



Evaluation of the Chemistry for Non-Specialists training programme

final report

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Evaluation of the Chemistry for Non-Specialists training programme

Final Report

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Dedication

This report is dedicated to the memory of Dr Frank Ellis CChem MRSC (Schools Liaison Manager, GlaxoSmithKline) who had the original idea for the programme and who was instrumental in setting the programme up by obtaining funding from GSK to match the DIUS 'Gateways to the Professions' funds.

Executive Summary

Introduction

This executive summary presents the key findings from the evaluation of the Chemistry for Non-Specialists (CFNS) training programme. The research was conducted by the National Foundation for Educational Research (NFER) on behalf of the Royal Society of Chemistry (RSC) and was undertaken between February and June 2008.

Chemistry for Non-Specialists began in January 2007 and is a three-year programme of courses which are designed to raise the confidence and expertise of non-specialist teachers teaching chemistry in UK secondary schools. The £1.3M project is funded by the Department for Innovation, Universities and Skills (DIUS), GlaxoSmithKline (GSK) and the Royal Society of Chemistry.

Aims of the research

The research aimed to explore both the ‘soft’ and ‘hard’ outcomes and impacts of the CFNS programme on teachers and pupils by:

- investigating how far the CFNS programme leads to soft outcomes
- assessing early indications of how far the CFNS programme may lead to hard outcomes
- investigating reasons for drop out from days 1&2 to day 3 and day 4 of the training programme
- exploring programme effectiveness to inform future policy and investment decisions
- developing a robust evaluation strategy and processes to investigate longer-term impacts of the programme.

Methodology

Two phases of data collection were employed:

- **Phase one:** a questionnaire survey with 184 teachers who had participated in the CFNS programme
- **Phase two:** a case-study interview phase comprising 28 interviews with CFNS teachers, 10 interviews with heads of department or CPD leaders

(face-to-face and telephone interviews) and pupil questionnaires completed by 70 pupils.

Key messages and recommendations

This section presents the key messages from the CFNS programme evaluation in relation to the aims and objectives of the research.

Indications as to how far the CFNS programme leads to soft outcomes

This evaluation has provided strong evidence that **the programme is leading to soft outcomes for the CFNS teachers themselves but also for their colleagues and science departments. There are also early indications that the programme is positively impacting on the pupils** to whom CFNS teachers teach chemistry.

The impacts realised by teachers include: increased confidence to teach chemistry and practical chemistry, enhancements in teaching practice and better access to, and usage of, resources and materials. Positive impacts are also evident in relation to teachers' chemistry knowledge and understanding, their motivation and attitudes towards chemistry and the amount of practical chemistry that they are teaching. Where the impacts of the programme have been the strongest, the programme has also impacted on teachers' roles and responsibilities and professional development. The area where the least impact has been seen is on teachers' awareness of chemistry careers.

Where teachers have taken the opportunity to embed the learning from the programme into their teaching practice, pupils have benefitted and there has been a positive effect on pupils' enjoyment of, and interest in, chemistry. Teachers have also reported that the programme has increased pupils' understanding of chemical concepts as well as their attainment and achievement in chemistry and motivation to study chemistry. The majority of pupils responding to the pupil survey said that they found chemistry lessons practical and over half felt that they were using more materials, resources and equipment in lessons, understood chemistry better and were doing better in chemistry, since their teacher had undertaken the CFNS programme. The sample of pupils was small and hence caution should be exercised in terms of generalisation from the findings. However, these early indications of change

suggest that the programme is beginning to positively impact on pupils' chemistry understanding and attainment.

Where CFNS teachers have shared learning and resources from the programme, positive impacts have been seen in relation to their colleagues' practice. Most commonly, this has been in relation to colleagues' access to materials and resources and new ideas for teaching practical chemistry. In addition, impacts have been noted in relation to departments' flexibility in deploying staff, enhanced teaching and learning and the development of curriculums and Schemes of Work.

Early indications as to how far the CFNS programme may lead to hard outcomes

There are some early indications from this evaluation that the CFNS programme has the potential to lead to hard outcomes on pupils in relation to their attainment in chemistry. Both the teachers and pupils consulted suggested that there had been a positive impact on pupil understanding and attainment in chemistry since the teacher had attended the programme. Indeed, these impacts were noted despite the limited time period that teachers had had since completing or undertaking programmes to embed new learning from the programme into their teaching practice. However, as the evaluation did not involve the collection of any before and after or other comparative data, these findings remain only indicative at this stage.

At this early stage, there has been no apparent impact on pupils' interest in studying chemistry further. Only very small numbers of pupils said that they intended to study more chemistry in the future and were interested in a career in chemistry. This may link to the lack of impact of the programme on teachers' awareness of chemistry careers and the indicative finding from a small number of interviews that science teachers did not necessarily see the delivery of careers information as part of their role, but more the remit of careers staff. However, many teachers felt that the improved learning experience of chemistry that they were providing for their pupils could only help to cultivate more positive attitudes to chemistry amongst their pupils and, in the longer-term, they hoped that it would encourage them to continue studying it further.

There are also early indications that the programme may have the capacity to impact on the shortage of chemistry specialist teachers available to teach chemistry in secondary schools. Nearly a third of CFNS teachers were teaching more chemistry since attending the programme. In addition, the evaluation revealed that the CFNS programme had inspired teachers to further develop their expertise and training in the discipline of chemistry, as well as facilitated their career progression within this discipline.

Reasons for drop out from days 1&2 to day 3 and day 4 of the training programme

Teachers reported a range of reasons for drop-out from days 1&2 to day 3 and day 4 of the CFNS programme. The primary reason was intention to attend the programme in the future (often programmes were not yet completed). Other less common reasons included: inconvenient time; unwell; did not know about the dates of follow up days; unable to get cover; reluctant to get cover; did not have time to attend; and no longer teaching or intending to teach chemistry. There was also some evidence to suggest that teachers may have dropped out of the programme following the initial two days as they felt that their needs from the programme had been met by this stage.

It is important to note, that, **in general, those teachers attending days 1 and 2 plus at least one of days 3 and 4 experienced greater levels of impact for themselves and their pupils.** However, impacts were high even for those teachers attending days 1 and 2 only.

Evidence of the effectiveness of the programme to inform future policy and investment decisions

Teachers were generally very positive about the effectiveness of the CFNS programme and regarded it as being of high quality. Teachers, and their heads of department, felt that the programme had met their needs which included: to improve teachers' confidence in teaching chemistry; to improve knowledge and understanding of chemistry and the teaching of practical chemistry; to increase the number of trained chemistry teachers available in the department; and to provide the teacher with professional development.

The programme was seen to be appropriate in its content, to be of engaging delivery, to include appropriate activities and approaches, and to offer useful materials and resources. **The most valued elements of the programme include:**

- the **emphasis on practical chemistry**
- **support from chemistry specialists** on the programme
- **resources and support materials**
- the **programme structure**
- **flexibility and tailoring** of the programme to meet individual needs
- opportunities for **sharing ideas and networking**
- the **balance between practical and theoretical chemistry**.

Based on the views of the majority of teachers consulted, **the programme appears to be meeting its aim to provide non-specialist chemistry teachers with *confidence, flair and enthusiasm* to teach chemistry.**

In the small number of cases where teachers felt the programme had not been effective, this was often because teachers expected something of the programme that it was not necessarily designed to provide. For instance, some teachers appeared to want a CPD programme to help them deliver new science curriculums, or provide either an introductory or advanced programme on chemistry. However, **the future success of the programme could be enhanced by further tailoring and differentiating the programme to teachers' needs** and more detailed advertising regarding the programme and the types of teachers and departments it may suit. This would help to address teachers' minor and occasional criticisms of the programme and may alleviate drop-out from the programme.

It is important to bear in mind that, overall, teachers and their heads of departments were positive about the CFNS programme, both in terms of experiences and the impacts of the programme. **It is, thus, recommended that any suggested improvements detailed here should be treated as information regarding how to enhance the success of the programme and tailor it to individual needs, rather than substantially change it in any way.**

Recommendations for the development of the programme include:

- **increase the relevance of the programme to the new science courses taught in schools**
- **ensure explicit links are made on the programme to KS3 and KS4 level teaching** (e.g. links between the practicals taught on the

programme and how these may fit into the syllabuses)

- **ensure sufficient coverage of chemistry theory** to underpin the practical work
- **ensure the chemistry taught on the programme is relevant to teaching various ability levels of students**
- consider **further tailoring of the programme to teachers' different needs** (e.g. by considering offering a two tiered programme). A few teachers would have preferred the level to be higher, while others needed it to be more basic
- **provide more detail in advertising the programme as to who the programme is targeted at** and the types of teachers and departments it might suit (including, to encourage teachers and departments to consider the value of supporting a teacher to attend the programme and how they might be supported to integrate any new learning into their own practice and that of the department)
- consider **offering teachers experiences in setting up some of the experiments**, rather than having them already prepared, so that they are confident about setting them up back in school
- consider using a **mix of more local venues** for the programme, so that teachers have less distance to travel and can network with teachers from other local schools
- improve **communication and advanced planning regarding dates of follow-up sessions** to ensure teachers are able to pre-arrange and plan time out of school
- impacts were high, even for those teachers attending days 1&2 only. It may be that the additional burden on science departments of follow-up days (in terms of securing time away from the classroom and out of school in a climate of staff shortages and tight budgets) could be offset by **providing ongoing support or sustained CPD through other means such as virtual discussion groups or local networks**. This may be of particular use for the two-thirds of CFNS teachers who were not found to be teaching more chemistry since attending the CFNS training programme and who were sometimes teaching less, if any at all, due to a constantly shifting science department profile
- consider some form of **ongoing support/forum and promotion of networking amongst science/non-specialist teachers** (perhaps providing non-specialists with chemistry specialist e-mentors) to support non-specialist teachers with ongoing issues in relation to chemistry understanding, theory and practical work
- in addition, if the programme seeks to encourage teachers to discuss chemistry career options with their pupils, **consideration may be needed in terms of how to enhance the impact of the careers aspect**, given that it has been reported to have resulted in relatively moderate impacts
- due to the success of the programme, we **recommend that the current level of financial support is maintained to enable the programme to continue to be delivered in the longer-term.**

Suggestions for a robust evaluation strategy and processes to investigate longer-term impacts of the programme

This evaluation was undertaken at an early stage in the delivery of the CFNS programme and a proportion of the teachers consulted had not completed all of the four days of the programme, or had the opportunity to put what they had learnt into practice. Despite this fact, the findings have been very positive suggesting that the programme is beginning to result in a range of important impacts. In relation to investigating the longer-term impacts of the programme, we suggest that all, or a selection of, the following activities are considered.

Recommendations for the evaluation of the longer-term impacts of the programme

- We recommend that all of **the 184 teachers who took part in the teacher survey are tracked in six months and/or in a year's time** to explore how far the impacts of the programme reported at this stage have been retained, and what further impacts have emerged in relation to themselves and their practice, their pupils and their schools. It would also be useful if a proportion of these teachers were encouraged to administer a survey with their pupils 6 to 12 months after they have completed the programme to explore the impacts that pupils have realised. Additionally, teachers should be encouraged to track attainment of pupils against predictions and progression rates in chemistry to establish if positive changes have arisen which may, to some extent, be attributable to their involvement in the CFNS programme.
- We suggest that **the data collected within the pre- and post-programme questionnaires completed by teachers taking part in the programme in the future is collated and analysed on an on-going basis** to explore and document changes in teachers': knowledge and understanding of chemistry; their motivation to teach chemistry; their confidence in teaching chemistry; their confidence in teaching practical chemistry; usage of resources and materials; roles and responsibilities in relation to chemistry; and involvement in on-going CPD. We also suggest that **a sample of teachers completing courses in the future (for example 20 per cent) are then tracked** 6 to 12 months after completing the programme to assess the retention of impacts and other impacts emerging over time.
- **A sample of future teachers (for example 20 per cent), who are already teaching chemistry at KS3 or 4, should be encouraged to administer pre- and post-programme survey questionnaires to their pupils** to assess the impacts of the programme on pupils. We suggest that the post programme questionnaires are administered at least 6 months after the teacher's completion of the course to allow for the embedding of learning into the teacher's practice.
- Should data be required on the impacts of the programme on chemistry teaching and science departments, **we suggest that a different sample**

of teachers (again, 20 per cent) are asked to administer post-programme survey questionnaires with their heads of department or other senior level colleagues. Again, at least 6 months would need to have elapsed since the teacher completed the programme before the post programme questionnaire was completed.

The surveys used need to be short and simple to keep the burden on teachers and schools to a minimum and could be adapted from the research instruments used in this study. We suggest that the findings are analysed via SPSS or Excel.

1 About the study

1.1 Introduction

This final report presents findings from the evaluation of the Chemistry for Non-Specialists (CFNS) training programme. The research was conducted by the National Foundation for Educational Research (NFER) on behalf of the Royal Society of Chemistry (RSC) and was undertaken between February and June 2008.

After the following introduction to the background of the CFNS training programme, this introduction will go on to describe:

- the aims of this study
- the research methodology
- the structure of the report.

1.2 Background

Chemistry for Non-Specialists began in January 2007 and is a three-year programme of courses which are designed to raise the confidence and expertise of non-specialist teachers teaching chemistry in UK secondary schools. The £1.3M project is funded by the Department for Innovation, Universities and Skills (DIUS), GlaxoSmithKline (GSK) and the Royal Society of Chemistry and was designed partly in response to the report published by the Department for Education and Skills (as was) titled: *‘Mathematics and Science in Secondary Schools: The Deployment of Teachers and Support Staff to Deliver the Curriculum’* (Moor *et al.*, 2006). The report stated that 44 per cent of science teachers in English maintained secondary schools are biology specialists, compared with 25 per cent of chemistry specialists. For this reason, many teachers are teaching chemistry outside of their specialist area.

It is widely recognised, especially within the STEM community, that the best teachers are those who have specialist subject knowledge and passion and enthusiasm for the subject they teach. It is these teachers who pass on their interest in the subject to their pupils and nurture future scientists.

A 2006 Wellcome Trust report on teachers' attitudes to CPD indicated that updating subject knowledge and teaching skills were rated the most important areas for CPD and could:

- make teachers more confident in their role
- increase morale
- benefit the whole school.

In particular, secondary science teachers were keen to update their subject knowledge; 72 per cent of these teachers wanted more CPD in that area, compared with 60 per cent for teachers of other subjects. Only 35 per cent were satisfied with subject related courses available to them, compared with 48 per cent for secondary school teachers overall. Finally, half of all secondary science teachers had not experienced subject-related CPD in the previous five years.

One of the key aims of the RSC is to 'foster the study and teaching of the chemical sciences at all levels', which includes enhancing the supply and availability of teachers through INSET training such as CFNS. In the light of the Wellcome Trust evidence, the RSC worked with GSK and DIUS to design a three-year programme of training courses to raise the confidence and expertise of non-specialist science teachers teaching KS3 or KS4 chemistry in UK secondary schools.

About the CFNS training programme

The CFNS programme aims to train 900 teachers per year to provide them with the *confidence, flair and enthusiasm* to teach chemistry at KS3 or KS4. The training programme is described as affordable (£120 for a four-day course) and high quality¹. It takes place over four days comprising of a two-day residential and two one-day follow-up events spaced at approximately one term intervals. The training programme covers key chemistry concepts and provides hands-on experiences of both student practical work and teacher demonstrations. There are two courses on offer to teachers; one for KS3 and one for KS4.

¹ <http://www.rsc.org/Education/Teachers/INSET/ChemNonSpec/>

Training programmes are administered and delivered via the National Network of Science Learning Centres (NNSLC) in the following regions:

- National Science Learning Centre (in York)
- North East
- North West
- Yorkshire and the Humber
- East Midlands
- West Midlands
- East of England
- London
- South East
- South West.

The training programmes are delivered by trainers some of which are SLC deliverers, some are secondary teachers who have been recruited and trained by the RSC to deliver the training programme and one is an RSC Education Department trainer. The majority of the training programmes take place in secondary schools, where school equipment can be more readily replicated. There are a maximum of 17–18 places per training programme, although the number of attendees varies according to time of year (attendance is lower at programmes that take place in the spring term). In the autumn term 2007 a course was run at Cardiff University and subsequent courses are being held in other Welsh regions. So far no courses have been run in Scotland or Northern Ireland, but the funding from GSK will allow for this if a demand exists. During the autumn term 2007, ten places per region were funded for teachers from Aimhigher schools.

At the time of the research, 48 training programmes had begun, with a further five planned for the spring term 2008 (see Table 1.1 below). These courses had attracted 489 attendees across the ten SLCs (nine regions and one national course).

Table 1.1: CFNS training programmes underway at the time of the research

Term start date:	No. of training programmes	No. of attendees
Spring Term 2007	7	46
Summer Term 2007	18	175
Autumn Term 2007	18	217
Spring Term 2008	5	51
TOTAL	48	489

Source: Data obtained from RSC

1.3 Aims of the research

The research aimed to explore both the ‘soft’ and ‘hard’ outcomes and impacts of the CFNS programme on teachers and pupils by:

- investigating how far the CFNS programme leads to soft outcomes
- assessing early indications of how far the CFNS programme may lead to hard outcomes
- investigating reasons for drop out from days 1&2 to day 3 and day 4 of the training programme
- exploring programme effectiveness to inform future policy and investment decisions
- developing a robust evaluation strategy and processes to investigate longer-term impacts of the programme.

1.4 Methodology

Two phases of data collection were employed, namely:

- Phase one
 - a questionnaire survey to participating CFNS teachers; questionnaires were returned from 184 CFNS teachers
- Phase two
 - 15 case studies with participating teachers were planned, however, due to the methodological issues discussed below, the achieved case study sample comprised of 28 interviews with CFNS teachers, 10 interviews with Heads of Department or CPD leaders (face-to-face and telephone interviews) and the completion of questionnaires by 70 pupils.

Further details of both phases are presented below.

Phase one

A questionnaire survey was despatched to all teachers who had attended days 1&2 (the residential segment) of a CFNS training programme before 20th February 2008. The ten SLCs provided the RSC with the teacher name, school name, and course details of all teachers who had attended a training programme by this date. This provided the NFER with a sample of 489 participating teachers. This was subsequently reduced to a sample of 478 teachers to whom surveys were despatched, the reduced sample was as a result of incomplete or inconsistent details for 11 teachers (e.g. no school name).

The teacher questionnaire surveys were eight pages in length and were despatched in early March 2008 to 478 teachers. The correspondence was sent directly to the named teacher at their school address. Due to the timescale of the research and the five-week period of overlapping Easter holidays experienced in 2008, an early letter of encouragement was sent in mid-March 2008 in order to remind teachers to respond prior to their Easter holiday or once they returned from their break.

Further details of the teacher sample and response rates are provided in 2.2 below.

Phase two

The research design also set out to capture evidence of shorter-term outcomes and perceptions as to the longer term impacts on teachers, pupils and their schools through the undertaking of 15 case studies in schools. The case study phase aimed to include interviews (face-to-face or by telephone) with the participating teacher, their head of department or CPD lead (as appropriate) and, if a visit was possible, discussion groups with pupils of participating teachers. In addition, during the visit, researchers (or teachers if a school visit was not possible) would administer a pupil survey to a class of pupils to whom the teacher taught some chemistry.

Case study schools would be:

- based in different regions of the UK
- represent a range of school types including: 11-16; 11-18; independent and special schools
- have different levels of attainment
- have different socio-economic contexts.

In addition, the case study schools would be representative of the schools participating in the KS3 or KS4 training programmes on offer to teachers and of teachers who had attended all four training days, three training days or just days one and two.

Potential case studies were identified through the database of teachers produced for the teacher survey. Researchers first identified all training programmes that had completed the requisite four days by February 2008. These programmes were then distributed into regions and a representative sample of completed courses was selected based on region and level (e.g. KS3 or KS4). For each training programme, the participating teachers' schools' characteristics were identified. In addition, the selection of the sample took into account whether the teacher had completed the four days of the training programme or not. The initial case study sample is shown in Table 1.2 below.

Table 1.2: Initial case study sample

Case study	Region	Course level	School type	Days attended
1	East of England	KS4	Comprehensive to 18	4
2	East of England	KS4	Comprehensive to 18	unknown
3	East Midlands	KS4	Comprehensive to 16	4
4	London	KS3	Comprehensive to 18	unknown
5	London	KS4	Comprehensive to 18	4
6	North East	KS4	Comprehensive to 18	unknown
7	North East	KS4	Comprehensive to 18	unknown
8	North West	KS4	Comprehensive to 18	unknown
9	North West	KS4	Comprehensive to 16	unknown
10	South East	KS4	Comprehensive to 16	unknown
11	South West	KS4	Independent school	4
12	South West	KS3/4	Comprehensive to 16	4
13	West Midlands	KS4	Comprehensive to 16	4
14	West Midlands	KS4	Special School	4
15	Yorkshire and Humber	KS4	Comprehensive to 18	4

Source: NFER sample of case study schools.

