Evaluation of the Stimulating Physics Network

Final Report

for

The Institute of Physics and National Science Learning Centre

by
Babcock Research

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Evaluation of the Stimulating Physics Network

by
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The responsibility for the contents of this report rests with Babcock Research.

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EXECUTIVE SUMMARY

This final report documents the results of a two wave evaluation of the Stimulating Physics Network (SPN). Two groups of schools were evaluated – the 'partner schools[1]' receiving intensive support from the SPN; and control schools who have access to 'global' or less intensive support. The latter were randomly selected control schools from the school population in England minus partner schools.

Web surveys of students studying a physics course enabling them to continue to A-level were carried out in April-June 2010 and December 2010 - February 2011. At the same time, surveys of school leaders, subject leaders and teachers were undertaken. Survey responses were received from both partner and control schools.

In Wave 1, 1034 students responded to the web surveys: 748 from partner schools and 286 from control schools. In Wave 2, 1019 students responded to the web surveys: 797 from partner schools and 222 from control schools. In Wave 1, 103 teachers and school leaders responded to the web-surveys: 77 from partner schools and 26 from control schools. In Wave 2, 131 teachers and school leaders responded to the web-surveys: 93 from partner schools and 38 from control schools. Since the teacher and school leader data are drawn from small bases, care should be taken in interpretation.

Qualitative research was undertaken with 41 teachers, subject leaders and school leaders, and 170 students after Wave 1.

Aims of the SPN and the Evaluation

The SPN has been carried out in response to widespread concerns over the decline in uptake of physics A Level and beyond. The Network aims to provide support to schools and teachers to provide stimulating and appropriate lessons, a dynamic and physics-friendly environment for physics teachers, and enrichment and enhancement activities for students. In turn, it is expected that the inputs into school ethos and teaching will inspire teachers, and result in more students wishing to continue in their study of physics.

The evaluation is required to measure the impact of the SPN's interventions, most particularly through its Key Performance Indicators.

Summary of the Impact of the SPN to Date

The evaluation data demonstrates a positive impact on most KPI areas measured.

KPI	Impact
Increase in engagement of School Leaders	⇧
Increase in engagement of Subject Leaders	⇧
Increase in E&E activities	⇧
Increase in Y11 Pupils likely to take Physics	⇧
Increase in proportion of Y11 Girls likely to take Physics	⇩

The area showing the largest impact is the increase in enrichment and engagement activities. Where other areas show lesser impact, positive knock on effects of increased E&E on school leader, subject leader and particularly on pupil engagement may not yet have fully emerged.

Positive impacts have also been measured in areas such as prevalence of CPD in partner schools; increase in general physics support for teachers; increased confidence among non-specialist teachers in planning and delivering physics teaching; increase in perceived status of physics by teachers; and increases in positive attitudes towards physics by students.

[1] Schools receiving intensive support were selected because they had an identified problem with their Physics provision.

Unfortunately, the proportion of girls as a proportion of all students stating that they would be likely to take physics has decreased. This is mainly because of the large increase in boys stating that they are likely to take physics while girls' views across the 2 waves stayed static.

School Ethos

A cornerstone for establishing a dynamic and developmental environment for physics is the school ethos, presided over by the school leadership.

School leaders tended to give a high absolute value score to physics (see KPI). However, when asked a comparative question, a different story emerges. When asked to select priority subjects to which they would give additional resources, school leaders tended to select 'core subjects' – English, Maths and General Science.

> **KPI:Strand 2 'Reinvigorating the School Ethos'**
> *Increase average engagement of senior leaders, as measured on a 4 point scale measuring value given to physics (their own perception and that of their science subject leader)*
> Baseline (Summer 2010):
> 3.6/4.0 (partner school leaders)
> 3.0/4.0 (partner school subject leaders)
> Achieved at Wave 2 (Winter 2010/11):
> 3.9/4.0 (partner school leaders)
> 3.1/4.0 (partner school subject leaders)

School leaders stated that they would aim to fill a physics position with a specialist physics teacher. However, they also stated that science teachers should be equally capable of teaching any of the sciences; and that the ability of teachers to enthuse students can compensate for a lack of specialist knowledge.

