology or textiles). The SKE course was beneficial *'as the subject and teaching were very much intertwined'*, which he felt gave the course a good balance. Robert feels that although he didn't appreciate it as much at the time, with hindsight the SKE tutors also provided examples of best practice for structuring and modelling lesson plans whilst they taught the subject itself to SKE candidates. It also gave him the confidence, ability and ideas to adapt projects and teach them at curriculum level: *'We learnt about initial ideas for making a folder of work, designing it, planning – exactly the same as you would do in schools so I know how to help them [pupils] plan their folders. It's teaching to the system, but that is what is required, so the SKE was fantastic for that'*.

PGCE course: Robert's PGCE course specialised in secondary D&T (11-16). He felt *'reasonably'* prepared for this, especially as he had already covered curriculum content during his SKE course in a way that degree students had not when they progressed directly to PGCE. He thought, however, that he needed more time to learn computer-animated manufacturing and design (CAM and CAD) that recent graduates understood much better. Robert initially found teaching a challenge as he didn't feel during his first placement there was much opportunity to *'put my own mark'* on projects, and that teaching *'to a set sequence of instructions'* meant that the teaching process in the school he joined felt *'stale'*. Robert wished to be more creative in lessons, but found it difficult to apply his creative subject knowledge to the constraints of set lesson plans.

Future plans: Robert does not currently have any *'burning ambitions'* to become head of department although he might think about this again one day. At the moment he is focusing on becoming an *'efficient and effective'* teacher who is comfortable with his teaching. In the future he would like to have more freedom to write his own schemes of work and thinks that additional responsibility will be more appealing as he gains in confidence as a teacher.

6. Trainee: Suzie (20-25) Physics SKE student.

Suzie obtained her NQT placement after finishing her PGCE and is currently teaching three sciences up to GCSE and is also a form tutor. During her NQT year she has found pupil behaviour management the biggest challenge, but has learned how to ensure that pupils *'take me seriously [and]... realise my lessons allow them to work and talk together, that my lesson are interesting and now they like doing them'*. She is enjoying teaching and is keen to advance her career and help share best practice with other teachers. Suzie thinks that the SKE will help her to achieve her ambitions since understanding the subject has given her the confidence to focus more on developing her teaching skills.

Background: Suzie graduated in medical genetics in 2009 and went onto the SKE course as she had always wanted to be a teacher. Her degree modules had covered

chemistry and biology, but not physics and mathematics. Undertaking the SKE course meant that she had *'all three sciences under my belt so I'm not limited'*.

Suzie's teacher training experience.

The SKE course: Suzie took a nine month physics SKE course, which included physics and chemistry enhancement. Suzie found the course valuable because it gave her ideas for *'thinking outside of the box'* when it came to delivering practical lessons, giving new ways to approach subjects in the classroom that help develop the interest and motivation of pupils. Suzie thinks that having to deliver group presentations and working with GCSE examination papers during the SKE course was a good stepping-stone into teaching, and she uses the same resources, worksheets and information packs she received as an SKE candidate in the classroom. *'The experiments that I learnt on the SKE I use now. Nearly everything I have done during my NQT year has been influenced by what I learnt on the SKE course'*. Because she has a better understanding of the subject, Suzie has the confidence to teach it in different ways. Part of this is making sure that she can provide *'extension tasks'* for higher ability pupils and provide more one-to-one support for those pupils who find science a little more demanding.

PGCE course: Suzie's PGCE course was in secondary science with a chemistry specialism. She felt that because she was already confident in her subject from the SKE course, she could concentrate on the pedagogical aspects a lot more when she started her PGCE. Suzie believes that without the preparation of the SKE course she would have been *'very nervous'* starting her PGCE.

Future plans: Suzie hopes to be promoted fairly quickly as she has been writing schemes of work and lesson plans for the school. Rather than being head of department, Suzie would like to become an Advanced Skills Teacher (AST) in science, meaning that she could share good practice with other colleagues.

7. Trainee: Bridget (26-30) Chemistry SKE student.

Bridget is currently teaching chemistry up to GCSE level in her NQT year. After her first year in teaching Bridget will also be teaching A level chemistry in her school. Bridget admits to having a *'fantastic'* first year in teaching with plenty of support from a *'great department'* which she really feels she has fit into well. She has found herself teaching things that she was not expecting to including teaching BTEC physics which she also enjoys.

Bridget managed to secure the post at the end of the PGCE course. Completing an SKE Bridget said has made her much more confident and she feels it helped her in getting a job *'I don't think they would have looked at me without an SKE as my degree was in a different subject'*. Bridget defines herself as a geologist first and foremost then chemist but admits *'when I've got my school head on and I'm being a teacher I'm definitely a chemist. My colleagues regard me as a chemist'*. Bridget feels confident to teach to key

stage 3 and GCSE but admits she needs to refresh bits of the syllabus as it changed to a new one in her PGCE year.