The selected potential case-study teachers were initially contacted by letter inviting them to take part. This was followed up by telephone calls and, where possible, emails. Where participation in the research was refused, an alternative teacher was sought who had attended the same course. In total, 31 teachers were contacted and, of these, 5 teachers from this initial approach agreed to take part in some capacity. The following reasons were given where teachers did not wish to take part:

- teacher no longer at the school
- teacher will be leaving school/maternity leave/sick leave
- teacher not teaching chemistry due to role e.g. technician, supply teacher
- teacher not had chance to teach any chemistry since programme or had not attended all of the programme (so did not feel able/wish to comment)
- time and particular pressures at the time of the evaluation (e.g. SATS/GCSE exam preparation, some teachers in this situation mentioned they would be willing to take part later in the summer term)

- time and capacity issues (e.g. unable to participate due to staff shortages in the department, unable to be involved at the time due to other issues and pressures e.g. Ofsted)
- teacher training (e.g. on GTP programme and did not want additional burden)
- lack of confidence in own practice and unwillingness to take on additional pressure.

Due to the poor take up of involvement in the case-study phase, researchers adopted an increasingly flexible approach by which case-study teachers could select the degree to which they would like to engage with the research. For example, willing teachers could agree to a half-day visit to the school by a researcher for interviews with them, the head of department and administration of the survey with pupils. Or, participants could be interviewed over the telephone, with surveys posted to the school that the teacher could administer with pupils in their own time. At the most basic level of engagement, teachers could take part in a telephone interview.

Once this sample had been exhausted, researchers obtained details of the first 34 respondents to the teacher survey. These teachers were then contacted by letter to solicit their engagement with the case-study phase. Those that did not respond were then emailed and then contacted by telephone. In order to achieve the final case-study sample, a further 31 teachers, in addition to the 34 mentioned above, were contacted by email regarding the evaluation, inviting themselves and their head of department to participate in a telephone interview (by this stage the deadline to collect pupil questionnaire data had been reached). Finally, two regions which were underrepresented in the sample were specifically targeted. The final achieved case study sample involved 29² schools and included interviews with 28 CFNS teachers and 10 heads of department, as well as pupil questionnaires with 70 pupils. More information about the achieved case-study sample is provided in 2.3 below.

1.5 Report structure

This report presents the findings from both phases one and two of the evaluation of the CFNS programme. Following this introductory chapter, there are five further chapters to this report, a conclusion and references.

² In one school data was gathered from the head of department only and there was no corresponding teacher interview.

- [Chapter 2 About the samples](#), including: details of the teacher survey sample and the schools they represent; the case-study sample and difficulties experienced in obtaining this and the pupil survey sample.
- [Chapter 3 Who attends CFNS?](#) including: details of the qualifications of teachers who attend CFNS; their characteristics; and what CFNS teachers teach in schools.
- [Chapter 4 Motivations for attending CFNS](#) including: how teachers and schools found out about the CFNS programme; their motivations for attending; and how CFNS fits in with other CPD opportunities for science teachers.
- [Chapter 5 Experiences of the CFNS programme](#) including: attendance on the CFNS programme (e.g. number of days and support to attend); perceptions of the CFNS programme (e.g. programme organisation, content and activities, support and continuity and extent to which programme met expectations) and; suggestions for future development of the programme.
- [Chapter 6 Impacts from the CFNS programme](#) including impacts for teachers, their pupils and their schools.
- [Chapter 7 Conclusions and recommendations.](#)

Throughout the report, Chemistry for Non-Specialists will be referred to as CFNS.

2 About the samples

2.1 Introduction

This chapter presents information on the achieved samples from which the data presented in this report has been obtained. It begins with a description of the teacher survey sample, including the characteristics of the schools at which they teach. It then goes on to describe the case-study sample, including some information about the teachers interviewed for the study and the type of school at which they taught. Finally, the chapter outlines the characteristics of the pupils surveyed during the evaluation.

2.2 Teacher survey sample

The methods described in section 1.4 above produced responses from a total of 184 teachers who had attended the CFNS training programme. This represents a response rate of 38.5 per cent. This section of the report presents data on the characteristics of the teachers and schools involved in the CFNS teacher survey.

2.2.1 CFNS training programmes represented in teacher survey sample

Table 2.1 presents the regional spread of the CFNS training programmes attended by teachers in the sample, according to the National Network of Science Learning Centre region, rather than the region in which the school at which the teacher taught was situated (for this information, see 2.2.2 below).

Table 2.1: Regional spread of CFNS training programmes attended by teachers in the survey sample

SLC region of training programme	N	%
East of England	49	27
South East	29	16
West Midlands	27	15
London	22	12
South West	16	9
East Midlands	11	6
Yorkshire & Humber	11	6
North East	9	5
North West	8	4
National	2	1
TOTAL	184	

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

The largest proportion of respondents (27 per cent) attended training programmes that took place in the East of England, with the South East, West Midlands and London all being well represented within the sample. Fewer respondents attended training programmes in the North East and North West. When the sample of respondents is compared with the whole sample of 478 teachers to whom surveys were despatched (see section 1.4 above), chi-square tests reveal no significant differences between the two groups, indicating that the CFNS teacher sample is representative of the courses that took place in all ten SLCs.

Table 2.2 presents the level of the training programmes (whether KS3, KS4 or a combination of the two) attended by teachers in the CFNS sample.

Table 2.2: Level of CFNS training programmes attended by teachers in the survey sample

Level of training programme	N	%
KS3	17	9
KS4	159	86
KS3/4	8	4
TOTAL	184	

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

Most teachers attended a training programme aimed at teachers of KS4 (86 per cent), with nine per cent having attended a KS3 programme. A small minority attended a combined KS3/4 course that took place in the South West region. When this sample of respondents is compared with the whole sample of 478 teachers to whom surveys were despatched (see section 1.4 above), chi-square tests reveal no significant differences between the two groups, indicating that the CFNS teacher sample is representative of the courses on offer to teachers.

2.2.2 Schools represented in the CFNS teacher survey sample

Of the 184 teachers who responded to the survey, 183 were matched to their school using the NFER's Register of Schools, and this section describes the characteristics of the schools at which CFNS teachers taught. The teachers who responded to the survey taught at a variety of different types of school (see Table 2.3 below).

Table 2.3: Types of school employing teachers in the survey sample

Type of school	N	%
Comprehensive to 18	77	42
Comprehensive to 16	51	28
Independent schools	20	11
Secondary Modern	13	7
Grammar	5	3
Special schools	5	3
Middle deemed Secondary	4	2
Pupil referral units	4	2
Other Secondary schools	2	1
FE colleges	2	1
TOTAL	183	

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

The majority of respondents taught at comprehensive schools, and only small minorities of respondents came from other types of establishment. The types of CFNS schools do not reflect the composition of schools across England, and comparisons of other school characteristics (e.g. attainment, free school meals) would be unfairly affected by these differences in school types.

The following sections compare the CFNS schools in which teachers were based with schools in England. To address the fact that the CFNS schools do not reflect the

composition of schools across England, national data has been weighted so that it comprises the same proportions of school type as the CFNS schools. As a result, comparisons can be made with schools in England of the same type.

The respondents came from schools located across the nine Government Office regions (GORs) (see Table 2.4 below). Comparison of the sample with similar schools across England shows that, although all the GORs are represented in the sample, there are several regions that are under/over-represented. In particular, the sample included proportionally more schools from the East of England, and proportionally fewer schools from London and the North West.

Table 2.4: Government Office region survey sample schools were located within

Government Office region	Schools of respondents		Other 'similar' schools in England
	N	%	%
East of England	50	27	11
South East	36	20	17
West Midlands	25	14	11
South West	18	10	9
London	13	7	14
Yorkshire & Humber	12	7	9
East Midlands	11	6	9
North West	10	6	14
North East	8	4	5
TOTAL	183		

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

Comparison data weighted by school type

Schools of respondents were located in different types of local authorities (see Table 2.5 below). Comparison of the sample with all similar schools across England shows that schools in the London Boroughs and Metropolitan Authorities are under-represented, and schools in counties and English unitary authorities are over-represented in the survey sample.

Table 2.5: LA type that survey sample schools were located within

LA type	Schools of respondents		Other 'similar' schools in England
	N	%	%
Counties	122	67	50
English Unitary Authorities	32	18	15
Metropolitan Authorities	16	9	21
London Boroughs	13	7	14
TOTAL	183		

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

Comparison data weighted by school type

The characteristics of the schools that employed the responding teachers were also analysed. The respondents included teachers from single-sex and co-educational schools (see Table 2.6 below). Comparison of the sample with all similar schools in England shows that the sample is broadly representative, with a slight under-representation of girls' schools.

Table 2.6: Gender of survey sample schools' pupils

Gender of school's pupils	Schools of respondents		Other 'similar' schools in England
	N	%	%
Boys	12	7	6
Girls	7	4	7
Co-educational	162	89	87
Missing	2	1	<1
TOTAL	183		

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

Comparison data weighted by school type

The teachers taught at schools with varying proportions of their pupils eligible for free school meals (FSM) (see Table 2.7 below). Comparison of the sample with all similar schools in England shows that the sample is broadly representative, with only those schools with the highest proportion of pupils eligible for FSM being under-represented in the sample. FSM can be taken as a reliable indicator of deprivation, which would indicate that CFNS schools were generally not amongst the most deprived in England.

Table 2.7: Proportion of pupils eligible for FSM in survey schools

Pupils eligible for FSM (2005)	Schools of respondents		Other 'similar' schools in England
	N	%	%
Lowest 20%	24	13	11
2 nd lowest 20%	44	24	22
Middle 20%	35	19	22
2 nd highest 20%	35	19	18
Highest 20%	13	7	11
Missing	32	18	16
TOTAL	183		

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

Comparison data weighted by school type

Attainment data was gathered for the schools that employed teachers responding to the survey. The sample included schools with varying attainment rates for science at KS3 (see Table 2.8 below). Comparison of the sample with all similar schools in England shows that the sample is broadly representative in terms of KS3 science performance.

Table 2.8: KS3 Science performance in survey schools

KS3 Science performance achievement band (2006)	Schools of respondents		Other 'similar' schools in England
	N	%	%
Lowest band	32	18	17
2 nd lowest band	25	14	17
Middle band	33	18	16
2 nd highest band	27	15	15
Highest band	29	16	15
Missing	37	20	20
TOTAL	183		

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

Comparison data weighted by school type

Data was also gathered on the overall performance of the schools at KS3 (see Table 2.9 below). Comparison of the sample with all similar schools in England shows that the sample is broadly representative in terms of KS3 performance overall.

Table 2.9: KS3 overall performance in survey schools

KS3 overall performance achievement band (2006)	Schools of respondents		Other 'similar' schools in England
	N	%	%
Lowest band	31	17	18
2 nd lowest band	34	19	17
Middle band	31	17	16
2 nd highest band	24	13	15
Highest band	28	15	15
Missing	35	19	19
TOTAL	183		

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

Comparison data weighted by school type

As well as KS3 performance, data was gathered on the attainment of schools at GCSE level (see Table 2.10 below). Comparison of the sample with all similar schools across England shows that schools in the second lowest band of attainment are over-represented in the sample, and schools in the lowest band are under-represented. So, sample schools tended to be lower attaining in terms of GCSE performance, but not the lowest attaining schools.

Table 2.10: GCSE performance in survey schools

Total GCSE point score (2005)	Schools of respondents		Other 'similar' schools in England
	N	%	%
Lowest band	24	13	18
2 nd lowest band	48	26	18
Middle band	30	16	17
2 nd highest band	25	14	16
Highest band	30	16	15
Missing	26	14	16
TOTAL	183		

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

Comparison data weighted by school type

Data was also gathered on the attainment of schools at A-level (see Table 2.11 below). Again, comparison of the sample with all similar schools across England shows that schools in the second lowest band are over-represented in the sample.

Therefore, as was seen for GCSEs, sample schools tended to be lower attaining in terms of A-level performance, but were not the lowest attaining schools.

Table 2.11: A-level performance in survey schools

Total A-level point score (2005)	Schools of respondents		Other 'similar' schools in England
	N	%	%
Lowest band	23	13	15
2 nd lowest band	32	18	13
Middle band	19	10	11
2 nd highest band	17	9	8
Highest band	15	8	6
Missing	77	42	48
TOTAL	183		

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

Comparison data weighted by school type

2.2.3 Characteristics of CFNS training programme participants

This section considers the characteristics of the CFNS teachers who responded to the survey questionnaire, including:

- gender
- age
- length of time in teaching and in teaching science
- role and/or responsibility in the science department.

Of the 182 respondents who responded to the question on gender on the survey, 67 per cent were female. The CFNS teachers also spanned a wide age-range, see Table 2.12 below.

Table 2.12: Age range of CFNS teachers in the survey sample

Age range	N	%
Under 25	12	7
25-34	61	33
35-44	57	31
45-54	46	25
55-64	7	4
TOTAL	183	

Source: NFER survey of CFNS teachers

No response: 1 respondent

Due to percentages being rounded to the nearest integer, they may not sum to 100

Teachers ranged in age from under 25 (12 teachers) to between 55 and 64 years of age (seven teachers), with the majority aged between 25 and 44.

Table 2.13 below shows how long teachers in the survey had been a qualified teacher and how long they had been teaching science.

Table 2.13: Length of time teachers in survey sample have been qualified as a teacher and have been teaching science

	Length of time as a qualified teacher		Length of time teaching science	
	N	%	N	%
Less than 4 years	77	44	76	45
4 to 5 years	21	12	25	15
6 to 10 years	29	17	30	18
11 to 15 years	15	9	13	8
16 to 20 years	11	6	8	5
More than 20 years	22	13	16	10
No response	9		16	
TOTAL	184		184	

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

The data shows that many teachers taking part in the survey were experienced teachers with 45 per cent having been qualified as a teacher for more than 6 years, more than a quarter having been qualified for over ten years and 13 per cent having been qualified for more than 20 years. However, on the other end of the spectrum, more than 40 per cent of teachers had been teaching for less than four years with more than half having been teaching for less than six years.

There was only a slight difference in the time that teachers had been a qualified teacher as opposed to teaching science, with slightly higher proportions of

respondents having been a qualified teacher for more than six years than teaching science over the same time period (45 per cent and 41 per cent respectively).

CFNS teacher survey respondents were asked to state their role or responsibility within the science department in their school (see Table 2.14 below).

Table 2.14: Role or responsibility in the science department as stated by CFNS teachers in the survey sample

Role or responsibility in department	N	%
Teacher	96	62
In charge of a curriculum phase	13	8
Newly Qualified Teacher	9	6
Head of science department	9	6
Assistant head of science department	7	4
Trainee/GTP teacher	7	4
Other	7	4
In charge of a curriculum area	4	3
Leading teacher	3	2
Advanced Skills Teacher	1	<1
TOTAL	156	

Source: NFER survey of CFNS teachers

No response: 28 respondents

Due to percentages being rounded to the nearest integer, they may not sum to 100

In terms of their roles and responsibilities within the science department, the majority (62 per cent) of the CFNS teachers described themselves as a teacher. In addition, a small proportion was in charge of a curriculum phase such as KS3 or post-16 (eight per cent), or was in charge of a curriculum area such as biology (three per cent). Similarly, small proportions were either heads or assistant heads of science departments (six per cent and four per cent respectively). Some training programme participants were newly qualified or were currently training through the graduate teaching programme (six per cent and four per cent respectively). Other roles included cover teachers, science technicians or teaching assistants and unqualified teachers.

2.3 Case-study sample

This section of the report presents data on the characteristics of the teachers and schools in the case-study sample. The data was gathered from the CFNS teachers at the point of interview and drawn from the NFER Register of Schools.

The case study sample involved 29³ schools in England and included:

- 28 interviews with CFNS teachers
- 10 interviews with heads of department or CPD leaders (or equivalent senior roles e.g. deputy head of department)
- the completion of 70 pupil questionnaires within 4 schools.

Table 2.15 below presents more detailed information in relation to the characteristics of the case study schools.

Table 2.15: Case-study sample characteristics: gender, course level, CFNS days attended, school type, and Government Office region

Characteristic		N	%
Gender	Male	8	28
	Female	21	72
Course Level	KS3	2	7
	KS3/4	2	7
	KS4	25	86
Days Attended	Days 1 & 2 only	2	7
	Days 3 or 4 anticipated	7	24
	Day 4	20	69
School type	Comprehensive to 18	12	41
	Comprehensive to 16	9	31
	Special schools	3	10
	Independent schools	2	7
	FE colleges	1	3
	Middle deemed Secondary	1	3
	Other Secondary schools	1	3
Government Office Region	East Midlands	7	24
	East of England	5	17
	London	4	14
	North West	3	10
	North East	3	10
	South West	2	7
	West Midlands	2	7
	Yorkshire & Humber	2	7
	South East	1	3
TOTAL		29	

Source: NFER interviews with CFNS teachers and NFER's Register of Schools

³ In one case an interview was conducted only with the head of department and researchers were unable to arrange an interview with the corresponding CFNS teacher.

Table 2.15 above presents data on the characteristics of the case study interview sample of schools. The most common type of school in the sample was comprehensive to 18 (12) and comprehensive to 16 (nine), with only small minorities of respondents coming from other types of establishment. Generally, in terms of school type, the case study interview sample is similar to that of the survey sample (in regard to the proportions of comprehensive schools), which was found not to be fully representative of the composition of schools across England. The case study sample has slightly more representation from special schools in comparison to the survey sample and has slightly less representation from independent schools and no representation from grammar schools and secondary moderns.

Case study schools represented the nine government office regions, with the East Midlands having the highest proportion of schools (seven), followed by the East of England (five), London (four), North West (three), North East (three), South West (two), West Midlands (two), Yorkshire and Humber (two) and South East (one). This sample represents a different geographical distribution to that of the respondents to the teacher survey who were predominantly from the East of England, South East and West Midlands.

The majority of the teachers interviewed in the case study sample were female (21) with the remaining eight being male. The proportion of teachers attending the different levels of the CFNS programme were very similar to the survey data, with the majority of the case study teachers participating in KS4 courses (25), and the rest attending KS3 courses (two) and KS3/4 courses (two).

Twenty of the teachers interviewed in the case studies had already completed the full four days of the CFNS programme, a further five teachers were anticipating to complete the full programme, two anticipated completing 3 days and only 2 had completed days one and two only. Due to the poor take up of involvement with the case study phase by teachers who had only completed the first two days of the programme, the case study sample was under represented in terms of teachers who had dropped out of the programme.

Table 2.16 below provides further details on the case study sample characteristics in relation to: free school meals (FSM); and KS3 overall, KS3 science, GCSE and A-level attainment.

Table 2.16: Case-study sample characteristics: attainment level and free school meals (FSM)

		N	%
% FSM eligibility 2005	Lowest 20%	5	17
	2nd lowest 20%	2	7
	Middle 20%	7	24
	2nd highest 20%	9	31
	Highest 20%	1	3
	Missing	5	17
KS3 Overall performance 2006	Lowest 20%	6	21
	2nd lowest 20%	6	21
	Middle 20%	1	3
	2nd highest 20%	5	17
	Highest 20%	4	14
	Missing	7	24
KS3 Science performance 2006	Lowest 20%	5	17
	2nd lowest 20%	5	17
	Middle 20%	4	14
	2nd highest 20%	3	10
	Highest 20%	5	17
	Missing	7	24
GCSE Achievement 2005	Lowest 20%	7	24
	2nd lowest 20%	4	14
	Middle 20%	4	14
	2nd highest 20%	4	14
	Highest 20%	3	10
	Missing	7	24
A Level Achievement 2005	Lowest 20%	3	10
	2nd lowest 20%	5	17
	Middle 20%	4	14
	2nd highest 20%	1	3
	Highest 20%	1	3
	Missing	15	52
TOTAL		29	

Source: NFER's Register of Schools

The data in Table 2.16 above shows that CFNS teachers in the case study sample taught at schools with varying proportions of pupils eligible for free school meals. A higher number of schools fell within the 2nd highest 20% and highest 20% categories (34) than in the 2nd lowest 20% and lowest 20% categories (24) which suggests that higher numbers of schools were based in deprived areas than areas of relative wealth.

For KS3 overall performance, KS3 Science performance, GCSE and A-level performance, higher numbers of schools fell within the 2nd lowest 20% and lowest 20% of schools than within the 2nd highest 20% and highest 20% categories. And, for GCSE and A-level attainment, larger proportions of schools fell within the 2nd lowest 20% and lowest 20% categories suggesting that attainment in many schools decreased as pupils progressed through the school.

2.4 Pupil sample

The total pupil sample achieved was 70 pupils, which comprised a reasonably equal proportion of males and females (37 and 33 respectively) and included pupils from Years 7, 10 and 11. The vast majority of pupils were of white ethnicity, with smaller numbers of Black Caribbean, Bangladeshi, Chinese and mixed race individuals.

Below is a breakdown of the science courses pupils in the sample were studying:

- KS3 science, 22 pupils
- core science, 24 pupils (7 of these pupils were undertaking GCSE chemistry in addition to the core science course)
- additional science, 21 pupils
- additional applied science, 3 pupils.

In terms of indications of the pupils' attainment levels, at KS3, all pupils (22) said that they did not know their predicted level of achievement for science. While at KS4 most pupils reported predicted grades of A* to B (27) or did not know their predicted grade (13), a minority of pupils were predicted lower grades of E to G (8) in their GCSEs.

3 Who attends the Chemistry for Non-Specialists programme?

Key findings

The qualifications of teachers who attend:

- The vast majority of teachers consulted held some form of post-A-level qualification in science, usually a degree in either biology, chemistry, physics, general science or another science.
- When compared with science teachers in England overall, the CFNS teacher survey sample was over-represented in terms of the proportion of teachers with a degree either in biology or in another science subject. There was also a slight over-representation of teachers attending the CFNS programme with no post-A-level qualification in science, compared with science teachers overall in England.
- Two thirds of those attending CFNS training programmes held no higher than an A-level qualification in chemistry, with a quarter holding no higher than GCSE or the equivalent.

What CFNS teachers teach in schools:

- The main subject taught by CFNS teachers was general science, followed by biology. Very few CFNS teachers taught subjects other than science for more than 50 per cent of their time.
- The majority of CFNS teachers consulted, taught chemistry at KS3 and at least some KS4 science. CFNS teachers tended to teach core or additional science GCSE courses at KS4, with a smaller proportion, though still up to a quarter, teaching chemistry as a separate GCSE subject and smaller proportions still were teaching additional applied science and other science courses.

3.1 Introduction

This chapter uses the evidence from the teacher survey and case study interviews with teachers in order to characterise the teachers who attended the Chemistry for Non-Specialists training programme. It provides information on CFNS teachers' level of science and chemistry qualifications, and the subjects and levels that CFNS teachers teach in schools.

It is important to note that, in a number of cases, CFNS teachers declined to take part in case study interviews as they were currently, or no longer, teaching any chemistry,

thus they perceived a reduced relevance for their involvement in the programme evaluation.

3.2 The qualifications of teachers who attend CFNS

The questionnaire surveys to CFNS teachers sought information on each respondent's individual qualifications and this section presents data on the qualifications that teachers reported they held. When interpreting the findings in this section, it is important to bear in mind that the data from the teacher survey relates only to the 184 teachers who attended the CFNS training programme and returned a teacher survey, rather than to all science teachers completing the training programme. The case study interviews with teachers (28 interviews) also gained further information on teachers' qualifications, these findings are presented, where appropriate, to support the data from the teacher survey.

This section begins by presenting the qualifications that the CFNS teachers reported they held in terms of their highest post-A-level qualification in science. These have been categorised into eleven qualification bands in line with those identified in the 2006 DfES report on mathematics and science in secondary schools (Moor *et al.*, 2006). The qualification bands are:

- Degree or higher degree in biology
- Degree or higher degree in chemistry
- Degree or higher degree in physics
- Degree or higher degree in general science
- Degree or higher degree in other science
- B.Sc or BA with QTS or B.Ed in science
- Cert Ed incorporating science
- PGCE incorporating science
- Other post-A-level qualification in science
- A-level science qualification
- No post-16 qualification in science.

Table 3.1 presents the breakdown of the CFNS teacher survey sample in terms of their highest qualification in science. The teachers are counted once against their highest qualification in science. For example, if a teacher holds a degree in general science and a higher degree in biology, they would be counted as holding a degree in biology

as their highest qualification in science. If an individual holds a degree in physics and a PGCE in science, they would be counted as holding a degree in physics as their highest qualification in science.

Table 3.1: Highest qualification in science held by CFNS teachers in the survey sample

Qualification in science	N	%
Degree in biology	80	44
Degree in other science	60	33
Degree in physics	11	6
Degree in general science	8	4
A-level science	8	4
PGCE incorporating science	4	2
Degree in chemistry	3	2
Other post A-level science qualification	3	2
No post-16 science qualification	3	2
B.Sc or BA with QTS or B.Ed in science	2	1
Cert Ed incorporating science	2	1
TOTAL	184	

Source: NFER survey of CFNS teachers

Due to rounding to the nearest integer, percentages may not sum to 100

Table 3.1 shows that, in total, nine out of ten (89 per cent) CFNS teachers in the sample held a degree in either biology, chemistry, physics, general science or another science. As would be expected, very few CFNS teachers held a degree in chemistry as their highest qualification in science (three teachers, representing two per cent of the sample). Of the degrees, degrees in biology and other sciences were the most represented. Overall, just six per cent of CFNS teachers did not hold a post-A-level qualification in science, suggesting that the majority of CFNS attendees held a post-A-level science qualification.

The breakdown of the CFNS teachers' qualifications in science were then compared with those reported for science teachers in the 2006 DfES report on mathematics and science in secondary schools (Moor *et al.*, 2006). The comparison is shown in Table 3.2 below.

Table 3.2: Comparison between CFNS survey teachers and all science teachers in terms of their highest post A-level qualification in science

Qualification in science	CFNS	DfES
	%	%
Degree in biology	44	27
Degree in other science	33	15
Degree in physics	6	10
Degree in general science	4	6
A-level science	4	1
Degree in chemistry	2	16
PGCE incorporating science	2	7
Other post A-level science qualification	2	2
No post-16 science qualification	2	1
B.Sc or BA with QTS or B.Ed in science	1	11
Cert Ed incorporating science	1	4
No response	0	<1
TOTAL	184	2,756

Source: NFER survey of CFNS teachers and NFER survey of teachers of science 2006 (Moor et al., 2006)

Due to rounding to the nearest integer, percentages may not sum to 100

Table 3.2 shows that, in comparison with science teachers in England overall, the CFNS survey sample has an over-representation of teachers with a degree in biology or with a degree in another science subject. This is not surprising, given that the CFNS training programme is designed for non-specialist teachers of chemistry. However, there is also a slight over-representation of teachers attending the CFNS training programme who have no post-A-level qualification in science (four per cent with A-level science and two per cent with no post-16 science qualification), compared with science teachers overall in England.

As well as identifying CFNS survey teachers' highest qualification in science, the survey data was also analysed to produce a breakdown of the highest chemistry qualifications that CFNS teachers reported that they held. These were categorised into four qualification bands as follows:

- Degree in chemistry
- Degree in chemistry and another subject
- A-level or equivalent in chemistry
- GCSE or equivalent incorporating chemistry.

Table 3.3 presents the breakdown of the CFNS teacher sample in terms of their highest qualification in chemistry. The breakdown was arrived at by combining teachers' responses to a question on the chemistry qualifications that they held, with their responses to a question on any degree or higher degree-level qualification that they held and teachers are counted once against their highest qualification in chemistry. Thus, if a teacher stated that they held a degree in chemistry as one of their chemistry qualifications, this would be categorised as 'degree in chemistry' and they would not be counted a second time. The figures do not match those for highest qualification in science shown in Table 3.1 above, as here teachers reported their highest qualification in chemistry, whereas they may have held a higher (different) qualification in science (e.g. biology) overall.

Table 3.3: Highest qualification in chemistry held by CFNS teachers in the survey sample

Qualification in chemistry	N	%
Degree in chemistry	11	6
Degree in chemistry and another subject	29	16
A-level or equivalent in chemistry	75	41
GCSE or equivalent	44	24
Missing	25	14
TOTAL	184	

Source: NFER survey of CFNS teachers

Due to rounding to the nearest integer, percentages may not sum to 100

Table 3.3 shows that only six per cent of the CFNS teacher sample indicated that their highest qualification in chemistry was a degree in chemistry. For the largest proportion of CFNS teachers, an A-level or equivalent qualification (e.g. Scottish higher, overseas qualification) was their highest level of qualification in chemistry and a quarter of the sample (24 per cent) had not achieved a qualification beyond KS4 level (e.g. GCSE in chemistry or dual award science, or equivalent overseas qualification).

The case study interview sample was similar to the survey sample in that the majority of teachers held no higher than an A-level qualification in chemistry: ten held A-levels in chemistry, while seven held GCSE-level qualifications. However, eight CFNS teachers in the interview sample reported that they had undertaken elements of chemistry as part of their degree course. The two teachers in the case study sample who did not hold any chemistry qualifications were teachers in special schools.

Survey respondents were asked to state the class of the degree that they held. Table 3.4 presents the degree class of CFNS teachers compared against the degree class of teachers from the 2006 DfES study (Moor *et al.*, 2006).

Table 3.4: Degree class held by CFNS teachers in the survey sample and all science teachers

Degree class	CFNS	DfES
	%	%
1 st	6	6
2 nd	4	4
2 (i)	38	33
2 (ii)	27	29
3 rd	2	7
Other	1	4
No response	23	17
TOTAL	184	2,756

Source: NFER survey of CFNS teachers and NFER survey of science teachers, 2005 (Moor et al., 2006)

Due to percentages being rounded to the nearest integer, they may not sum to 100

Table 3.4 shows that the surveyed CFNS teachers are broadly similar to all science teachers in terms of the class of degree that they held, with a slightly larger proportion (38 per cent compared with 33 per cent) holding an upper second class (2(i)) degree.

3.3 What CFNS teachers teach in schools

In order to give a flavour of what CFNS teachers teach, this section explores the subjects that CFNS teachers stated that they teach, and examines the levels at which they teach science.

Survey respondents were asked to state their main teaching subject – i.e. the subject that they taught for more than 50 per cent of their time. They were also asked, where appropriate, to specify any individual science subject(s) that they taught (see Table 3.5 below).

Table 3.5: Main teaching subject (i.e. taught for more than 50 per cent of time) of CFNS teachers in the survey sample

Subject	N	% of cases
Science (general)	106	58
Biology	49	27
Chemistry	27	15
Physics	18	10
Maths	4	2
English	1	<1
Biochemistry	1	<1
No response	17	9
TOTAL	184	

Source: NFER survey of CFNS teachers

Percentages are rounded to the nearest integer

Respondents could give more than one response, therefore percentages may add to more than 100, and number of responses may add to more than 184

Table 3.5 shows that, for the majority of teachers who attended the CFNS training programme, their main teaching subject was science (general) (58 per cent) or an individual science subject. More than a quarter (27 per cent) stated that they taught biology, and 15 per cent and 10 per cent respectively taught chemistry and physics. Other subjects taught included biochemistry, maths and English.

In total, 96 per cent of CFNS teachers responding to the survey reported teaching KS3 science with just four per cent not timetabled to teach science at KS3. Teachers were asked in the survey to indicate the science they taught at KS4 (see Table 3.6 below).

Table 3.6: KS4 science taught by CFNS teachers in the survey sample

Subject	N	% of cases
Core science	126	69
Additional science	97	53
GCSE biology	61	33
GCSE chemistry	49	27
GCSE physics	32	17
Additional applied science	28	15
Other KS4 science	21	11
None	10	5
No response	1	<1
TOTAL	184	

Source: NFER survey of CFNS teachers

Percentages were rounded to the nearest integer

Respondents could give more than one response, therefore percentages may add to more than 100, and number of responses may add to more than 184

Table 3.6 shows that the majority of teachers (69 per cent) who responded to the survey were timetabled to teach GCSE core science, with more than half (53 per cent) timetabled to teach GCSE additional science. A third of CFNS training programme attendees (33 per cent) taught GCSE biology and, more than a quarter (27 per cent) were teaching GCSE chemistry as a separate subject. Other KS4 equivalent subjects taught included: applied science, Entry Level science, and GCSEs in human physiology and health, electronics, environmental science and psychology.

Survey respondents were also asked to state the nature of any post-16 science that they taught. Responses here were lower, reflecting the fact that some schools in the sample did not offer post-16 courses (see Table 3.7).

Table 3.7: Post-16 science taught by CFNS teachers in the survey sample

Subject	N	% of cases
AS/A2 biology	50	27
AS/A2 physics	10	5
AS/A2 other science subject	8	4
Other post-16 science qualification	8	4
AS/A2 chemistry	2	1
Not teaching post-16 science	118	64
TOTAL	184	

Source: NFER survey of CFNS teachers

Percentages are rounded to the nearest integer

Respondents could give more than one response, therefore percentages may add to more than 100, and number of responses may add to more than 184

Almost two-thirds of CFNS teachers did not teach any post-16 science (64 per cent). However, more than a quarter of teachers did teach AS or A2 level biology (27 per cent). Very few teachers responding to the survey were timetabled to teach any post-16 chemistry, just two teachers representing one per cent of cases.

The case study sample of CFNS teachers was very similar to that of the survey sample in terms of the subjects taught and level of KS4 teaching. The majority of teachers in the case-study sample were teaching general science at KS3 level and were also teaching various science courses at KS4. Although many of those interviewees teaching KS4 science did not specify the type of course they taught, those who did indicated that they were teaching core science GCSE, with slightly fewer teaching additional and additional applied GCSE science courses. Only two teachers taught GCSE chemistry as a separate subject and none taught chemistry to A-level. As with the survey sample, the teachers in the case-study sample were most likely to teach biology to the highest level and as their main subject as biology specialists, and were least likely to be teaching physics as their main subject. Case-study teachers were also asked in the interviews if they taught subjects other than science, and the majority reported that they did not teach outside the sciences (16), those who did teach outside the sciences tended to teach PSHE (six) and citizenship (three), whilst others also taught PE (one), art (one) and maths (one).

3.4 CFNS teachers not teaching chemistry

The case study interviews with CFNS teachers found that a minority of teachers, even after they had attended the CFNS programme, were not teaching chemistry and a number were also unsure as to whether they would be teaching chemistry next year

due to staffing reasons, or the timetable not yet being finalised. These issues are discussed in more detail in Chapter 6 in the section entitled ‘impact on amount of chemistry teaching’. During the process of contacting CFNS teachers to take part in the case study interviews, a number of teachers declined to participate in the interviews, giving a range of reasons for this decision such as not currently teaching chemistry, and not being timetabled to teach chemistry next year which meant that they felt that they had little to contribute to the evaluation. To this end, it seems that the relevance of participating in both the evaluation and possibly the programme itself, was reduced when the CFNS teacher was no longer teaching or going to be teaching chemistry in school. This would indicate that those attending the CFNS programme do so because they are currently teaching chemistry or plan to do so in the near future, and that there may be some transiency in science departments in terms of what teachers are teaching from year to year.

4 Motivations for attending the Chemistry for Non-Specialists programme

Key findings

How teachers and schools found out about the CFNS programme:

- Teachers found out about the CFNS programme through various means, the most common way being through the head of department, who either disseminated the information to the whole department, encouraged specific staff to consider undertaking the course, or found out about the course at the request of teachers. Other common means were through the Science Learning Centres website, and direct marketing by email or post.

Motivations for attending the CFNS programme:

- Teachers participated in the CFNS programme for different reasons. The most common was personal interest or motivation, as they wanted to gain confidence in teaching chemistry, improve their teaching of practical chemistry and/or their knowledge and understanding of chemistry. Another common reason was because it was suggested by their head of department.
- The most common reasons that heads of department released staff to participate in CFNS was because they needed more qualified chemistry teachers, and because they saw it as a good professional development opportunity for individuals.

How CFNS fits in with other CPD opportunities

- The majority of teachers consulted had not undertaken further CPD relating to chemistry either during or after participating in the CFNS programme. However, the responses of those interviewed suggest that over two-fifths may do so in the future.
- Half of those teachers who were interviewed indicated that they intended to undertake further learning in other subjects that they were not specialists in. In most cases this was in physics.
- The CFNS programme fitted in with departmental/school strategic and CPD plans in most schools by providing extra capacity and skills in teaching chemistry that was deemed necessary, and/or by fitting in with existing CPD activities (e.g. cascading CFNS learning as part of internal training).
- Nearly all of the heads of department interviewed indicated that their staff who had participated in the CFNS programme had also taken part in other CPD in the department whilst they had been at the school. Such activities included external training, internal training at the school and peer coaching.

4.1 Introduction

This chapter considers the motivations behind teachers' decisions to participate in the CFNS programme. It draws on evidence from the teacher survey and case study interviews with teachers and heads of department (or an equivalent senior role). The chapter is split into the following sections:

- how teachers and schools found out about the programme
- motivations for attending the programme, both from a teacher and a school perspective
- how CFNS fits in with other CPD opportunities for science teachers.

4.2 How teachers and schools found out about the CFNS programme

This section explores how school staff found out about the CFNS programme. The ways that those who participated in the survey found out about the programme are shown below (see Table 4.1).

Table 4.1: How teachers in the survey sample found out about CFNS programme

Method of finding out about CFNS	N	%
Head of department	101	55
Science Learning Centre website	33	18
Direct marketing	20	11
Word of mouth/colleague	19	10
Print advertisement	16	9
RSC website	12	7
School CPD lead	4	2
Attendance at another CPD course	3	2
Other	3	2
TOTAL	184	

Source: NFER survey of CFNS teachers

Percentages are rounded to the nearest integer

Respondents could tick more than one response, therefore percentages may add to more than 100, and number of responses may add to more than 184.

For those who participated in the teacher survey, the most common way of finding out about CFNS was through the head of department (55 per cent). After head of department, the website of the Science Learning Centres was the next most common way of finding out about the programme, with just under a fifth (18 per cent) of

teachers using the site to find out about the programme. Other forms of advertising the programme such as direct marketing (11 per cent), printed advertisements (nine per cent), and the RSC website (seven per cent) also contributed to some teachers finding out about the programme. Only a small minority of teachers (three) found out about the programme in ways different from those in the table above, and they indicated that they had found out through a training school, a contact in the Local Authority, and the Association for Science Education.

The same methods of finding out about the CFNS programme were apparent in the case study interviews with teachers. The most common way of finding out was through the head of department, followed by the Science Learning Centre website or emails, and then direct advertising by post from the Science Learning Centres or RSC. In relation to heads of department, some heard about the CFNS programme and then circulated the information to all of their staff to see if any were interested. Other teachers explained that their head of department had found out about the course and had then encouraged specific members of staff to consider the course (e.g. because they were non-specialists teaching significant amounts of chemistry, or would be teaching more in the future). Lastly, some teachers had asked their head of department to look for chemistry courses for non-specialists, as they felt they needed more expertise and/or confidence in teaching chemistry.

Interviews with heads of department corroborated the accounts of teachers. In terms of how the heads of department had found out about the CFNS programme, some had been told about the programme by the member of their staff who participated, but most had found out through pamphlets being sent to the school, or emails about the course being sent from the Science Learning Centres. In addition, one head of department had seen an article about the course in a science magazine she received.

How teachers and schools found out about the CFNS programme

CFNS teacher, Yorkshire and Humber, 4 days, KS4 programme

My head of department flagged it up, that's where I first heard of it. It was just kind of sharing information and seeing if we were interested.

CFNS teacher, East Midlands, 4 days, KS4 programme

My department head gave me the pamphlet [about CFNS]. I told him that I wasn't strong in chemistry so he was looking for things to help me with that.

4.3 Motivations for attending the CFNS programme

This section looks at motivations for attending the CFNS programme, both from the perspective of the teachers and the heads of department who sent them, or allowed them to go. The motivations of those who responded to the teacher survey are shown below (see Table 4.2).

Table 4.2: Why teachers in the survey sample decided to attend the CFNS programme

Reason for attendance	N	%
Personal interest or motivation	131	71
Suggested by head of department	72	39
Recommendation	9	5
Suggested by CPD lead	5	3
Other	16	9
TOTAL	184	

Source: NFER survey of CFNS teachers

Percentages are rounded to the nearest integer

Respondents could tick more than one response, therefore percentages may add to more than 100, and number of responses may add to more than 184.

The most common reason why teachers who participated in the survey decided to attend the programme was because they themselves were interested and motivated to participate (71 per cent). The second most common reason for attending the programme was that the head of department suggested it (39 per cent). Other reasons for attending the programme were only applicable to small minorities of teachers.

A minority of survey respondents (nine per cent) gave different reasons for attending the CFNS programme. Some of these reasons related to the individual teacher's motivations, for example wanting to improve practice and/or knowledge of chemistry, improve confidence in teaching chemistry, and learn new approaches to teaching. Other reasons related to the school, for example indicating that attendance contributed to a performance management target, and some teachers cited shortages in science staff at their school as a reason for attending.

The case study interviews with teachers also explored their motivations for attending the programme, as well as their expectations. As with the surveyed teachers, the majority of the teachers interviewed cited personal interests or motivations as their reason for participating. However, the more in-depth discussion possible as part of an interview highlighted some of the personal factors influencing participation, and the

most common related to confidence in teaching chemistry and in undertaking practicals, and knowledge and understanding of chemistry.

Some teachers wanted to gain confidence in teaching chemistry. For some, this was because they had not taught chemistry before whilst, for others, it was because they were now teaching chemistry at a higher level, or to more able young people. Some teachers specifically wanted to improve their teaching of practical chemistry. This was about gaining confidence in, and experience of, undertaking practicals. For a few of these teachers, a related motivation was that the programme would provide the opportunity to try out new practicals, as there was never a chance to try or practise new experiments whilst in school. Some teachers wanted to increase their knowledge and understanding of chemistry. For some, this was because they had identified a specific gap in their knowledge whilst, for others, it was a feeling that they could teach chemistry more effectively if they had more knowledge.