Background: Bridget has always been interested in teaching as a career which she says is partly from having come from a family of teachers. Bridget has a degree in geology and an A level in chemistry. Her first career was as an engineer in a geo-technical company but when she had the chance to take redundancy she did so, which then enabled her to pursue her ambition in teaching. Bridget was offered the SKE course when she went for her PGCE interview; it was suggested as it had been twelve years since she did her A level. She felt it would have been more difficult to do a PGCE without the SKE course and could have put her off the PGCE completely.

Bridget's teacher training experience.

Bridget took a year SKE course which included 24 weeks in chemistry and 12 in physics. She thinks that the SKE has made her a more effective teacher because she feels confident in knowing her subject well. The course also provided her with '*tips of the trade*' such as doing experiments and setting up a classroom when doing practical work. Bridget developed a great peer network whilst on the course which is still going strong and is useful for any queries or to share resources; she describes it as a '*smaller scale teacher network*'. She just wishes that schools knew more about SKE courses as she says they've not really heard of them. Bridget felt well prepared to go on to the PGCE course, particularly in terms of subject knowledge.

Future plans: Bridget's eventual career plans are towards head of department rather than the pastoral side of teaching but currently she just wants to remain in a teaching role rather than move into the management side, '*I enjoy getting up in the morning and going to work. So at the moment I'm happy being a class teacher but in the future I will be looking for the next step up*'.

8. Trainee: Adrian (20-25) Physics SKE student.

Adrian is teaching all three sciences up to GCSE level in his NQT year. He got the post when he had completed the PGCE. Adrian admits to finding his NQT year somewhat difficult but hopes to make progress and is on track to complete it, '*It's difficult, it feels like quite a large jump from the PGCE onto NQT and the amount of support that we got when we were at university, that really drops off quite sharply.*' He is currently teaching lower set pupils but feels confident in being able to teach up to key stage 4. Adrian is happy to consider himself as a subject specialist in physics, '*with physics it's there already; I have got a deep understanding of the subject that draws together all parts of the curriculum and I think that other teachers could consult me on it.*'

Background: Before going into teaching Adrian was a letting agent with an estate agent. Teaching was something that he had always considered and his experience as a personal trainer and gym instructor had provided him with experience of a teaching situation. It made him reconsider his career and how he could best make use of his

science degree (Adrian had a degree in bio-chemistry and an A level in physics); he was also prompted into teaching by learning that there was a shortage of science teachers. The bursaries that were on offer were an added incentive, as well as the potential future employment prospects. He was offered and accepted a place on the SKE course as his PGCE application was too late to go on the intake he applied for. He thought it a good idea to go on to reinforce his subject knowledge.

Adrian's teacher training experience.

Adrian took the 24 week SKE course in physics which he found useful to refresh his subject knowledge as he had been out of secondary education for a number of years and he felt it gave him a '*good foundation*' going forward to the PGCE. He found it more varied than he expected with quite a lot of individual learning. It made him feel very prepared for the PGCE course having been able to gain some experience in schools and learn more about how to present lessons and teaching techniques; this in turn boosted his confidence. He also found it useful to work with others on the course sharing ideas and feedback.

PGCE course: Adrian went on to complete a science PGCE. Adrian thought that a better connection between the two courses would have assisted in further preparing him for the demands of the PGCE course. However he did feel in a better position than those going straight on to the PGCE especially in terms of the connections he'd made with the institution and fellow students.

Future Plans: Adrian's immediate plans are to further develop his teaching skills but possibly in five years' time he may consider applying to move up in his department or apply to be an Advanced Skills Teacher (AST). His plans have not really changed from the outset of his teaching career.

9. Trainee: Claire (41-50) Mathematics SKE student.

Claire is currently teaching mathematics in her NQT year. This is Claire's second post; she did one term at her first school but left after finding it too difficult to cope with. They had offered her the post when she had been on a PGCE placement. Her current school she describes as '*superb*'. In addition to teaching mathematics to GCSE level, Claire is due to teach A level economics next year, she also expects to take on additional responsibilities in the near future as the department is reorganising and she has been encouraged to apply to take on more. Claire has found her first year teaching '*tiring*' but feels that the first year in any new job can be difficult until you get used to the ways of working and build up resources. One of the hardest things she admits is '*remembering the pupils' names!*'

Claire thought that the SKE really helped her performance as a teacher because of the pedagogy that she learned – about how to deliver the subject and the different ways of doing it. Claire wouldn't describe herself as a subject specialist: '*I'm not a mathematician*

I'm a teacher of maths'. However once she's had more experience she thinks she may be 'comfortable' with this: 'I think it's something that you can develop into and work towards'.