There were also some less commonly mentioned motivations for participating in the CFNS programme:

- some teachers wanted to **refresh their knowledge of chemistry**, as it had been a long time since they had studied or taught the subject
- some teachers wanted to gain **new ideas** to incorporate into their teaching, especially relating to practicals
- some teachers wanted to enhance their **career prospects** by developing a secondary specialism in chemistry.

Fewer teachers consulted via interviews were motivated to go on the programme solely because of departmental need and/or the suggestion of the head of department. Where this was the case, it was generally because there was a need in the department for more teachers who had some expertise in teaching chemistry. As one teacher explained: ‘...*within the department we’ve only got one true chemistry teacher and therefore I wanted to make sure that other members of staff got more trained up.*’ (CFNS teacher, East Midlands, 3 days (anticipated), KS4 programme). Also, two teachers explained that their departments wanted teachers to gain ideas and experiences that could be useful in implementing the new science syllabus.

Teachers who were interviewed were also asked about their expectations of the CFNS programme, and their expectations broadly mirrored their motivations for participating in the programme. However, their responses did provide some more

detail about what they were expecting and wanting from the course. Most of their comments related to learning more about using practical experiments as part of their teaching, and carrying out demonstrations for their students. Teachers expected to gain ideas for new practicals and demonstrations, and advice on how best to carry them out and use them to teach their pupils effectively. Teachers also expected to have the opportunity to try out new experiments, with support from experienced chemists, including experiments that might be considered more hazardous. Related to this, teachers expected to be given advice about health and safety, and a true picture of what experiments are allowed in the classroom. A minority of teachers also expected to learn some chemistry theory, and some suggestions of how to deliver that to pupils. As one teacher explained: *'I needed the theory and I needed to know how to teach - that's what I wanted.'* (CFNS teacher, East Midlands, 4 days, KS4 programme). One teacher expected that the course would start at the level she was at in terms of practical experience, but found that this was not the case:

...all these beautiful experiments were set up but assumed that I knew how to use the equipment, but I didn't and most of the other teachers did know because they had chemistry knowledge. So I had to jump in the deep end, but I learnt.

(CFNS teacher, West Midlands, 4 days, KS4 programme)

Heads of departments were asked why they had decided to send their staff on the CFNS programme, and the main reasons related to professional development for teachers, and a need for more chemistry expertise in the department:

- some heads of departments felt that the CFNS programme would be good **professional development** for their staff, as it would develop their skills and confidence to teach chemistry, and potentially help them develop a second teaching specialism
- some heads of department explained that they **needed more teachers qualified to teach chemistry**, and that CFNS was an effective way of increasing capacity in the department
- one head of department explained that, with a **new KS4 syllabus** coming in, the teacher was concerned that she needed more support to implement it, and the CFNS programme provided that support
- one head of department explained that the school had failed an Ofsted inspection, and that the school and the science department were facing challenges. Sending a teacher on the CFNS programme was a way to incorporate **more practical work** into their teaching, which would help increase pupil skills.

Motivations for attending the CFNS programme

Gain confidence in teaching chemistry

CFNS teacher, East Midlands, 4 days, KS4 programme

It was the case that I really don't feel strong at chemistry, and I'm doing a lot of teaching of chemistry.

Improve teaching of practical chemistry

CFNS teacher, London, 4 days, KS3 programme

...there were a lot of things that I didn't know about that I was teaching and I learnt it myself as I went along, which was fine, except for practical stuff which you can't learn from a book. So I needed that just to feel more confident doing practicals with the children.

Gain knowledge and understanding of chemistry

CFNS teacher, North West, 2 days, KS4 programme

...if you don't actually do it as a degree and you rely on A-level and textbooks, then you don't get as thorough knowledge of the subject as you would have if you'd gone through a degree process. So I wanted to make sure that my knowledge was up-to-date, and I wanted to see what was available that I didn't know about. I wanted to know what I didn't know.

4.4 How CFNS fits in with other CPD opportunities

This final section examines how participation in the CFNS programme fits with other CPD opportunities for teachers. It looks at their participation in other chemistry CPD, their future CPD plans, and how the CFNS programme relates to other CPD activities in their school.

Teachers responding to the teacher survey were asked whether they had undertaken any other chemistry-related CPD at the same time as, or since, participation in the CFNS programme (see Table 4.3 below).

Table 4.3: Survey teachers' participation in other chemistry-related CPD

Participation	N	%
Yes	7	4
No	177	96
TOTAL	184	

Source: NFER survey of CFNS teachers

Percentages are rounded to the nearest integer

Nearly all of the teachers who participated in the CFNS programme did not undertake any other chemistry-related CPD whilst participating, and have not undertaken any since finishing the programme.

Teachers who were interviewed were also asked whether they intended to undertake future programmes or courses in chemistry. The most common answer (from 13 interviewees) was that they did not intend to undertake more chemistry courses. Some interviewees felt that they did not need any more learning, some had no time for more courses, and others felt that they were not teaching enough chemistry to justify more courses. There were also those who felt that the CFNS programme had met their needs fully. As one teacher explained: '*...I think at the moment I'm quite happy with what I've done, so probably not.*' (CFNS teacher, East Midlands, 3 days (anticipated), KS4 programme).

Some of the teachers interviewed (five), felt that they might possibly undertake more learning in chemistry, for example if they came across a relevant and/or interesting course, or if it was relevant to the new syllabus. Some teachers (three) said that they would probably do a course in the future (e.g. to enable them to teach A-level chemistry, or to keep their chemistry knowledge up-to-date), but had no definite plans currently. Finally, four teachers had definite plans to do a course, or were already on a course. Of these, two were keen to specialise in chemistry and were planning to do a chemistry PGCE.

The teachers who were interviewed were then asked if they had plans to undertake courses for other subjects that were not their specialism. Half of the teachers (14) did have such plans, with the majority wanting to do courses for non-specialists in physics. Others intended to go on biology courses and other postgraduate studies (e.g. MAs). A significant minority of the teachers interviewed (nine) did not intend to go on courses for other subjects that were not their specialism.

Teachers were also asked if they attended CPD for their specialist subject. Just under half (13) reported that they did not attend such CPD, for example because they were comfortable with the subject, and already well-qualified, or because they were coming up to retirement. Fewer interviewees (ten) reported attending CPD for their specialist subject and, whilst some did so to keep up-to-date in their subject, others had been undertaking CPD activities to help them deal with changes to the syllabus that they were teaching in their specialist subjects.

Heads of department were asked how their teachers' participation in the CFNS programme fitted in with any departmental or school strategic and CPD plans. There were two main ways that the activities fitted with these plans:

- they provided **extra capacity and skills in teaching chemistry** that had been identified as a gap in the department. For example, some schools needed more staff who could teach chemistry, some wanted to help their teachers improve their delivery of chemistry, and one special school wanted a member of staff with the skills to teach a GCSE in science
- they fitted in with **existing CPD activities** in the department, as CFNS teachers shared what they had learnt with other teaching staff (e.g. during training days and departmental meetings).

Heads of department were also asked to describe the CPD activities that took place within their department. The main types of CPD activities were:

- sending staff on **external courses** (e.g. where the expertise in an area was not available within the school)
- carrying out **internal training** with external trainers, or members of staff with particular expertise in the area under consideration
- **peer coaching** within the department.

These CPD activities covered: content and curriculum issues within science (e.g. new areas to be taught such as nano-chemistry); teaching and learning techniques; and management training for those with leadership responsibilities. In nearly all cases, the CFNS teachers had been involved in other CPD activities such as those described above whilst they had been at the school. Where this was not the case, this was due to the short time they had been teaching in the department, or the level they had been teaching at, meaning that the CPD activities were not appropriate.

How CFNS fits in with other CPD opportunities

Need for extra capacity and skills in teaching chemistry within the department

Head of department, Yorkshire and Humber

I read about it in one of the science magazines that I get through. I thought it was quite interesting so I kept hold of it. I was down on a chemistry teacher in terms of the delivery of the KS4 and I approached [the CFNS teacher] and asked her if she would be willing to take on the chemistry and she said yes. And I thought well we'll put this in for professional development for her.

Head of department, East Midlands

It was professional development really for her [the CFNS teacher] and lack of chemistry teachers in the school.

Head of department, South West

Largely really for departmental reasons, the school faces quite a lot of challenges and the faculty has been facing quite a lot of challenges and there has been a lot of attention as to why science is not a particularly popular subject in the school. So we've been doing a lot to raise the profile of science, so I was keen to get more practical work, which is a really good way to increase pupils' skills.

5 Experiences of the Chemistry for Non-Specialists programme

Key findings

Attendance on the programme:

- The majority of teachers responding to the survey attended days 1 and 2 of the CFNS programme and there was evidence of some drop out: day 3 had fewer attendees, while day 4 had the fewest. However, almost a third of those who did not attend day 3 or 4 reported that they intended to do so in the future (indeed, over half of the survey sample had embarked on CFNS training programmes commencing in Autumn 2007 or Spring 2008, which were not yet completed). The interview sample of teachers was over represented by teachers who had attended (or anticipated attending) all four days of the programme.
- Reasons for drop-out from days 1&2 to day 3 and day 4 of the training programme included primarily, the intention to attend the programme in the future (when programmes were not yet completed). Other less common reasons included: inconvenient time; unwell; did not know about the dates of follow up days; unable to get cover; reluctant to get cover; did not have time to attend; and no longer teaching or intending to teach chemistry. There was also some evidence to suggest that teachers may have dropped out of the programme following the initial two days as they felt their needs from the programme had been met by this stage.
- The majority of teachers interviewed tended to feel well supported by their schools to attend the programme in terms of: being given time out of school, cover for lessons and support to purchase additional resources and equipment.

Perceptions of the programme:

- Teachers were generally positive about the programme organisation and structure (e.g. the timing and location, programme's 4 day format and the organisation by the Science Learning Centres).
- Teachers were generally very positive about the effectiveness of the CFNS programme, indicating that they considered the programme relevant to their needs, appropriate in its content, of engaging delivery, appropriate in its activities and approaches and offering useful materials and resources.
- Occasional issues were raised about the content of the programme, including the appropriateness of the level of the programme for both teachers themselves and the students they teach (e.g. for a small minority it was pitched too high), the relevance of the programme to new science courses, linkage between the practicals taught on the programme and science syllabuses and a lack of coverage of theory.
- Teachers in the South West of England were most positive about the effectiveness of the CFNS programme (e.g. its relevance and appropriateness).

- The most valued elements of the programme included: the emphasis on practical chemistry; support from chemistry specialists on the programme; resources and support materials; the programme structure; flexibility and tailoring; opportunity to share ideas and network, and; the balance between practical and theoretical chemistry.
- The majority of teachers interviewed tended to feel the programme offered a good level of continuity of support (e.g. on-going support from the tutor, resources, programme structure of two days and two separate follow-up days, peer support and a web-forum).
- The programme appears to be successful in meeting teachers' and heads of departments' expectations, particularly in terms of enhancing the teachers' confidence and competence to teach chemistry and practical chemistry.

Suggestions for future development of the programme:

- The future success of the programme could be enhanced by further tailoring of the programme to meet teachers' needs and more detailed advertising regarding the content of the programme and the types of teachers and departments it may suit. This would help to address teachers' occasional criticisms of the programme and may alleviate drop-out from the programme.

5.1 Introduction

This chapter describes teachers' experiences of the CFNS programme. It draws on evidence from the teacher survey and case study interviews with teachers and heads of department (or an equivalent senior role). The chapter explores the following areas:

- attendance on the programme
- perceptions of the programme including programme organisation, programme content and activities, the continuity of support offered by the programme and the extent to which the programme has met expectations
- suggestions for the future development of the programme.

5.2 Attendance on the CFNS programme

Survey respondents were asked to indicate in which term they had embarked on the CFNS training programme (see Table 5.1 below).

Table 5.1: Term start dates for CFNS programmes attended by teachers in the survey sample

Term start date:	N	%
Spring Term 2007	23	13
Summer Term 2007	43	23
Autumn Term 2007	105	57
Spring Term 2008	11	6
Missing	2	1
TOTAL	184	

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

The largest proportion of CFNS teachers began the training programme in autumn 2007 (57 per cent). The summer 2007 programme was the second most popular with 23 per cent attending. The distribution of programme attendance reflects the number of training programmes held by the SLCs (see Table 1.1), with summer 2007 (18 programmes, 175 teachers) and autumn 2007 (18 programmes, 217 teachers) having the greatest number of programmes running.

The survey asked teachers which days of the CFNS programme they had attended (see Table 5.2 below).

Table 5.2: Number of days of the CFNS programme attended by teachers in the survey sample

Programme days:	N	% of cases
Days 1 & 2	176	96
Day 3	128	70
Day 4	49	27
TOTAL	184	

Source: NFER survey of CFNS teachers

Percentages have been rounded to the nearest integer

Respondents could tick more than one response, therefore percentages may add to more than 100, and number of responses may add to more than 184.

The data from the surveys shows that most teachers (96 per cent) attended the initial two days of the 4-day programme. However, there was evidence of some drop out for days 3 and 4, with 70 per cent of respondents having attended day 3 and just over a quarter (27 per cent) having attended day 4. Findings reflect the fact that, for respondents who began the CFNS training programme in autumn 2007 or spring 2008, days 3 and 4 in many cases had not yet taken place.

To further break down the data on attendance:

- 96 per cent of teachers attended days 1&2 of the programme and, of these, 27 per cent attended only these days and no further days
- 22 per cent of teachers from the 184 responding to the survey attended the entire four-day programme.

Those respondents who did not attend days 3 and 4 of the programme were asked to state their reason for non-attendance (see Table 5.3 below).

Table 5.3: Reasons from teacher survey for non-attendance on day 3 and/or 4 of the CFNS programme

Reason for non attendance:	N	% cases
Intend to attend in future	46	32
Inconvenient time	6	4
Unwell	5	4
I did not know about it	5	4
Unable to get cover	5	4
Reluctant to get cover	3	2
Did not have time	1	1
Other reason	2	1
No response	74	51
TOTAL	144	

Source: NFER survey of CFNS teachers

Percentages have been rounded to the nearest integer

Respondents could provide more than one response, therefore percentages may add to more than 100, and number of responses may add to more than 144.

A filter question: only those teachers who did not attend day 3 or day 4.

Table 5.3 shows that half of the teachers surveyed (51 per cent) declined to provide a reason for not attending days 3 and 4 of the training programme. Approximately a third (32 per cent) of teachers intended to complete the remaining days of the programme in the future. In some cases, this was likely to be because they were on an autumn 2007 or spring 2008 programme, neither of which were completed. Only four per cent of teachers identified that the timing of the programme was inconvenient, four per cent were unable to get cover, while two per cent were reluctant to get cover.

In comparison to the survey sample, the interview sample of teachers was over represented by teachers who had attended (or anticipated attending) all four days of the programme (25 out of 29). Two teachers anticipated attending 3 days, and two teachers had only attended days 1&2. Reasons for not attending all four days included

that the dates clashed with holidays, exam dates and other CPD. One teacher suggested that she was less inclined to go on the follow up two days when changes in the science department and staffing of science meant that she would no longer be teaching chemistry. Three teachers, who missed at least one of the follow up days, also indicated that they received no advanced warning of the date of the follow up days, and, as a result, recommended this as an area for improvement, particularly as they had wanted to attend. Further reasons for drop-out of the programme were that teachers felt that they had got what they wanted from the programme after just two days (this was suggested by one interviewee and the evaluation data does show that there were positive impacts on participants after having only attending two days of the programme), and therefore these teachers may have perceived less need and priority to attend the follow-up days. Conversely, although never raised by teachers themselves, participants may have decided not to continue with the programme as they found it not to meet their expectations and needs.

There are some indications that organising four days out of school for CPD is challenging for teachers and schools. Indeed, during the process of contacting CFNS teachers for interviews regarding the programme evaluation, several teachers commented that they had only attended two days of the programme due to difficulties getting the further days out of school (e.g. staff absences, school commitments and pressures) and, therefore, did not feel able to contribute to the evaluation of the whole programme. Others suggested that their workload in school was a barrier to their involvement in the evaluation, which may also have been a challenge to their participation in the programme itself. Several interviewed teachers noted the drop-out on their programme between the first days and the follow up days and commented that this may have been due to difficulties getting time out of school. However, the interview sample commented that the fact that the CFNS programme was subsidised made it more feasible to take time out, as the school did not have the dual costs of an expensive course *and* releasing a teacher for four days. As these teachers explained:

The fact that the course is subsidised so that it's so reasonable is excellent, because it means that while it's very time expensive it's not expensive on top of that for the school to pay out.

CFNS teacher, London, 4 days, KS3 programme

The fact that the course was such good value for money has also really benefited and allowed us out. I think if it had been really expensive we wouldn't have been able to go out for four days.

CFNS teacher, East Midlands, 4 days, KS4 programme

The heads of departments interviewed were asked for their views on the cost of the programme and whether this was affordable and appropriate. Although two interviewees had not been aware of the costs, and two got free places on the programme (e.g. they were an Aimhigher and a host school), the remaining six felt that the cost had been reasonable and manageable adding, in some cases, that this was the case particularly because it had been so valuable and worthwhile.

During interviews, teachers and heads of departments were asked to discuss whether there had been support available from school to help teachers undertake the CFNS programme. Interviewees described how the CFNS teacher had been supported to attend the programme either by the department or school in terms of being given time out of school, cover for lessons and support to purchase additional resources and equipment. Most teachers were happy with the level of support provided by their school for them to undertake the programme. Nineteen teachers who were interviewed said that they did not require any more support than that detailed above. Those teachers who did note the need for additional support from their school, referred to the need for support to integrate what they had learned from the programme into their practice and share new learning with colleagues (issues more fully discussed in Chapter 6, section 6.2 and 6.4).

5.3 Perceptions of the CFNS programme

This section examines teachers' perceptions of the CFNS programme in terms of programme organisation, programme content and activities, the continuity of support offered by the programme and the extent to which the programme met expectations. It draws on data from the teacher survey and is supplemented by data from case-study interviews with teachers and their heads of department.

Programme organisation

The survey questionnaires provided teacher respondents with the opportunity to include additional open comments regarding their experiences of the CFNS training programme. A number of these comments related to the organisation of the programme in terms of recommendations and suggestions for ways to improve or tailor the programme, such as adjusting the structure of the programme to two sets of two consecutive days and providing follow-up sessions and ongoing support.

Teachers' experiences of the programme organisation were also discussed further during qualitative interviews as part of the case study phase. Overall, the majority of teachers interviewed (25 out of 28 interviewees) found the timing and location of the programme convenient. Only minor individual issues were mentioned in terms of the distance to the programme, the lack of adequate instructions for the journey and issues with the timing of the follow-up days of the programme (e.g. clashing with holidays and exam dates). Some teachers chose to endorse the timing of the programme, highlighting the convenience of CPD held at the end of the summer or autumn terms.

The majority of teachers were also positive and complimentary about the 4 day format of the programme (i.e. 2 days with 2 separate follow-up days), suggesting it was particularly successful at encouraging the embedding of new learning in practice, with time in between sessions to reflect and integrate learning. The programme structure also provided the opportunity to build relationships, rapport, and network with the tutors and fellow colleagues, which was found to create a conducive learning environment. Several teachers, however, did note issues with the format of the programme and, in some instances, suggested improvements (e.g. that the first two days alone would have been sufficient). Several teachers also suggested the possibly of structuring the programme with two sets of two days and another added that the overall length over which the programme was run could be reduced. Teachers were very positive about the organisation of the programme by the Science Learning Centres, noting a good, and often excellent, standard of administration and facilities.

Programme Organisation

Format of the programme:

CFNS teacher, East Midlands, 4 days, KS4 programme

Having it spaced out throughout the term meant you had some time and opportunity to try some of the ideas that you've talked about and practised. In between the sessions you've got time to practise them before you go back and you can feed back and maybe discuss any pitfalls or any problems you've come across.

Programme content and activities

The teacher survey asked respondents to rate the effectiveness of the CFNS training programme in a number of areas. For each area, the survey presented respondents with two opposing statements and asked them to circle the number (on a five-point scale) that most closely matched their view. Statements were organised such that

circling a '1' or '2' allied with a negative statement whereas '4' or '5' were closely allied with a positive statement. Responses to these questions are summarised in Table 5.4 below.

Table 5.4: Surveyed teachers' ratings of the effectiveness of the CFNS programme

Statement: The CFNS programme...	% Rating					N
	Very low (negative) 1	Low 2	Mid 3	High 4	Very high (positive) 5	
Was irrelevant/relevant to my individual needs	0	2	10	35	52	184
The content was inappropriate/appropriate to my needs	1	3	10	35	50	184
The delivery was not engaging/highly engaging	1	1	5	33	60	183
Had inappropriate/appropriate activities and approaches	0	3	8	29	60	183
Offered poor/useful materials and resources	1	2	3	22	72	183

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

A total of 184 respondents gave a valid response to at least one of their items

Table 5.4 shows that teachers who took part in the survey were generally very positive about the effectiveness of the CFNS programme. For all statements, the majority of teachers rated either a 4 or 5 (high/positive and very high/positive) on the scale, indicating that they considered the programme relevant to their needs, appropriate in its content, of engaging delivery, appropriate in its activities and approaches and offering useful materials and resources.

Overall, the teacher interview sample concurred with the survey sample in terms of their endorsement of the programme content and activities. Teachers generally felt that the programme content was appropriate, relevant and pitched at the right level both in terms of their own level of ability and that of the students to whom they taught chemistry. They approved of the relevance of the programme to the science syllabuses taught in school and felt the programme was appropriately focused on delivering chemistry in the classroom and how to make chemistry interesting and exciting. The programme was also felt to be relevant in terms of the extent to which it could be adapted to different levels of teaching, with additional information provided on how to simplify or extend. There was deemed to be a slightly greater emphasis on practical chemistry, with slightly less on theory, though, for most teachers, this was an

appropriate balance, as the practical was supplemented by discussion of the underpinning theory. Teachers valued the opportunity to have hands-on experience and time to practise doing practical chemistry. Teachers were also complimentary about the delivery of the programme, suggesting that the tutors were engaging and that there was a good ratio of tutors to participants. The teachers recalled and praised the opportunity to work on experiments in groups with fellow teachers, with the tutors on hand to support. The resources available, both during the programme and afterwards for teachers to take away, as well as additional sources of materials referred to on the programme, were considered to be of a very high standard, as well as being useful and relevant to teaching chemistry in school.

The vast majority of teachers interviewed (25 out of 28) were also very positive about the flexibility within the programme to adapt to their needs. Teachers felt this flexibility was achieved by the tutors' delivery and approach and the programme structure and facilities. The tutors were noted for providing sufficient opportunities for questions and queries, and, there was felt to be differentiation according to teachers' individual needs (e.g. the offering of additional ideas for teaching chemistry topics to pupils with special needs), with the opportunity to speak to tutors one-to-one. The programme structure also enabled teachers to make suggestions about what they wanted to cover in the subsequent sessions, which teachers valued. Furthermore, web-forum facilities provided over the duration of the programme offered ongoing contact with the tutor, enabling teachers to ask questions and seek the tutor's help with any problems as they arose back in school.

Although many teachers praised the content and activities of the programme, a small number of teachers completing the survey questionnaire and taking part in interviews identified minor issues with the programme content and activities. These issues included:

- Programme level for students (e.g. possibly pitched too high, being particularly relevant to able students, rather than lower ability students. Teachers called for ideas for how to engage lower ability students and offer less complex practicals)
- Programme level and pace for teachers (e.g. the programme may anticipate a certain level of prior knowledge and experience of chemistry that some teachers did not feel they possessed. These teachers called for a greater emphasis on chemistry theory and understanding the basics of chemistry)
- Programme relevance (such as, insufficient relevance to the new science courses offered in schools (e.g. 21st Century Science and core science GCSE) and lack of additionality to the science syllabus including ideas as to how to extend and enhance and use practicals)

- Programme content (including: lack of coverage of theory underpinning practicals though, in some instances, participants requested more emphasis on practical chemistry; lack of information regarding how practical experiments relate to the syllabus and explicit links to chemistry teaching and topics; lack of opportunity to practise setting up equipment; and the need for greater links to individual professional targets)
- Resources (including, insufficient resources for all teachers in the group to take copies away).

The survey data was analysed to explore whether attendance at a KS3, KS4 or combined training programme made any difference to teachers' perceptions of the effectiveness of the programme. It was found that, regardless of the programme level, teachers were equally positive regarding their perceptions of programme effectiveness.

In order to investigate whether there was a regional difference in the effectiveness of the CFNS programmes, the survey data was analysed to enable comparison between the region of the training programme and teachers' ratings of the effectiveness of the programme. Table 5.5 below shows the results of this analysis for the nine English regions. It presents the mean value from the ratings of the statements of effectiveness shown in Table 5.4 above.

Table 5.5: Survey teachers' ratings of the effectiveness of the CFNS programme summarised by region (mean ratings on a 1-5 scale)

Region:	No. of respondents	Relevance to my needs	Content	Delivery	Activities and approaches	Material and resources
North East	9	4.44	4.56	4.89	4.67	4.38
North West	8	3.50	3.00	4.00	3.63	4.13
Yorkshire and Humber	11	4.45	4.36	4.27	4.73	4.55
East Midlands	11	4.36	4.18	4.82	4.18	4.45
West Midlands	27	4.37	4.52	4.67	4.59	4.81
East of England	49	4.51	4.43	4.58	4.55	4.84
London	22	4.27	4.00	3.95	4.33	4.36
South East	29	4.28	4.21	4.52	4.28	4.62
South West	16	4.63	4.63	4.88	4.88	4.69
National	2	4.50	4.50	5.00	5.00	5.00
TOTAL	184					

Source: NFER survey of CFNS teachers

The data presented in Table 5.5 above shows that while surveyed teachers were generally positive about the effectiveness of the CFNS programme across all regions, those attending programmes in the South West were most positive and those attending programmes in the North West appeared slightly less positive⁴. However, these findings should be interpreted with some caution due to varied teacher attendance on the CFNS programme across the ten regions, with some regions having high numbers of attendees on training programmes included in the survey sample and other regions having low numbers.

In the survey, teachers were asked an open question about what aspect or feature of the programme they found most valuable, to which a range of responses were given (see Table 5.6 below).

⁴ While it looks like the National training programmes were particularly positive, this data is skewed due to a low number of responses.

Table 5.6: Aspect or feature of the CFNS programme surveyed teachers found most valuable

Valuable aspect or feature:	N	% cases
Practicals	110	60
Increased confidence	36	20
New ideas/knowledge/theory	28	15
Quality of the teaching	19	10
Resources available	13	7
Sharing ideas/working with colleagues	11	6
Time to browse websites/do practicals/ask questions	11	6
Good atmosphere	1	1
No response	21	11
TOTAL	184	

Source: NFER survey of CFNS teachers

Percentages have been rounded to the nearest integer

Respondents could provide more than one response, therefore percentages may add to more than 100, and number of responses may add to more than 184.

Almost two thirds of the teachers who responded to this question identified the practical aspects of the programme as the most valuable (60 per cent). Other valued aspects of the programme included: increased confidence (20 per cent), new ideas, knowledge and theory (15 per cent) and the quality of the teaching (10 per cent).

The interview data generally reflected the survey data in terms of teachers' and heads of departments' views of the most helpful and valuable elements of the programme, while also adding some additional insights as to why these features were so effective. The most valued elements of the programme are described below.

- **Emphasis on practical chemistry** – the programme was valued for the extent to which it focused on supporting non-specialists to teach practical chemistry, which was felt to be an aspect of the subject that was most difficult to learn and find time to learn. The practicals that were taught as part of the programme were felt to be relevant to chemistry teaching, could be integrated into lessons and were interesting and exciting and thus relevant to engaging students in chemistry. The programme provided teachers with time and space to gain hands-on experience of chemistry experimentation, in an environment where they were supported to explore how the experiment worked and could be undertaken most successfully and safely. Through this experience, which participants suggested was difficult to achieve within school, teachers gained confidence and competence to teach practical chemistry.
- **Support from chemistry specialists** – the programme was prized for the contact it provided with experienced and knowledgeable chemists. The tutors were felt to provide a high quality of teaching and created a successful learning environment

in which CFNS teachers felt comfortable to ask questions. The opportunity to work with chemistry experts allowed the teachers to ask for explanations of aspects of chemistry they did not understand and access support in trying out experiments, enabling the development of chemistry knowledge and understanding.

- **Resources and support materials** – participants considered the resources and support materials available through the programme to be of very high quality. Teachers learned about resources and teaching materials while on the programme that they could access to support their chemistry/science teaching and were given resources to take away following the programme. The resources were felt to be useful and relevant to chemistry teaching back in the classroom and could be shared with departmental colleagues.
- **Flexibility and tailoring** – the programme was deemed to offer a good level of flexibility and generally met teachers individual needs. The tutors differentiated their delivery to meet teachers needs, provided opportunity for one-to-one support and there was scope within the programme structure to enable teachers to suggest aspects they would like to cover (e.g. in subsequent sessions) or opt to work on specific practicals where they felt a greater need.
- **Balance between practical and theory** – teachers valued the fact that although primarily practically based, the programme covered some chemistry theory. The incremental process of learning some chemistry theory and then applying it to an experiment that demonstrated that aspect of chemistry in a practical way, was endorsed by teachers and was relevant to helping them teach chemistry to their pupils and build their own chemistry knowledge and understanding.
- **Programme structure** – the four-day programme structure of a two-day residential and two separate follow-up days was generally approved by teachers (explored with the interviewee sample only). The initial two days of the programme provided the opportunity to go into some depth and detail, while the follow-up days supported the processes of reflection on learning and integration of learning into teaching practices.
- **Sharing ideas and working with colleagues** – CFNS participants and their heads of departments valued the opportunity to work with other science teachers and share ideas, knowledge and experience. This networking was found to contribute to the CFNS teachers' learning and, in some instances, links with other teachers had been maintained following the programme to continue to provide support and share resources and ideas.

Content and activities

Emphasis on practical chemistry:

Head of department, Yorkshire and Humber

I think the most valuable aspect of the programme is giving the practical hands-on, chemistry is a very practically based subject and I think you have to have the confidence to be able to carry those experiments to get the maximum from that experience. So I think that an emphasis on that in the course is excellent.

CFNS teacher, East Midlands, 4 days, KS4 programme

Just being able to do it really, being given the opportunity to give it a go, if it doesn't work, why didn't it work, well let's try again, giving you that freedom to make mistakes, because you don't always get the chance at school to find the time to practise an experiment before you do it. Whereas there it was like oh I did that wrong, right try again, so that's why it worked - it's that opportunity.

CFNS teacher, East Midlands, 4 days (anticipated), KS4 programme

It's the fact that you've got the time to try the practical and then stand with the equipment and look at the results and try and work out the theory and have the tutor there with you going through it with you.

Support from chemistry specialists:**CFNS teacher, East Midlands, 4 days (anticipated), KS4 programme**

The practical aspect of it and the fact that you've got their time, you've got the tutors there being able to support you as well.

Head of department, Yorkshire and Humber

Just being able to ask freely about any areas that she didn't understand maybe as solidly as somebody with a full chemistry background would have, has been good for her.

Head of department, South West

I think that she felt that the level was exactly right. She was very impressed with the tutor, that she felt was very, very approachable. I don't know how big the group size was but clearly she felt she had enough individual attention. I think the tutor clearly had got exactly the right tone of enthusiasm and encouragement.

Networking and sharing experiences with colleagues:**CFNS teacher, East Midlands, 4 days, KS4 programme**

What I found helpful was meeting other teachers from different schools and in our lunch time or during practicals it was like 'we write out formulas like this, this will help people who struggle with this', so it was a nice opportunity to share practice as well.

Head of department, East of England

It is a very hands-on programme, and there weren't that many people on the course so there was the opportunity to talk to other teachers and the tutors on the course,

and that is something that is sometimes sorely missing in the pressurised environment in schools, to be able to talk about how things work and how you can do things.

Flexibility:

CFNS teacher, East of England, Days 1&2, KS4 programme

You could opt within it to look at the elements you were most interested in. So when the practicals were around the room, if there were particular bits you were most interested in you could spend longer doing that. And the ICT, we had a session with computers and you followed the bits that were relevant to you really, so that was good.

CFNS teacher, East of England, 3 days, KS4 programme

The course accommodated you as you went through, the tutors would steer the course to that need. It was really adapting to what you wanted, and there was partnership through the website where you can get support for your needs.

Continuity of support offered by the programme

During interviews, teachers were asked to discuss whether they felt there had been sufficient continuity of support offered by the CFNS programme. The majority of teachers (22 out of 28) were happy with the on-going support available from the programme tutors. Teachers felt support was provided by the resource packs they were given from the programme. In addition, the programme structure was felt to offer good support and continuity throughout, as tasks were set in between the days for teachers to try out and then discuss at the following session. There was also valued ongoing support from and contact with tutors and colleagues on the programme in the form of email and a web forum.

Support for teachers attending CFNS programme

CFNS teacher, Yorkshire and Humber, 4 days, KS4 programme

There was a forum set up on the internet, so that was good because you could ask questions and other people had written on there and said what they'd done and if it had worked, so that was good.

CFNS teacher, North East, 4 days, KS4 programme

The tutor was amazing, he was so knowledgeable. I'm still in touch with him now, and he's offered advice for various things. He's really approachable and very helpful.

Extent to which programme met expectations

This section presents data from the case study interviews with teachers and heads of department regarding their expectations of the programme and what they were hoping to get out of it, whether their expectations were met and how useful the programme has been for the teacher and their science department. The main expectation of the programme was to enhance teachers' confidence and competence to teach chemistry and practical chemistry in school. Other expectations included the hope that the programme would refresh and increase teachers' knowledge and understanding of chemistry, and give them ideas for how to teach it effectively. Overall, the majority of teachers, and all heads of department interviewed (23 and 10 respectively), suggested that the programme had met their expectations and teachers were getting out of it what they had hoped for. Teachers were more confident to teach chemistry, had gained ideas of how to teach it effectively, as well as knowledge and understanding of chemistry. The programme had also been motivational and inspirational and provided the teachers with access to more resources to teach chemistry.

As mentioned previously, for a minority of teachers, the programme had fallen short of their expectations. These teachers had wanted support and ideas for how to teach the new science curriculum and, in one instance, extend their chemistry teaching beyond the standard syllabus. Other teachers felt the programme lacked sufficient linkage between the practical elements and chemistry theory and the topics of the chemistry syllabus.

Extent to which programme met expectations

CFNS teacher, Yorkshire and Humber, 4 days (anticipated), KS4 programme

All the practical work, that's what I was after and that's what I got, I really, really enjoyed it, I could have spent all day doing practicals and practising the techniques.

CFNS teacher, East Midlands, 4 days, KS4 programme

Yes, I wanted to get a bit more confident in teaching chemistry and make my lessons more interesting, and I've achieved both those objectives.

CFNS teacher, North East, 4 days, KS4 programme

I've never really studied chemistry since I was 18, so it was confidence really and getting back to grips with it and getting out of it as much as I can and feeling confident in doing experiments in chemistry again and yes it worked, it really did.

CFNS teacher, East of England, 3 days (anticipated), KS4 programme

It was ideal, it was as if they'd taken the specification and done a practical CPD for that science course, that was just what I wanted.

5.4 Suggestions for future development of the CFNS programme

This section presents findings on teachers' and heads' of departments suggestions for the future development of the CFNS programme. It draws on data from the teacher survey and from interviews relating to the likelihood that participants would recommend the CFNS programme to colleagues, whether heads of department would consider supporting other staff members to attend the programme and comments relating to improvements or suggestions for the future.

Would participants recommend the CFNS programme?

Survey respondents were asked whether any of their colleagues had subsequently attended the CFNS training programme on their recommendation. Responses are displayed in Table 5.7 below.

Table 5.7: Colleagues attending CFNS training programmes based on recommendation from CFNS teachers responding to survey

Attendance of CFNS programme	N	%
No a colleague has not attended	133	72
A colleague intends to attend	35	20
Yes a colleague has attended	8	4
No response	8	4
TOTAL	184	

Source: NFER survey of CFNS teachers

Percentages are rounded to the nearest integer and may not sum to 100

More than three-quarters of those respondents who gave a response to this question did not have a colleague who had subsequently attended the CFNS training programme on their recommendation. However, a quarter of these respondents either

had a colleague who had also attended or a colleague who was intending to take up a place on a CFNS training programme.

The vast majority of teachers who were interviewed suggested that they would recommend the CFNS programme to their colleagues and many had done so, claiming that it had been useful and worthwhile. All heads of departments added that they would support other members of staff to attend the programme if it was applicable to their needs. Some interviewees suggested that they would recommend the programme, but that they had not yet done so as they were not in contact with anyone else to who it would be applicable (i.e. a chemistry non-specialist). Three teachers in the interview sample suggested that they would not recommend the programme as it had failed to meet their needs and, overall, they had gained only minor benefits from attending. These teachers offered the following reasons as to why they would not recommend the CFNS programme, as mentioned previously:

- the programme had been pitched at too high a level (e.g. aimed at teaching separate GCSE chemistry or A-level chemistry students) and had therefore not been relevant to the level of student to whom this teacher taught chemistry
- there was a lack of coverage of chemistry theory to underpin the practicals taught on the programme
- the programme had been boring and offered little in the way of new ideas for teaching chemistry, rather it regurgitated the syllabus the teacher was already teaching in school.

Recommend the programme

CFNS teacher, East of England, 3 days (anticipated), KS4 programme

Extremely useful, I would recommend it to everybody and anybody. I have spoken to other colleagues out of school and said how good the day was and if you get the opportunity it was well worth it because of the cost factor and its usefulness, being able to apply it in the classroom.

CFNS teacher, London, 4 days, KS4 programme

Definitely, I found it the most motivating piece of In-Service training I've ever been on. We have praised the course widely around the department. This course had you absolutely focused all the time. I think the people running the course actually appreciated that you were going back to run this with a class, in a school that doesn't necessarily have fine labs. They also had a good sense of fun too. Both of the tutors on the course had been teachers in the past.

Improvements and suggested future developments

This section draws together the data from the survey and interviews and is also supplemented by researchers' perceptions regarding possible improvements to the CFNS training programme. It is important to bear in mind in this section that, overall, teachers and their heads of departments were positive about the CFNS programme, both in terms of experiences and the impacts of the programme. It is, thus, recommended that any suggested improvements detailed here should be treated as information regarding how to enhance the success of the programme and tailor it to individual needs, rather than substantially change it in any way. Criticisms of the programme appear to arise when teachers have expected something from the programme that it was not necessarily designed to deliver. Hence, one possible area of development of the programme may be to provide more detail when advertising the programme as to what is offered and who it might be suitable for. There may also be scope to further enhance the programme's capacity to meet teachers' and science departments' specific needs, as these do obviously vary somewhat. Some teachers may require a shorter, 'refresher' programme and others may require a more comprehensive programme to develop understanding and confidence. One option may be to offer a two tiered programme with a two day course for teachers who seek to build on existing confidence and extend their practice, and a more intensive, four day programme to support those teachers who lack confidence and are wishing to develop their understanding of the subject. In summary, possible areas in which to develop the programme include:

- enhance the relevance of the programme to the new science courses taught in schools
- ensure explicit links are made on the programme to KS3 and 4 level teaching (e.g. links between the practicals taught on the programme and how these may fit into the syllabuses)
- ensure sufficient coverage of chemistry theory to underpin the practical work
- ensure the chemistry taught on the programme is relevant to teaching various ability levels of students
- consider further tailoring of the programme to teachers' different needs (e.g. by offering a two tiered programme). A few teachers would have preferred the level to be higher, while others needed it to be more basic
- provide more detail in advertising the programme as to who the programme is aimed towards and the types of teachers and departments it might suit (including, to encourage teachers and departments to consider the value of supporting a teacher to attend the programme, how they might be supported to integrate any new learning into their own practice and that of the department)

- consider offering teachers experiences in setting up some of the experiments, rather than having them already prepared, so that they are confident about setting them up back in school
- consider using a mix of more local venues for the programme, so that teachers have less distance to travel and can network with teachers from other local schools
- improve communication and advanced planning regarding dates of follow-up sessions to ensure teachers are able to pre-arrange and plan time out of school
- consider some form of ongoing support/forum and promotion of networking amongst science/non-specialist teachers (perhaps providing non-specialists with virtual chemistry specialist mentors) to support teachers' ongoing issues with chemistry understanding, theory and practical work.

6 Impacts from the Chemistry for Non-Specialists programme

Key findings

The CFNS programme was reported to have had numerous positive effects on teachers themselves, as well as on pupils and colleagues within the science department.

Teacher impacts:

- The programme was found to have strong positive impacts on teachers' confidence to teach chemistry and practical chemistry, their teaching practice and the resources and materials they were able to draw on in teaching chemistry.
- There were also strong positive impacts on teachers' chemistry knowledge and understanding and their motivation and attitudes towards chemistry.
- Where the impacts were strongest, the programme had also impacted on teachers' roles and responsibilities within the department and professional development (e.g. greater contribution to teaching and learning in the department, enhanced job prospects and diversity of skills as a science teacher) as well as the amount of chemistry CFNS teachers were teaching since the programme.
- Factors that affected whether or not the programme had impacted on teachers and, in particular, whether or not the teachers had been able to use what they learned, included issues around: the teachers' expectations of the programme; the programme content and relevance; opportunities to teach chemistry following the programme; and changes in departmental priorities and staffing.
- The programme was least likely to have affected teachers' awareness of chemistry careers and their ability to support students' decision making regarding further study and careers in chemistry.
- Those teachers attending days 1 and 2 plus at least one of days 3 and 4 tended to experience greater levels of impact.