Background: Claire was in banking for eighteen years before taking up a teaching career. She chose to do teaching when she was made redundant as she had always *'fancied going into teaching and really enjoy working with children'*. Although Claire has an economics degree with mathematics and A level in mathematics, it was more than twenty years ago, she therefore opted to do the SKE and PGCE which would provide her with effectively two years' training. Claire thinks that her experienced background enhances her abilities to teach as *'somebody with life experience brings a whole set of skills to being a teacher'*.

Claire's teacher training experience.

Claire opted to take the nine month mathematics SKE course rather than the six month option as it had more pedagogy and gave her opportunities to go into schools and see how the system works. SKE gave her more confidence in both her subject knowledge and in becoming a teacher as it gave her experience and some exposure to teaching. She says she felt prepared for the PGCE course and *'much better than people who hadn't done the SKE'* and would have felt very scared going straight on to the PGCE without having done the SKE course first.

PGCE course: On the PGCE course, Claire was able to put into use some of what she had learned on the SKE course, particularly in terms being able to *'unpick'* mathematics, look at it in different ways and finding different ways of teaching. She said she was able to replicate some ideas that she learned on the SKE course during her own teaching, *'teaching in context and trying alternative ways of teaching, taking maths out of the textbook and engaging children'*. Claire had some issues with the way teaching placements were allocated on her PGCE course; and she felt that the placement in a school with special measures (where she went on to take her first post) was unsuited to a trainee and felt unsupported by the university. She said she went from being *'a very good trainee'* to one that she felt was *'absolute rubbish'*. The experience made her stronger but she noted that for another student they may well have just *'crumbled'*.

Future plans: Claire would like to take on additional responsibilities next year and hopes to become a head of department at some point; she thinks probably within the next five years. She admits that she still has plenty to offer: *'I have another 20 years left in the work place so I can do a lot in that time'*.

10. Trainee: Sandra (31-40) Mathematics SKE student.

Sandra is currently teaching mathematics up to GCSE in her NQT year. Sandra was worried that as she didn't have a mathematics degree when applying for jobs, she would have a problem. However, she had been successful in her second interview to secure a full-time teaching post. She is also a form tutor. Sandra admits to finding her NQT year a

bit challenging and has had some difficulties in teaching low ability children which she didn't feel prepared for in terms of having the right resources but she is learning to tailor the lessons to suit them. She currently teaches up to key stage 4; she has taught key stage 5 in her placements but her current school doesn't have a sixth form.

Sandra found that doing the SKE course had a positive impact in terms of providing her with different ideas and resources but mostly in terms of building her confidence in her subject knowledge. Sandra does consider herself a mathematics subject specialist although she recognises that there are topics and areas in mathematics that she's less confident in at present, such as statistics. Her colleagues have used some lesson plans Sandra has developed and she says that '*they look on me as someone with new ideas*'.

Background: Before going into teaching Sandra was in the printing and packaging industry and was made redundant. Although she took up another job, she was not very satisfied with the way her career was progressing and decided on a change. As she had experience of teaching children as a part-time instructor and enjoyed it, Sandra thought teaching would be a good career, and it was something she had previously considered. Building on her engineering degree she opted to go for teaching mathematics, which is a subject she has always enjoyed. Sandra chose to take an SKE course as it had been some time since she had done A level mathematics and the curriculum had changed. Sandra also has an MBA which she completed part-time.

Sandra's teacher training experience

Sandra completed a 36 week SKE course in mathematics, as she wanted to get her subject knowledge up to the required standard; she found it gave her one level higher than A level and was a bit like '*doing part of a degree*'. Doing the SKE increased Sandra's confidence in the subject and made her '*more comfortable about the curriculum*'. One of the positives Sandra found about doing the SKE at the university was building relationships with others who then went on the PGCE course; together they were able to support each other and this still acts as a support base for her.

PGCE course: Going on to the PGCE, Sandra felt confident in her subject knowledge which she found '*a great help*' when doing her first placement. She found there was quite a lot of theory on the PGCE which she found helpful but admits '*it's very different standing in front of 30 kids who all have different abilities and different personalities; it's learning on the job*'. Sandra admits that if she had gone straight on to the PGCE course without the SKE she would have struggled, especially alongside younger students whose subject knowledge was fresher and more current.

Future plans: Sandra hopes to take up a more pastoral role in her new career and maybe year leader in about three years but she still wants to teach mathematics. However, at the present time she wants to improve her teaching and admits to '*learning all the time*'.



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