Pupil impacts:

- Between forty and sixty-five per cent of the teachers consulted felt that the programme had resulted in quite a lot of effect or a great effect on their pupils' enjoyment of chemistry, their interest in chemistry as a subject and their understanding and attainment in chemistry.
- Pupils themselves, tended to agree, rather than disagree, that they understood chemistry better, were doing better in chemistry, used more materials, resources and equipment in lessons and enjoyed it more. However, there were no apparent impacts on pupils' interest in studying more chemistry in the future (though this should not be an expected outcome at this early stage of the programme's

implementation). The sample of pupils was small and hence caution should be exercised in terms of generalisation from these findings.

- The majority of all the teachers consulted were more sceptical about the extent to which pupils' understanding of chemistry careers would be affected by their participation in the programme.
- There were slightly more pupil impacts where teachers had attended at least one of days 3 or 4.

Colleague and departmental impacts:

- At least half of the teachers consulted felt that their attendance on the training programme had impacted on colleagues within the science department.
- The most common impact of the CFNS programme on colleagues was on colleagues' access to materials and resources. Colleagues were using the ideas, practicals and resources that the CFNS teacher had gained from the programme in their own chemistry teaching practice. Impacts were also noted on departments' flexibility in deploying staff, enhanced teaching and learning and the development of curriculums and Schemes of Work.
- Vehicles for sharing learning included dissemination at departmental meetings, informal discussions and updating schemes of work.
- Teachers' attendance on the programme had little effect on colleagues' awareness of chemistry careers.

6.1 Introduction

This chapter describes the impacts associated with teachers' attendance on the chemistry for non-specialists programme. It draws on evidence from the teacher survey and case study interviews with teachers and heads of department (or an equivalent senior role) and a pupil survey. The chapter covers the following sections:

- impacts of the CFNS programme on teachers
- emerging impacts of the CFNS programme on pupils
- impact of the CFNS programme on schools (including on colleagues and the science department, as well as the wider school).

It is worth noting that the sample of pupils surveyed was small (N 70) and that caution should, therefore, be exercised in terms of generalisation from the findings. However, the findings do suggest some positive early impacts.

6.2 Impacts of CFNS for teachers

This section explores the impact of the CFNS programme on the participating teachers. It considers the different types of impact identified by both teachers consulted through the survey and interviews, including impacts on: the amount of chemistry teaching; chemistry teaching practice; affective outcomes (e.g. confidence, enjoyment and motivation); chemistry knowledge; awareness of chemistry careers, and; professional development. The section is then brought to a close by examining the perceptions of teachers who responded to the survey in relation to the overall extent of impact on their professional practice and the degree to which this is attributable to the programme itself.

Impact on amount of chemistry teaching

The teacher survey asked respondents to comment on whether they were teaching more chemistry since attending the CFNS programme (see Table 6.1 below).

Table 6.1: Survey sample of teachers: teaching more chemistry since the programme

	N	%
Yes	57	31
No	123	67
No response	4	2
TOTAL	184	100

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

Table 6.1 above shows that, of those who responded to this question, just under a third (31 per cent) of teachers reported teaching more chemistry since being on the programme. However, the majority of teachers (67 per cent) indicated that the programme had not made any difference to the amount of chemistry they were teaching.

Where CFNS teachers were teaching more chemistry since attending the programme, they were most likely to be teaching more KS4 chemistry (63 per cent), followed by more KS3 chemistry (18 per cent) or both (12 per cent) (see Table 6.2 below).

Table 6.2: Level of chemistry in which teaching has increased by CFNS survey teachers

	N	%
KS3	10	18

KS4	36	63
KS3 & 4	7	12
No response	4	4
TOTAL	57	100

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

A filter question: those teachers who said they were teaching more chemistry

This finding might be expected given that, overall, 87 per cent of the sample attended a programme aimed at KS4 chemistry teaching. However, it also suggests that, in some instances, those teachers who attended a KS4 programme were able to apply this to teaching more KS3 chemistry.

Similar to the teachers surveyed, the majority of the teachers who were interviewed also reported that there had been no change to their current amount of chemistry teaching since attending the programme, and half of the interview sample added that the programme would not change how much chemistry they were teaching in the future. In some instances, reasons for this lack of impact were provided, including that: the timetable was already planned for the year; deployment of staff was primarily based on teachers teaching within their subject specialism, and; teachers were already teaching all the science, as much science as they could fit in, or as much science as was needed, within the school and department.

Where teachers in the interview sample were teaching more chemistry as a result of attending the programme, or expected that they would be teaching more next year, this included teaching more periods of chemistry as well as teaching a higher level of chemistry. Several teachers added that they were not sure whether they would be teaching more chemistry next year as the timetable had not been confirmed, but two added that they hoped they would be teaching more and that they were now more confident and able to take on more chemistry teaching. Several heads of departments concurred with the views of teachers in this regard, stating that the programme had increased the amount of chemistry teaching the CFNS teacher was doing or would be doing in the future. Three teachers explained that they would be teaching less chemistry since they had been on the programme and, in two instances, this was due to the recent recruitment of additional chemistry specialists to the department and, in one instance, due to the teacher's ensuing retirement.

Impact on chemistry teaching practice

The survey asked teachers to rate the extent to which they felt the programme had affected their teaching practice. The vast majority of teachers (85 per cent) suggested that the programme had changed their practice. Only a small minority of respondents were less positive and no teachers claimed the programme had had no effect on their practice. Analysis was conducted to explore any variation in the extent of impact of the programme on practice by the course level and by teachers' highest chemistry qualification, but neither revealed significant differences. There appeared to be some slight variation in the extent of impact on practice depending on the region in which the course was held and delivered, although these results should be treated with caution due to the small numbers of courses delivered in some regions. In the North East, East Midlands, West Midlands and East of England, almost all teachers had changed their practice as a result of attending the programme⁵. In terms of both the effect of the programme on professional practices, and the extent to which practice had changed as a result of the programme, the North East, West Midlands and East of England stood out as regions in which impacts of this nature had been particularly strong.

Teachers were asked to rate (on a scale of 1 to 5) the effect of the programme on various aspects of their practice (see Table 6.3 below).

Table 6.3: Survey sample of teachers: extent of impact of CFNS programme on chemistry teaching practice

	1 = no effect (%)	2 = little effect (%)	3 = some effect (%)	4 = quite a lot of effect (%)	5 = great effect (%)	N
Materials and resources	2	4	17	52	25	182
Chemistry teaching practice	3	4	23	53	17	184
Enjoyable and engaging chemistry lessons	1	5	31	50	13	182
Variety of practical lessons	3	10	28	46	14	182
Practical chemistry class management	6	8	28	42	16	182

⁵ This was also the case for the National programme although the numbers are extremely small.

Number of practical lessons	11	14	33	31	11	182
Investigative work	10	19	42	24	6	183

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

A series of single response items

A total of 184 respondents gave a valid response to at least one of these items

Table 6.3 shows that the majority of the teachers surveyed had experienced positive impacts from the programme in relation to their chemistry teaching practice (the majority of respondents rated a 3 or more for all of these items). The table above shows that the programme's strongest impact on teachers' practice appeared to be on the materials and resources teachers are able to draw on in their chemistry teaching, as well as impacting on their chemistry teaching practice generally (with the majority of respondents rating these items with a 4 or a 5). The programme also appears to have had a positive impact on how enjoyable and engaging teachers perceive their chemistry lessons to be, the variety of practical lessons taught and teachers' classroom management of practical chemistry lessons (the majority of respondents rated a 3 or 4 for these items). To a lesser extent, impacts were noted on the number of practical lessons taught and the use of investigative approaches in teaching (usually rated a 3).

The teacher interviews echoed the findings of the survey data, and their comments shed further light on the nature of the impacts on chemistry teaching practice. Teachers had particularly gained knowledge of experiments, practicals and demonstrations that they could use in their chemistry lessons, including more effective ways of carrying out experiments. Teachers also reported gaining resources from the programme, including videos, CD-ROMs and books. In addition, teachers gained chemistry theory and knowledge from the programme, as well as new ideas for how to teach chemistry (e.g. how to explain specific concepts, topics and ideas and how to engage pupils in chemistry). Interestingly, the teachers interviewed noted the long-term benefits of the programme, particularly as it provided relevant ideas and knowledge that could be applied to teaching chemistry year after year, as well as providing resources that the teacher could keep and refer to repeatedly. Despite these impacts, as mentioned previously, the extent to which teachers had actually been able to integrate learning into their practice at the point of interview, varied somewhat. Factors that affected whether or not teachers had been able to use what they learned from the programme included issues around the teachers' perceptions of the programme content and relevance, opportunities to teach chemistry following the programme and changes in departmental priorities and staffing.

In many cases, teachers interviewed also reported how the programme had resulted in them teaching more practical chemistry lessons, or that this was anticipated in the following academic year. The teachers who were interviewed also discussed how they had changed the way they engaged with their pupils in teaching chemistry. These teachers suggested that they were more enthusiastic, came across as being more confident and used more anecdotes and stories to explain chemistry to the students. In addition, teachers asserted that the programme had affected their teaching of other science subjects. The programme had enhanced teachers' confidence and understanding as well as their practical skills and this could be applied across the sciences and the various topics.

Where teachers were not teaching any more practical chemistry following the programme, the reason for this, in some instances, related to the perceived lack of relevance of the programme to the level of ability of students the CFNS teacher taught chemistry to (i.e. the programme was pitched too high) and insufficient coverage on the programme as to how practicals fitted into the syllabus and related to chemistry theory. Other restrictions to teachers using the programme to teach more practical chemistry included local health and safety regulations and the teachers' stage on the syllabus (often they had finished teaching the chemistry modules or topics for the academic year which lent themselves to practical chemistry teaching).

Further analysis of teacher interview data revealed that there was no difference between either the extent or type of impacts on teachers depending on their level of existing chemistry qualification. Those with higher levels of chemistry qualification (e.g. who had studied chemistry as part of their degree) were no less likely to benefit from the programme. This finding suggests that the programme has been effective in producing positive outcomes for teachers regardless of their relative starting positions in terms of chemistry qualifications.

Due to difficulties with engaging the participation of teachers who had only experienced days one and two of the programme in the interview phase of the evaluation, the sample is biased towards those teachers who completed the full four days of the programme and the extent of impacts reported here may be accordingly swayed. However, it may be interesting to note that, the two teachers in the sample who had only experienced days one and two, reported more moderate impacts of the programme. For one of these teachers, the impact of the programme was reduced as they were no longer going to be teaching chemistry due to the recruitment of more chemistry specialists to the department. The other teacher had experienced little

impact of the programme as she had not found it to be relevant to helping her teach the new 21st Century science curriculum.

Data from the pupil survey revealed that pupils were more likely to agree, rather than disagree, that there had been improvements to their chemistry lessons over the academic year (see Table 6.4 below).

Table 6.4: Surveyed pupils' views about changes to chemistry lessons

Changes to chemistry lessons	Positive response	Neutral N	Negative response	N
	N		N	
More practical work/experiments in lessons	30	27	11	68
Teacher knows more about different topics	40	24	3	67
Teacher able to answer my questions better	46	19	2	67
Use more materials, resources and equipment in lessons	37	19	12	68
Teacher tells more stories/anecdotes about chemistry	19	29	21	69
Teacher talks more about scientific careers and what scientists do	8	28	33	69
N = 70				

Source: NFER survey of pupils (teachers attended CFNS programme)

Data presented in the table are the highest positive and negative response on a 1-5 scale (1 is a highly positive response while 5 is highly negative)

Two or three pupils did not respond to certain items of this question

Table 6.4 above shows that over half of the pupils agreed that their teacher seemed to know more about different chemistry topics and could answer their questions better (40 and 46 respectively). Just over half of the pupils (37) endorsed the statement that they were using more materials, resources and equipment in lessons. Just under half of the pupils (30) replied that lessons involved more practical work and experiments. In slight contrast, pupils tended to be neutral about whether or not their teachers were using more anecdotes or stories to explain chemistry. Interestingly, pupils were considerably more likely to disagree, than agree, that their teacher talked more about scientific careers and what scientists do since the programme – adding weight to the finding that this had not been a strong impact of the programme.

Impact on teachers' chemistry teaching practice

CFNS teacher, Yorkshire and Humber, 4 days, KS4 programme

It's improved my awareness of all the different types of things you can do with chemistry, given me lots of ideas of how to teach it. Finding out about different methods of teaching certain concepts and things, the more you find out the more you can play around with them and see what works best.

CFNS teacher, East Midlands, 4 days, KS4 programme

It's made me a more confident and effective teacher of chemistry, and it's probably, made me a bit safer, to be honest, as well.

CFNS teacher, South East, 4 days, KS4 programme

I use a wider variety of practicals and demos now, and we were given quite a lot of resources as well, so those are quite handy to look at, and pick up ideas, things that we didn't even necessarily cover on the course.

Head of department, East of England

After she did her first two days they showed her some experiments that were possible, feasible and safe to do and I actually did a lesson observation on her Key Stage 4 delivery as part of performance management, but she certainly had more confidence in showing the children, allowing the children to actually use the equipment, make mistakes with it, and actually partake in a real practical lesson which EBD children don't often get.

Affective outcomes

The survey asked participating teachers to rate the extent to which the programme had affected their confidence in teaching chemistry. Table 6.5 below presents teachers' responses to this category of items.

Table 6.5: Survey sample of teachers: extent of impact of CFNS programme on affective outcomes

	1 = no effect (%)	2 = little effect (%)	3 = some effect (%)	4 = quite a lot of effect (%)	5 = great effect (%)	N
Confidence to demonstrate	1	2	9	46	43	183
Confidence to teach practical lessons	2	4	11	50	34	184

Confidence to teach chemistry	1	3	15	53	29	183
Morale and wellbeing	5	7	28	39	21	175

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

A series of single response items

A total of 184 respondents gave a valid response to at least one of these items

The table above shows that the CFNS programme had a strong impact on teachers' confidence to demonstrate chemistry, teach practical chemistry lessons and teach chemistry generally, with the vast majority of the sample giving ratings of 4 or 5 in response to these items. Accordingly, impact on teachers' confidence to teach chemistry and practical chemistry constitutes the strongest impact of the CFNS programme overall. Teachers also reported that the programme had affected their morale and wellbeing positively.

Data from interviews undertaken with CFNS teachers and heads of departments corroborated this finding that the programme had a strong positive impact on teachers' confidence to teach chemistry. Teachers maintained that they felt more confident in what they were doing and, therefore, more willing to undertake practical work with the students. Teachers felt that they were more equipped and skilled to deliver the subject and to a higher quality. In addition, teachers claimed that the programme had resulted in them being more excited by chemistry and more willing to teach chemistry. The programme had helped teachers overcome their reservations and fears about teaching chemistry (e.g. that it was a difficult subject that they did not understand or that practicals would go wrong in front of the pupils) and they were enjoying teaching it more. One teacher had been motivated by the programme to use additional science publications to further develop her knowledge. Those teachers who were not impacted in this way by the programme tended to comment that they already enjoyed, or had a positive attitude towards, chemistry and teaching chemistry.

Affective outcomes

CFNS teacher, Yorkshire and Humber, 4 days, KS4 programme

Confidence and skills with practicals. I got lots of experience, I'm more confident doing practicals now, I'm more willing to do them.

CFNS teacher, North East, 4 days, KS4 programme

I enjoy teaching it a lot more now. I always enjoyed teaching it, but there was always a little bit of a fear like 'I'm not quite sure if I can do that' or 'if this doesn't work, I don't know how to fix it'. Whereas now I'll just go in and I'll try stuff, and if initially it doesn't work, well I'll just tell the kids 'get on with this, I'll sort this out'...I know why that didn't work, I didn't mix it well enough or I need to add a bit of heat...It gives you a lot more independence that way I think.

CFNS teacher, South West, 4 days (anticipated), KS3/4 programme

I think I've realised how much fun chemistry is and I just think it's enlightened me, I wish I'd done it ten years ago. Since being involved I've been receiving things like the catalyst and things like that, magazines, they're superb, it's given me lots more information than I had before.

CFNS teacher, North West, 4 days, KS4 programme

It really developed my interest further in chemistry, and it obviously increased my subject knowledge as well.

Head of department, West Midlands

[The CFNS teacher's] confidence in doing the chemistry has greatly improved, and she will now attempt experiments that she wouldn't have tried before.

Chemistry knowledge

The survey asked teachers to rate the extent to which the programme had affected their chemistry knowledge and understanding and the application of their chemistry knowledge and theory in the classroom. Table 6.6 below presents teachers' ratings of these impacts.

Table 6.6: Survey sample of teachers: extent of impact of CFNS programme on chemistry knowledge

	1 = no effect (%)	2 = little effect (%)	3 = some effect (%)	4 = quite a lot of effect (%)	5 = great effect (%)	N
Knowledge of chemistry	2	9	24	49	16	183
Understanding of the topics covered	3	10	25	49	14	183
Ability to	4	13	34	39	10	183

explain theory						
Use of anecdotes in teaching	4	19	38	33	6	180

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

A series of single response items

A total of 184 respondents gave a valid response to at least one of these items

It can be noted from Table 6.6, that the CFNS programme had a positive impact on teachers' knowledge and understanding of chemistry and of the chemistry topics covered during the programme. To a slightly lesser degree, the programme was also felt to have impacted on teachers' ability to explain chemistry theory to pupils and support their use of anecdotes to aid pupils' understanding. Overall, the majority of teachers felt that the programme had resulted in at least some effect on their chemistry knowledge.

Interviews with teachers and heads of department revealed equally strong impacts of the programme on teachers' chemistry knowledge and understanding. Teachers felt better able to explain chemistry to their pupils and to go into more detail and enrich their teaching with more background information and stories in order to aid pupils' understandings. Several other teachers noted how the programme had refreshed their previous chemistry knowledge and enhanced their knowledge of practical techniques. The views of heads of departments mirrored those of teachers and they described how they had witnessed a growth in the CFNS teachers' chemistry knowledge and understanding since the programme. Where this had not been an impact, teachers felt that the programme had not focused sufficiently on developing and extending knowledge and understanding and one teacher felt that the programme failed to develop a basic understanding of chemistry theory. For other teachers, the lack of impact on their chemistry knowledge was due to an existing competence in this regard.

Impacts on teachers' knowledge and understanding

CFNS teacher, South West, 4 days (anticipated), KS3/4 programme

I think it has given me more background, because I think we always tend to say when you're teaching your own specialism you have so much background knowledge on all aspects of it that when you're actually put into something that you regard as something you're not quite as confident in, you just haven't got the background stories, so yes it has helped.

CFNS teacher, East Midlands, 4 days, KS4 programme

Definitely, made me bring it to a head because it's been a long time since I did chemistry, there were bits that I had forgotten and then remembered.

Head of department, Yorkshire and Humber

I think she's developed more confidence. I think she feels that she can tackle some of the demonstrations and talk around them. So I think it has improved her confidence and her knowledge and I think she's enjoyed being able to talk to other people in the same boat as herself on the course, the chat that you have with people on the course can be quite informative as well.

Awareness of chemistry careers

The survey asked teachers to rate the extent to which the programme had affected their awareness of chemistry careers, chemistry careers resources and their capacity to advise pupils regarding chemistry further study and careers. Table 6.7 below presents teachers' responses to each of these items.

Table 6.7: Survey sample of teachers: extent of impact of CFNS programme on awareness of chemistry careers

	1 = no effect (%)	2 = little effect (%)	3 = some effect (%)	4 = quite a lot of effect (%)	5 = great effect (%)	N
Awareness of chemistry careers	28	25	32	13	3	182
Awareness of chemistry careers resources	24	29	26	16	5	176
Capacity to advise pupils	26	30	28	14	2	175

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

A series of single response items

A total of 184 respondents gave a valid response to at least one of these items

Teachers surveyed indicated that the programme had had little effect on their awareness of chemistry careers and their capacity to advise students regarding further chemistry study or careers, with the majority of the sample rating these items with a 1 to 3 score. The CFNS programme appears to have had least impact in this area.

Responses from teachers in the interviews generally concurred with the findings of the survey data, in that the programme had resulted in the least impact on teachers' awareness of chemistry careers. Interviewees felt that this lack of impact was due to chemistry careers not being a major focus of the programme or an element that had been covered in any detail. Some CFNS teachers felt that they already had some background information to bring to bear regarding chemistry careers, and others questioned the relevance of discussing careers information with the pupils they were teaching. Where teachers in the interview sample did feel they had gained some knowledge of chemistry careers from their experiences on the programme, this was usually through resources and discussion with tutors and fellow colleagues on the programme. However, despite this increased awareness, it was not evident that these teachers had imparted this information to pupils with any consistency. Indeed, two teachers acknowledged that they had not done so, suggesting that the pupils were too young to be considering careers and that this was not part of the teacher role, but more relevant to the career adviser role.

Awareness of chemistry careers

CFNS teacher, North East, 4 days, KS4 programme

A little bit, I would say that the course covered more about what we would be teaching, practicals and demonstrations, it didn't necessarily go into that much detail about what chemistry careers were available.

CFNS teacher, East of England, 3 days (anticipated), KS4 programme

It [chemistry careers resources] would probably have been something that I would pass on had we got a careers adviser, although it is useful to drop in because kids think, well what does a scientist do, but I think I probably had the knowledge before anyway.

Professional development

The survey asked teachers to rate the extent to which the programme had affected their own professional development, as well as their contribution to colleagues and the school as a whole. Table 6.8 below presents teachers' responses to these items.

Table 6.8: Survey sample of teachers: extent of impact of CFNS programme on professional development and wider contribution

	1 = no effect (%)	2 = little effect (%)	3 = some effect (%)	4 = quite a lot of effect (%)	5 = great effect (%)	N
Own professional development	4	6	27	43	20	175
Contribution to colleagues and school	3	7	33	42	15	177

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

A series of single response items

A total of 184 respondents gave a valid response to at least one of these items

The majority of teachers surveyed experienced positive effects on their own professional development and their contribution to colleagues and the school, commonly rating these items from 3 to 5. This type of impact of the programme was rated slightly less strongly than impacts on teachers' confidence to teach chemistry and practical chemistry (the most prominent impacts of the programme on teachers), but is rated equally to the degree of impact on teachers' chemistry knowledge.

Interviews with teachers and heads of department provided some further insight as to the nature of this impact. Teachers' roles had been developed as a result of their involvement in the programme in that they had been asked to teach more chemistry or take on the teaching of a higher level chemistry course (e.g. GCSE, A-level teaching or a greater role in the science club). For other teachers impacted by the programme in this way, although their actual role had not been altered, their capacity to carry out an existing role or responsibility had been positively affected. For instance, several teachers noted that they were able to bring more ideas and experience to bear on existing roles such as Advanced Skills Teacher and KS3 science coordinator, as a result of attendance on the programme. In one instance, the programme had impacted on a teacher's career development in enabling him to move into science teaching from another subject discipline and for other teachers the experience of the programme was felt to have enhanced their diversity of skills as a science teacher. Heads of department noted impacts in relation to the development of teachers and the curriculum, this included: teachers' greater contribution to teaching and learning within the department; enhanced confidence to network with other science teachers, including in other schools, and; the development of Schemes of Work and curriculums. This had resulted in some teachers being given responsibility for

teaching more chemistry or teaching at a higher level. Where there had not been an impact on teachers' professional development as a result of attending the programme (in around half of the interview cases), teachers explained that this had not been the aim of their participation, that they were part-time or were the only member of staff in the department.

Impacts on professional development

Head of department, East Midlands

She's a KS3 coordinator, so it actually allowed her to feed back and expand that role, she developed that part of teaching and learning in the KS3 in her normal role.

Head of department, Yorkshire and Humber

She's moved from teaching KS4 Year 10 into teaching Year 11 and I wouldn't have felt comfortable doing that if I hadn't seen her make quite rapid improvement in terms of what she was doing over the time, so that in itself changed practice and it's good experience for her, so she's able to write it into her CV in the future that she's managed to deliver both subjects at GCSE and I think that can be quite valuable.

Other impacts

The survey questionnaire gave teachers the opportunity to identify any 'other' impacts of the programme on themselves. Other impacts of the programme were noted on their awareness and access to science teaching resources. The programme had also motivated teachers' own further learning around chemistry. In addition, during interviews with teachers and heads of departments, other impacts were also noted regarding teachers' links with other science teachers, as well as those from other schools. Furthermore, one head of department identified that as a result of the increased confidence in teaching chemistry that one CFNS teacher had gained on the programme, their management and engagement of the class had been enhanced.

Overall extent of impact on practice

In order to sum up the amount of impact of the CFNS programme on teachers' practice, respondents were asked to rate the overall extent of impact and the extent to which they attributed this impact to the CFNS training programme (see Table 6.9 below).

Table 6.9: Survey sample of teachers: overall effect of CFNS on professional practice

	1 = no effect (%)	2 = little effect (%)	3 = some effect (%)	4 = quite a lot of effect (%)	5 = great effect (%)	N
Affect on professional practices overall	1	5	16	61	18	182
Extent of attribution of impact to CFNS programme	2	4	17	36	41	172

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

A total of 184 respondents gave a valid response to at least one of these items

Table 6.9 shows that the CFNS programme had a positive effect on teachers' professional practice to quite a strong degree (79 per cent rated a 4 or 5). More than three-quarters of respondents (77 per cent) then also confirmed that this impact could be attributed to their attendance on the CFNS programme as opposed to other science related CPD undertaken during a similar time frame.

Further analysis was carried out to explore whether there was any variation in terms of the impact of the programme on professional practice, depending on the number of programme days the teacher had attended. Table 6.10 below sets out the results of this analysis.

Table 6.10: Survey sample of teachers: effect on professional practice by days attended

	1 = no effect (%)	2 = little effect (%)	3 = some effect (%)	4 = quite a lot of effect (%)	5 = great effect (%)	N
Days 1 & 2 only	0	13	23	43	21	47
Days 1 & 2 plus at least one of Day 3 or 4	1	2	13	67	16	135

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

No response: 2 respondents

Table 6.10 shows that sixty-four per cent of teachers who attended days 1 and 2 only, rated that the programme had quite a lot of effect or a great effect on their professional practices. In comparison, eighty-three per cent of teachers who attended at least one of days 3 and 4 rated the programme as having quite a lot or a great effect. This finding suggests that attendance at three or all four of the days of the programme leads to greater impact on practice. However, it also indicates that those who attended days 1 and 2 also experienced impacts, possibly suggesting that a lack of impact may not be behind reasons for drop out of days 3 and 4 and intimating that a two-day training programme may be sufficient to change or improve non-specialists' chemistry teaching practice.

Variation in impact according to the number of days attended was explored further in order to examine its effect on different aspects of practice in more detail. Table 6.11 below compares the ratings of those who attended days 1 and 2 only and those who attended at least one of days 3 or 4 to each of the areas of impact on teachers.

Table 6.11: Survey sample of teachers: extent of effect on aspects of practice (those giving a rating of 3 or more) by days attended

	Days 1 & 2 only (%)	Days 1 & 2 plus at least one of Day 3 or 4 (%)
Materials and resources	85	96
Chemistry teaching practice	86	97
Enjoyable and engaging chemistry lessons	89	95
Variety of practical lessons	83	89
Practical chemistry classroom management	81	87
Number of practical lessons	63	80
Investigative work	64	73
Confidence to teach chemistry	96	96
Confidence to teach practical chemistry	98	93
Confidence to demonstrate	100	98
Morale and wellbeing	84	90
Knowledge of chemistry	83	91
Understanding of topics covered	76	90
Ability to explain theory	76	85
Anecdotes	70	79
Awareness of chemistry careers	50	48
Awareness of chemistry careers resources	55	43
Capacity to advise pupils	48	42
Own professional development	87	92
Contribution to colleagues and school	83	92
TOTAL	47	137

Source: NFER survey of CFNS teachers

A series of single response items

A total of 184 respondents gave a valid response to at least one of these items

Overall, in almost every area of impact, those teachers attending at least one of days 3 and 4 reported experiencing greater levels of impact. In particular, there appears to be a greater effect on the materials and resources teachers are able to draw on, teachers' chemistry teaching practice, the number of practical lessons taught and their understanding of the topics covered where teachers have attended at least one of days 3 or 4 rather than days 1 and 2 only. However, in some aspects of practice, there appears to be very little or no difference between those attending a greater number of

days (see shaded areas on table). For instance, the impact of the programme on teachers' confidence to teach chemistry, practical chemistry and demonstrate chemistry is just as high, if not higher, for those who did not attend either day 3 or 4. In these cases, the percentages are very high for both teachers who have attended at least one of days 3 or 4 or days 1 and 2 only. Furthermore, in terms of impact on teachers' awareness of chemistry careers, those attending only days 1 and 2 report greater levels of impact. This variation in the extent of impacts may warrant further exploration and may well relate to the types of teachers attending, their motivations and reasons for attending and relative starting positions. It may also be a feature of the training programme that it is successful at achieving impacts after only days 1 and 2 and perhaps that days 3 and 4 provide additional consolidation and development in particular areas, such as the confidence to increase the number of practical lessons that teachers deliver.

6.3 Emerging impacts of CFNS for pupils

This section explores the extent to which teachers' attendance on the programme has resulted in impacts on the pupils to whom they teach chemistry. However, at this early stage of the programme, where many teachers have not yet completed all of the days of the programme and may not have had the opportunity to use or embed any learning from the programme, significant impacts on pupils may not be expected. This section, thus, provides a suggestion of the early impacts where teachers have been able to put into practice what they had learned.

The survey asked teachers to comment on the extent to which they felt their attendance on the training programme had subsequently affected the pupils to whom they taught chemistry. Table 6.12 below presents teachers' responses to a list of possible pupil impacts.

Table 6.12: Surveyed teachers' perceptions of the changes to pupils' experiences of and attitudes towards chemistry since attending the programme

	1 = no effect (%)	2 = little effect (%)	3 = some effect (%)	4 = quite a lot of effect (%)	5 = great effect (%)	N
Enjoyment of chemistry	1	7	27	52	13	168
Interest in chemistry	3	10	35	45	8	168
Understanding of chemical concepts	4	11	36	44	5	169
Attainment/achievement in chemistry	4	13	43	36	4	160
Motivation to study chemistry	7	14	41	34	4	166
Future intentions to study chemistry	13	23	49	13	3	158
Understanding of chemistry careers	30	24	36	8	2	162

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

A series of single response items

A total of 170 respondents gave a valid response to at least one of these items

As can be seen from the table above, the teachers surveyed felt that, to some extent, their pupils had been affected positively in a range of ways by their attendance on the programme (although these impacts are rated less strongly than those on the teachers themselves and are rarely rated 5, as 'great effect'). In particular, teachers suggested that their participation in the programme had enhanced their pupils' enjoyment of, and interest in, chemistry (92 per cent and 88 per cent of teachers respectively rated these items as 3 or more). Teachers also claimed their attendance on the programme had affected their pupils' understanding of chemical concepts as well as their attainment and achievement in chemistry and motivation to study chemistry (more than 79 per cent of teachers rated these items a 3 or more). Sixty-five per cent of teachers also felt that their attendance on the CFNS programme would have some positive effect on their pupils' future intentions to study chemistry. Teachers were, however, sceptical about the extent to which pupils' understanding of chemistry careers would be affected by their experiences on the programme (90 per cent of teachers rated this item a 3 or less). This latter finding is in line with the impacts identified on the teachers themselves as many did not feel that the programme had enhanced their own awareness of chemistry careers.

Survey respondents were also given the opportunity to describe ‘other’ impacts they had noticed on their pupils as a result of their involvement in the training programme. Several teachers identified pupils’ increased confidence, engagement and concentration. Other teachers provided reasoning as to the limited impact of their involvement in the programme on pupils, identifying pupil ability, the need to link chemistry with real-life situations, the lack of opportunity to teach chemistry, a lack of time and that it was difficult to assess and measure impact on pupils.

Further analysis was conducted to explore whether the number of days of the programme the teacher had attended affected pupil impacts. Table 6.13 below presents these findings.

Table 6.13: Surveyed teachers’ perceptions of the extent of effect on pupils (those giving a rating of 3 or more) by days attended

	Days 1 & 2 only	Days 1 & 2 plus at least one of Day 3 or 4
Understanding of chemical concepts	82	87
Interest in chemistry	78	91
Enjoyment of chemistry	86	94
Motivation to study chemistry	77	80
Future intentions to study chemistry	65	64
Attainment/achievement in chemistry	76	85
Understanding of chemistry careers	49	46
TOTAL	47	137

Source: NFER survey of CFNS teachers

A series of single response items

A total of 184 respondents gave a valid response to at least one of these items

The table above highlights that there were increased pupil impacts where teachers had attended at least one of days 3 or 4. This was particularly the case in terms of impact on pupils’ enjoyment of chemistry and interest in chemistry. However, there was no real variation of impact in terms of pupils’ understanding of chemistry careers and their future intentions to study chemistry by the number of days attended: this was lower regardless.

Teachers interviewed tended to be slightly more positive than the teachers surveyed about the impacts of their attendance on the programme on the pupils to whom they taught chemistry and this may be due to the fact that most of the interview sample had

attended 4 days of the programme (or had attended 3 and anticipated attending 4 days). Teachers interviewed described the impacts on their pupils, which included: increased enjoyment of chemistry; enhanced understanding of chemistry; and increased attainment in chemistry. The teachers felt that, since attending the programme, the quality of their lessons had been improved as they were better able to explain chemistry theory and concepts, answer pupils questions and queries and were teaching more practical chemistry which, in turn, aided pupil enjoyment, interest and learning. For instance, teachers suggested that practicals helped pupils to understand chemistry better (e.g. bringing it to life, and helping them to see chemistry in action), improved pupils' practical skills and aided their recall of chemistry knowledge in examinations. During discussion in interviews, CFNS teachers also suggested that pupils were more engaged and excited by the greater proportion of practical chemistry that they were teaching since attending the programme. Teachers were, however, less aware of whether the impact on pupils would manifest itself in terms of encouraging them to consider studying more chemistry in the future or a chemistry career. However, teachers hoped that this interest would be cultivated by the enhanced enjoyment and quality of learning experience the pupils had encountered since they had attended the CFNS programme.

Heads of department were similarly positive about the impacts of the CFNS programme on pupils. They, too, suggested that teachers' experiences on the programme would lead to enhanced pupil enjoyment of chemistry and engagement in chemistry lessons, including a reduction in behavioural issues. They reiterated that the teachers' improved confidence and abilities in chemistry teaching had led, and would lead, to a better chemistry learning experience for the pupils. In several instances, the heads of department noted that they were aware of such impacts either through substantial discussion with the CFNS teacher, or by observing their practice. Conversely, in a couple of instances, heads of department were not aware of whether or not there had been any impact on pupils.

The pupil questionnaire asked pupils to rate their attitudes towards chemistry on a 5 point scale in order to gauge their views and the extent to which they held positive perceptions of chemistry and chemistry lessons in school. The table below presents their responses, comparing the extent of positive and negative response to each statement.

Table 6.14: Surveyed pupils' attitudes towards chemistry

Attitude towards chemistry	Positive response	Neutral N	Negative response	
	N		N	N
I enjoy chemistry	32	28	10	70
I am doing well in chemistry	31	28	11	70
Chemistry is hard	22	33	15	70
Chemistry is useful/relevant to my everyday life	15	25	30	70
I know a lot about what chemists do (in the real world)	18	19	33	70
N = 70				

Source: NFER survey of pupils (teachers attended CFNS programme)

Data presented in the table are the highest positive and negative response on a 1-5 scale (1 is a highly positive response while 5 is highly negative)

The table above shows that pupils were generally positive about chemistry, with just under half (32) of the pupils reporting that they enjoy chemistry and are doing well in the subject. Pupils were more split about whether they thought chemistry was 'hard'; the majority of pupils (33) gave a response of neither positive or negative to this statement, a third (22) reported chemistry to be hard while a further 15 pupils said that it was easy. Even though pupils said that they enjoyed chemistry, the majority (30) reported that they considered chemistry to be 'not useful/irrelevant to their everyday life' and a similar number also reported knowing little about 'what chemists do in the real world' (33).

The survey asked pupils to rate on a 5 point scale their attitude towards the way chemistry is taught, the findings are presented in the table below (Table 6.15).

Table 6.15: Surveyed pupils' attitudes towards the way chemistry is taught

Attitude towards the way chemistry is taught	Positive response	Neutral N	Negative response	
	N		N	N
Chemistry lessons are interesting	31	25	14	70
Chemistry lessons are practical	50	12	8	70
Chemistry lessons are exciting	28	25	17	70
Chemistry lessons rarely involve copying from books	22	27	21	70
N = 70				

Source: NFER survey of pupils (teachers attended CFNS programme)

Data presented in the table are the highest positive and negative response on a 1-5 scale (1 is a highly positive response while 5 is highly negative)

The findings presented in Table 6.15 above suggest that almost half of pupils (31) found chemistry lessons interesting. Nearly three quarters (50) of pupils agreed that their chemistry lessons were practical, while 28 found them exciting. Pupils were split in relation to whether their lessons involved copying from books, with 22 saying they rarely did this and 21 saying that they often did this. The pupil survey asked pupils if they had experienced any chemistry/science events or activities since being at their current school; 19 pupils commented that they had experienced science events. These included demonstrations/talks (9), experiments (7), science week/science festival (3) and fairs (1). Overall, the pupils in the sample seemed generally fairly positive about chemistry and chemistry lessons in school, and although this cannot be attributed to their teachers' experiences on the CFNS programme, it suggests encouraging evidence that these pupils are receiving an interesting and practical experience of chemistry in their school lessons.

The pupil survey asked pupils to rate the extent to which there had been any changes to their experiences of chemistry lessons over the course of the year that their teacher had experienced the CFNS programme.

Table 6.16: Surveyed pupils' views on changes to their experiences of chemistry

Changes to chemistry lessons	Positive response N	Neutral N	Negative response N	N
I enjoy chemistry lessons more	30	28	12	70
I understand chemistry better	41	18	11	70
I'm doing better in chemistry	37	22	11	70
N = 70				

Source: NFER survey of pupils (teachers attended CFNS programme)

Data presented in the table are the highest positive and negative response on a 1-5 scale (1 is a highly positive response while 5 is highly negative and 3 is neutral)

Table 6.16 above shows that just over half of the pupils agreed to the statements that they understood chemistry better and that they were doing better in chemistry (41 and 37 respectively) since their teacher had been on the programme. Slightly fewer than half (30 pupils) agreed to a statement that they were enjoying chemistry lessons more, a further 28 students neither disagreed, nor agreed. These findings suggest that the pupils themselves recognised only modest changes to their chemistry lessons since their teacher had been on the programme. Although this is likely to be due to the fact that teachers attending the CFNS programme had had only limited opportunity to

embed and integrate any new learning into their practice since completing the programme.

The survey asked pupils to rate on a 5 point scale their attitudes to studying more chemistry in the future, the findings are presented in the table below (Table 6.17).

Table 6.17: Surveyed pupils' future plans

Pupil's future plans in relation to chemistry	Positive response	Neutral N	Negative response	Don't know	N
	N		N	N	
I would like to study more chemistry in the future	9	8	47	6	70
I intend to take chemistry A-level	5	5	52	8	70
I would be interested in doing a degree in chemistry	4	4	54	8	70
I would be interested in a career in chemistry	6	3	53	8	70
N = 70					

Source: NFER survey of pupils (teachers attended CFNS programme)

Data presented in the table are the highest positive and negative response on a 1-5 scale (1 is a highly positive response while 5 is highly negative)

Table 6.17 above shows that pupils tended to respond that they would not be interested in studying more chemistry and did not intend to take chemistry at A-level, degree level or for a career (rated by approximately two thirds), although smaller numbers were not yet sure or were positive about studying more chemistry in the future. Pupils were also asked a question about the highest level to which they intended to take chemistry study (e.g. GCSE, A-level, degree level). The majority of pupils (60) intended to take chemistry to GCSE level only (i.e. compulsory level). The pupil questionnaire also asked pupils whether they had any ideas about what they would like to do in the future for a career. A small proportion of pupils intended to pursue a career in an aspect of science (seven) or opt for science related A-levels (eight), while greater numbers suggested that they were interested in careers related to the arts, design, sport and trades. Some pupils did not know what they wanted to do for a career and others commented that they wanted to go to university but they were not sure what they wanted to study.

Although pupils were not overwhelmingly positive about the impact of the CFNS programme on their experiences of chemistry or future plans, this was an extremely small sample, based on only four schools (indeed not necessarily schools where the

teacher had claimed a substantial impact from the programme) and there are notorious methodological difficulties in asking pupils to identify changes in their experiences of lessons. Given that the CFNS intervention is not designed to work with young people directly, it might be expected that the impacts on individual students are more subtle and long term.

Pupil impacts

CFNS teacher, Yorkshire and Humber, 4 days, KS4 programme

Yes, some little things that we picked up, like little facts, interesting facts I've used and that's got the pupils to be a little bit more enthusiastic I think. Yes because the majority of them really enjoy doing practical work, so the more there is and the more different types of it the better really and they seem to enjoy it more.

CFNS teacher, London, 4 days, KS3 programme

I think I taught it better and certainly my chemistry results in the exams did improve. My confidence, my ability, the fact that they could do practicals, they really always want to do practicals, being able to back that up with, inevitably when you're on a four day course when you're with teachers who are teaching the same as you, you talk about things and you just pick up little snippets that mean suddenly things make a little bit more sense, it means that you develop more knowledge.

CFNS teacher, West Midlands, 4 days, KS4 programme

They [pupils] have more of an interest in it now, because I've got more of an interest in it and it rubs off on to the students. They come into the class asking "what experiment are we going to be doing today miss?"

Head of department, Yorkshire and Humber

I think lesson observations of her actual teaching have given me an insight into that, when you see an increased number of pupils on task, pupils more comfortable in the room, with [the CFNS teacher] being in more control, so, I think it's the confidence, the confidence issue is a huge one when you're teaching outside your specialism.

Head of department, South West

I think so because it's been more practical and she's been more enthusiastic and I think in the past she was very much a book and blackboard sort of person. So I think it's made it a much better experience for the kids. Which was the reason behind it really, to improve the engagement.

6.4 Impacts of CFNS for schools

This section explores whether there have been any wider impacts on departmental colleagues and the school as a result of teachers' participation in the CFNS programme.

The survey questionnaire asked CFNS teachers to comment on whether their attendance on the programme had impacted on their colleagues in the science department. Fifty per cent of teachers suggested that their involvement in the CFNS programme had impacted on their colleagues within the department. A further twenty-two per cent of the sample did not believe the programme had led to impacts on their colleagues and the remaining twenty-eight percent were not sure whether it had impacted or not. Those teachers who felt there had been an impact on colleagues in the science department were then asked to rate the extent of impact in different areas. Table 6.18 below sets out the ways in which teachers' attendance on the programme had affected colleagues in the science department.

Table 6.18: Survey sample of teachers: impacts on colleagues in science department

	1 = no effect (%)	2 = little effect (%)	3 = some effect (%)	4 = quite a lot of effect (%)	5 = great effect (%)	N
Colleagues' access to materials and resources	3	5	33	40	20	76
Variety of practical lessons colleagues run	8	18	32	35	7	74
Colleagues' chemistry teaching practice	9	19	41	27	4	75
Number of practical lessons colleagues run	18	19	39	19	5	74
Colleagues' awareness of chemistry careers	44	24	21	4	7	75

Source: NFER survey of CFNS teachers

Due to percentages being rounded to the nearest integer, they may not sum to 100

A series of single response items

A filter question: Teachers who responded that their attendance did impact on the colleagues

A total of 76 respondents gave a valid response to at least one of these items

The most common impact of the CFNS programme on colleagues in the science department was on colleagues' access to materials and resources (93 per cent of teachers rated this effect as 3 or more). Teachers also felt their experiences on the programme affected the *variety* of practical lessons that colleagues ran, colleagues' chemistry teaching practice and, to a lesser extent, the *number* of practical lessons that colleagues ran. In addition, several teachers surveyed also described 'other' impacts on their colleagues and the department which included: more staff available to teach chemistry/courses; encouraging other staff to consider CPD; guidance and support for other staff, including technicians; enhanced risk assessment procedures, and; raised the profile of the department. However, teachers' attendance on the programme had little effect on colleagues' awareness of chemistry careers, with the majority of respondents rating 'no effect' in this area.

Teachers and heads of departments who were interviewed were somewhat more positive about the extent of impact of attendance on the programme on colleagues and the science department (again, this may have been because the interview sample was largely made up of teachers who had attended, or intended to attend, all four days of the programme). Case study interviewees suggested that colleagues were using resources, practicals, demonstrations, ideas and knowledge that CFNS teachers had disseminated from the programme, thus there had been impact on colleagues' chemistry teaching practice. Departmental-wide impacts were also identified, for instance, as the CFNS teacher was now more competent in teaching chemistry, there was more scope and flexibility within the department in terms of the deployment of staff and organisation of teaching groups. The departments also had more resources and ideas, with greater input from the CFNS teacher and there was less pressure on other members of staff to assist the non-specialist chemistry teacher. The enhanced competence of the CFNS teacher was also deemed to be impacting on the department in terms of the teacher's contribution to developing and revising Schemes of Work and new curricular, increasing the range and level of science courses the department was able to offer, enhancing the support available to new staff within the department and increasing flexibility for deploying staff within the department. Indeed, when asked an overall question about the usefulness of the CFNS programme for teachers and the science department, heads of department were unanimously positive about the value of the programme (reiterating the impacts discussed throughout this chapter). However, in two instances, heads of department admitted that the usefulness of the programme had been somewhat reduced due to department staff changes which meant that the CFNS teacher was no longer going to be teaching chemistry. The majority of

the teachers surveyed and teachers and heads of departments who were interviewed, indicated that there were no negative effects of participation in the programme on colleagues or the science department.

The interview phase asked teachers to comment on whether there had been any wider impacts on the school as a result of their participation in the CFNS programme. Teachers tended to report that there had not been any further impacts, beyond the teacher themselves, science colleagues and the science department. However, several interviewees identified wider impacts on the school in terms of a raised profile of science in the school (where the programme had been held at the school), increased skill base within the school and enhancement to the science courses the school was able to offer (e.g. particularly in two special schools where, as a result of the teachers attendance on the programme, GCSE chemistry could now be offered).

During interviews, teachers and heads of departments described how the CFNS teacher had shared their learning from the programme with colleagues in their department (or had plans to do so) and that this had, in turn, led to the impacts discussed above. Such sharing included disseminating ideas for practicals, demonstrations and different ways of teaching chemistry topics and concepts that they had learned from the programme. Methods for such sharing included: presenting at departmental meetings, at lunchtimes or through putting on INSET sessions; sharing resources or referring colleagues to resources; informal conversations with colleagues; revising Schemes of Work, and; trying practicals out with colleagues. There was variation across teachers' responses in terms of whether this learning was disseminated to the department as a whole, just the chemists, or just the non-chemists, with variation in the perceived relevance of the learning from the programme for different groups of staff. In most instances, where discussed, there was a plan of how to incorporate the professional development the teacher had gained on the CFNS programme into their practice and science provisions. Teachers explained how it was standard practice to undertake follow-up work from external courses, usually in the form of sharing learning with the department. The CFNS programme was also part of teachers' individual CPD plans in some instances - and post-programme practice was observed in a couple of instances by CPD leaders - as well as departmental plans, to deploy the teacher to teach more chemistry and to contribute to the development of Schemes of Work for new science courses.

Where the teachers interviewed had not shared what they had learned from the programme, this was due to various reasons, including: there being no one else in the

department, or no one else teaching science to the relevant level; the lack of any other non-specialist or inexperienced staff in the department with whom it would be appropriate to share learning; and the lack of a departmental ethos of sharing learning. Dissemination activity, sharing of resources and tools, revising and incorporating ideas and practicals into Schemes of Work, new curricular and syllabuses, and colleagues learning together on the programme (e.g. in one school the CFNS programme was held at the site and all staff in the science department attended) all acted as vehicles for propagating the impact of the CFNS programme. Where there had not been an impact on colleagues or the department this was usually because it had not been relevant to disseminate (e.g. the CFNS teacher was the only science teacher or only non-specialist) or because no substantial dissemination had taken place.

Through discussions in interviews with the teachers, it emerged that, generally, teachers felt well supported in school and by programme tutors since they had completed the programme. CFNS teachers received support from colleagues or technicians in various ways, which included:

- support to try out practicals they had learned on the programme
- support from colleagues regarding further understanding of theory and encouraging the teacher to share what they had learned
- peer support from colleagues on the programme or from colleagues within school who had also attended the programme
- support from the school or department to purchase new equipment and resources
- support to access further training
- and in addition, support from RSC and email support from the programme tutors regarding any problems or questions.

For the smaller proportion of teachers who felt that they did not receive support following the programme, some were content with this and did not require any additional support, while others chose to mention additional support that would have been helpful. This included: support with setting up experiments; time and support to practise experiments; further support with theory; support to access further training; support to share learning with the department, and; a more structured Scheme of Work (into which new learning and ideas could be more readily integrated).

It is worth noting that, on further analysis, there seemed to be a relationship between these support factors and the strength of impacts the interview sample of teachers

reported. Where support was available and interest taken in the teachers' participation in the programme, impact was greater. In contrast, where other school pressures were evident and where there was limited relevance of the teachers' participation in the programme (e.g. where they were no longer going to be teaching chemistry) there was less impact. Thus, the impacts may have been particularly strengthened by the support and value placed on the teachers' participation in the programme (including being part of planned CPD or departmental development and support being provided to integrate learning into practice and/or disseminate learning).

Colleague and science department impacts

CFNS teacher, Yorkshire and Humber, 4 days, KS4 programme

I've noticed that the RSC stuff, they [colleagues] were already aware of but they kind of said they stick to what they normally do and they haven't really looked at updated versions and it had encouraged them to do that, and remember certain things that they'd forgotten, so that was good.

CFNS teacher, East Midlands, 4 days, KS4 programme

They [colleagues] have used the practicals. The practicals have been used in teaching, and have been incorporated into the syllabus that they are teaching.

Head of department, East Midlands

Oh definitely, yes because we've all been doing the experiments that she [the CFNS teacher] actually showed us, we use the ideas in both KS3 and KS4 and we have used them as starters and plenaries in our Schemes of Work .

Head of department, Yorkshire and Humber

I think it's given me more flexibility in the teams for the delivery at Key Stage 4, I've got a better team, better balance within the team. [The CFNS teacher] has been involved in the development of the Schemes of Work for Key Stage 4 both for the chemistry and biology and she has prepared lessons for the whole of the department in that particular area and I'm quite sure that she brought some of the knowledge that she's gained from the course to those lessons.

Head of department, South West

I'm really delighted with the impact it's had, I was a bit sceptical as to how useful it would be, at one point the school weren't very keen on releasing her [the CFNS teacher], just because of other school pressures, they've really reduced the amount

of staff training people can do going out of school. So there was concern about it, but I think it's had a knock on effect across the department actually.

7. Key messages and recommendations

This section presents the key messages from the CFNS programme evaluation in relation to the following areas:

- indications as to how far the CFNS programme leads to soft outcomes
- early indications as to how far the CFNS programme may lead to hard outcomes
- reasons for drop out from days 1&2 to day 3 and day 4 of the training programme
- evidence of the effectiveness of the programme to inform future policy and investment decisions
- suggestions for a robust evaluation strategy and processes to investigate longer-term impacts of the programme.

Indications as to how far the CFNS programme leads to soft outcomes

This evaluation has provided strong evidence that **the programme is leading to soft outcomes for the CFNS teachers themselves but also for their colleagues and science departments. There are also early indications that the programme is positively impacting on the pupils to whom CFNS teachers teach chemistry.**

The impacts realised by teachers include: increased confidence to teach chemistry and practical chemistry, enhancements in teaching practice and better access to, and usage of, resources and materials. Positive impacts are also evident in relation to teachers' chemistry knowledge and understanding, their motivation and attitudes towards chemistry and the amount of practical chemistry that they are teaching. Where the impacts of the programme have been the strongest, the programme has also impacted on teachers' roles and responsibilities and professional development. The area where the least impact has been seen is on teachers' awareness of chemistry careers.

Where teachers have taken the opportunity to embed the learning from the programme into their teaching practice, pupils have benefitted and there has been a positive effect on pupils' enjoyment of, and interest in, chemistry. Teachers have also reported that the programme has increased pupils' understanding of chemical concepts as well as their attainment and achievement in chemistry and motivation to study chemistry. The majority of pupils responding to the pupil survey said that they found chemistry lessons practical and over half felt that they were using more materials, resources and equipment in lessons, understood chemistry better and were doing better in chemistry, since their teacher had undertaken the CFNS

programme. The sample of pupils was small and hence caution should be exercised in terms of generalisation from the findings. However, these early indications of change suggest that the programme is beginning to positively impact on pupils' chemistry understanding and attainment.

Where CFNS teachers have shared learning and resources from the programme, positive impacts have been seen in relation to their colleagues' practice. Most commonly, this has been in relation to colleagues' access to materials and resources and new ideas for teaching practical chemistry. In addition, impacts have been noted in relation to departments' flexibility in deploying staff, enhanced teaching and learning and the development of curriculums and Schemes of Work.

Early indications as to how far the CFNS programme may lead to hard outcomes

There are some early indications from this evaluation that the CFNS programme has the potential to lead to hard outcomes on pupils in relation to their attainment in chemistry. Both the teachers and pupils consulted suggested that there had been a positive impact on pupil understanding and attainment in chemistry since the teacher had attended the programme. Indeed, these impacts were noted despite the limited time period that teachers had had since completing or undertaking programmes to embed new learning from the programme into their teaching practice. However, as the evaluation did not involve the collection of any before and after or other comparative data, these findings remain only indicative at this stage.

At this early stage, there has been no apparent impact on pupils' interest in studying chemistry further. Only very small numbers of pupils said that they intended to study more chemistry in the future and were interested in a career in chemistry. This may link to the lack of impact of the programme on teachers' awareness of chemistry careers and the indicative finding from a small number of interviews that science teachers did not necessarily see the delivery of careers information as part of their role, but more the remit of careers staff. However, many teachers felt that the improved learning experience of chemistry that they were providing for their pupils could only help to cultivate more positive attitudes to chemistry amongst their pupils and, in the longer-term, they hoped that it would encourage them to continue studying it further.

There are also early indications that the programme may have the capacity to impact on the shortage of chemistry specialist teachers available to teach

chemistry in secondary schools. Nearly a third of CFNS teachers were teaching more chemistry since attending the programme. In addition, the evaluation revealed that the CFNS programme had inspired teachers to further develop their expertise and training in the discipline of chemistry, as well as facilitated their career progression within this discipline.

Reasons for drop out from days 1&2 to day 3 and day 4 of the training programme

Teachers reported a range of reasons for drop-out from days 1&2 to day 3 and day 4 of the CFNS programme. The primary reason was intention to attend the programme in the future (often programmes were not yet completed). Other less common reasons included: inconvenient time; unwell; did not know about the dates of follow up days; unable to get cover; reluctant to get cover; did not have time to attend; and no longer teaching or intending to teach chemistry. There was also some evidence to suggest that teachers may have dropped out of the programme following the initial two days as they felt that their needs from the programme had been met by this stage.

It is important to note, that, **in general, those teachers attending days 1 and 2 plus at least one of days 3 and 4 experienced greater levels of impact for themselves and their pupils.** However, impacts were high even for those teachers attending days 1 and 2 only.

Evidence of the effectiveness of the programme to inform future policy and investment decisions

Teachers were generally very positive about the effectiveness of the CFNS programme and regarded it as being of high quality. Teachers, and their heads of department, felt that the programme had met their needs which included: to improve teachers' confidence in teaching chemistry; to improve knowledge and understanding of chemistry and the teaching of practical chemistry; to increase the number of trained chemistry teachers available in the department; and to provide the teacher with professional development.

The programme was seen to be appropriate in its content, to be of engaging delivery, to include appropriate activities and approaches, and to offer useful materials and resources. **The most valued elements of the programme include:**

- **the emphasis on practical chemistry**
- **support from chemistry specialists** on the programme
- **resources and support materials**

- the **programme structure**
- **flexibility and tailoring** of the programme to meet individual needs
- opportunities for **sharing ideas and networking**
- the **balance between practical and theoretical chemistry**.

Based on the views of the majority of teachers consulted, **the programme appears to be meeting its aim to provide non-specialist chemistry teachers with *confidence, flair and enthusiasm* to teach chemistry.**

In the small number of cases where teachers felt the programme had not been effective, this was often because teachers expected something of the programme that it was not necessarily designed to provide. For instance, some teachers appeared to want a CPD programme to help them deliver new science curriculums, or provide either an introductory or advanced programme on chemistry. However, **the future success of the programme could be enhanced by further tailoring and differentiating the programme to teachers' needs** and more detailed advertising regarding the programme and the types of teachers and departments it may suit. This would help to address teachers' minor and occasional criticisms of the programme and may alleviate drop-out from the programme.

It is important to bear in mind that, overall, teachers and their heads of departments were positive about the CFNS programme, both in terms of experiences and the impacts of the programme. **It is, thus, recommended that any suggested improvements detailed here should be treated as information regarding how to enhance the success of the programme and tailor it to individual needs, rather than substantially change it in any way.**

Recommendations for the development of the programme include:

- **increase the relevance of the programme to the new science courses** taught in schools
- **ensure explicit links are made on the programme to KS3 and KS4 level teaching** (e.g. links between the practicals taught on the programme and how these may fit into the syllabuses)
- **ensure sufficient coverage of chemistry theory** to underpin the practical work
- **ensure the chemistry taught on the programme is relevant to teaching various ability levels of students**
- consider **further tailoring of the programme to teachers' different needs** (e.g. by considering offering a two tiered programme). A few teachers would have preferred the level to be higher, while others needed it to be more basic
- **provide more detail in advertising the programme as to who the**

programme is targeted at and the types of teachers and departments it might suit (including, to encourage teachers and departments to consider the value of supporting a teacher to attend the programme and how they might be supported to integrate any new learning into their own practice and that of the department)

- consider **offering teachers experiences in setting up some of the experiments**, rather than having them already prepared, so that they are confident about setting them up back in school
- consider using **a mix of more local venues** for the programme, so that teachers have less distance to travel and can network with teachers from other local schools
- improve **communication and advanced planning regarding dates of follow-up sessions** to ensure teachers are able to pre-arrange and plan time out of school
- impacts were high, even for those teachers attending days 1&2 only. It may be that the additional burden on science departments of follow-up days (in terms of securing time away from the classroom and out of school in a climate of staff shortages and tight budgets) could be offset by **providing ongoing support or sustained CPD through other means such as virtual discussion groups or local networks**. This may be of particular use for the two-thirds of CFNS teachers who were not found to be teaching more chemistry since attending the CFNS training programme and who were sometimes teaching less, if any at all, due to a constantly shifting science department profile
- consider some form of **ongoing support/forum and promotion of networking amongst science/non-specialist teachers** (perhaps providing non-specialists with chemistry specialist e-mentors) to support non-specialist teachers with ongoing issues in relation to chemistry understanding, theory and practical work
- in addition, if the programme seeks to encourage teachers to discuss chemistry career options with their pupils, **consideration may be needed in terms of how to enhance the impact of the careers aspect**, given that it has been reported to have resulted in relatively moderate impacts
- due to the success of the programme, we **recommend that the current level of financial support is maintained to enable the programme to continue to be delivered in the longer-term**.

Suggestions for a robust evaluation strategy and processes to investigate longer-term impacts of the programme

This evaluation was undertaken at an early stage in the delivery of the CFNS programme and a proportion of the teachers consulted had not completed all of the four days of the programme, or had the opportunity to put what they had learnt into practice. Despite this fact, the findings have been very positive suggesting that the programme is beginning to result in a range of important impacts. In relation to investigating the longer-term impacts of the programme, we suggest that all, or a selection of, the following activities are considered.

Recommendations for the evaluation of the longer-term impacts of the

programme

- We recommend that all of **the 184 teachers who took part in the teacher survey are tracked in six months and/or in a year's time** to explore how far the impacts of the programme reported at this stage have been retained, and what further impacts have emerged in relation to themselves and their practice, their pupils and their schools. It would also be useful if a proportion of these teachers were encouraged to administer a survey with their pupils 6 to 12 months after they have completed the programme to explore the impacts that pupils have realised. Additionally, teachers should be encouraged to track attainment of pupils against predictions and progression rates in chemistry to establish if positive changes have arisen which may, to some extent, be attributable to their involvement in the CFNS programme.
- We suggest that **the data collected within the pre- and post-programme questionnaires completed by teachers taking part in the programme in the future is collated and analysed on an on-going basis** to explore and document changes in teachers': knowledge and understanding of chemistry; their motivation to teach chemistry; their confidence in teaching chemistry; their confidence in teaching practical chemistry; usage of resources and materials; roles and responsibilities in relation to chemistry; and involvement in on-going CPD. We also suggest that **a sample of teachers completing courses in the future (for example 20 per cent) are then tracked** 6 to 12 months after completing the programme to assess the retention of impacts and other impacts emerging over time.
- **A sample of future teachers (for example 20 per cent), who are already teaching chemistry at KS3 or 4, should be encouraged to administer pre- and post-programme survey questionnaires to their pupils** to assess the impacts of the programme on pupils. We suggest that the post programme questionnaires are administered at least 6 months after the teacher's completion of the course to allow for the embedding of learning into the teacher's practice.
- Should data be required on the impacts of the programme on chemistry teaching and science departments, **we suggest that a different sample of teachers (again, 20 per cent) are asked to administer post- programme survey questionnaires with their heads of department** or other senior level colleagues. Again, at least 6 months would need to have elapsed since the teacher completed the programme before the post programme questionnaire was completed.

The surveys used need to be short and simple to keep the burden on teachers and schools to a minimum and could be adapted from the research instruments used in this study. We suggest that the findings are analysed via SPSS or Excel.

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Evaluation of the Chemistry for Non-Specialists training programme: final report

Conducted by the NFER for the Royal Society of Chemistry (RSC), this report focuses on the findings from the evaluation of the Chemistry for Non-Specialists training programme. The programme takes place over four days and covers key chemistry concepts providing hands-on experience of pupil practical work and teacher demonstrations.

This evaluation explores the early indications of impact from the training programme on teachers' confidence and expertise to teach chemistry and pupils' experiences of chemistry in school. Based on the views of teachers, heads of science departments and pupils, a range of positive impacts from the programme were identified and the programme appears to be meeting its aim to provide non-specialist chemistry teachers with confidence, flair and enthusiasm to teach chemistry. Due to the success of the Chemistry for Non-Specialists programme, the evaluation concludes with recommendations for the continuation of the programme long term.