Teachers

Non-specialist teachers in partner schools are less confident in every statement relating to a range of physics teaching related areas than specialist teachers. However, the difference in Wave 1 and Wave 2 mean scores shows that non-specialist teachers in partner schools gained confidence in all areas related to planning and delivering physics teaching.

There was an increase in the number of physics-related CPD sessions and in the proportion of these sessions in relation to CPD. Teachers and subject leaders in partner schools in Wave 2 reported an average of 8.0 CPD sessions in the previous year, including 2.6 physics-based. This is an increase from Wave 1 and more than for control schools: (5.7 sessions, including 1.0 physics-based). The proportion of physics-related CPD sessions in relation to general CPD also rose slightly from 30% in Wave 1 to 32% in Wave 2.

In Wave 2, an increased proportion of teachers and subject leaders in partner schools report more frequent physics support activities since Wave 1. 34% of partner school respondents say that their department subscribes to a physics journal regularly or always (19% Wave 1). A third of Wave 2 partner school respondents also report that staff regularly or always discuss physics teaching in the prep room, (23% Wave 1).

Teachers and subject leaders were asked to provide the number of physics E&E activities in their school during the previous year to provide the following KPI.

> **KPI: Strand 2 'Reinvigorating the School Ethos'**
> *Marked increase in physics-based E&E activities in all partner schools (subject leaders and teachers)*
> Baseline: Average of 3.3 activities per year
> Wave 2: Average of 6.3 activities per year

Lack of time within the curriculum; lack of money; lack of cover; and school location/travel were the most commonly cited barriers to E&E activities.

Teachers estimated only half of students are retained between AS and A level physics. Underperformance and subject difficulty are given as reasons for this.

Students

Students were asked about their perceptions of physics. Over half of students from partner schools find physics relevant (54% Wave 2, 44% Wave 1) and interesting (53% Wave 2, 46% Wave 1). Over half (56%) also believe that physics opens up a wide range of careers and that they can do well in life with physics qualifications. Girls tended to have clearer views than boys (fewer expressed 'no opinion'), but were less likely to agree that physics is easy (60% of girls disagreed) or that physics is exciting (43% disagreed). These results are similar for both Waves.

Students were generally positive about their teachers' ability to explain concepts, be understandable, make examples relevant, and to encourage questions and ideas in class. However, students were more likely to agree that they learn more from practicals and experiments than from books; but that they did not do enough practical work.

Less than a third (29%) of students (of those who remain in education post-16) from partner schools said they would definitely not choose to study physics post-GCSE, compared with four in ten (39%) of those from control schools and 31% in Wave 1. 16% of students at partner and 15% of control school students had considered physics post-GCSE and decided against.

One of the SPN's Key Performance Indicators (KPIs) is an increase in partner schools' Y11 students saying they are likely or very likely to take physics A-level.

KPI: Strand 2 'Reinvigorating the School Ethos'

Increase in Y11 pupils (in partner schools expressing the view that they are likely/very likely to choose physics A-level

Baseline: P% of pupils = 36%
(those staying on in education)
Achieved at Wave 2: P'% of pupils = 40%

Girls are far more likely to rule out taking physics absolutely (47% Y11 girls) compared to boys (22% Y11 boys). This was similar for both Waves.

KPI: Strand 2 'Reinvigorating the School Ethos'

Increase in proportion of Y11 girls (partner schools) stating that they are likely/very likely to choose physics A level

Baseline: G% of P are girls = 43%
(those staying on in education)
Wave 2: G% of P are girls = 31%

Partner school Y11 students who stated that they definitely were not going to study physics A-level indicated the following contributory factors: Difficulty of physics; Lack of enjoyment/interest; irrelevance to them or their future career.

1 INTRODUCTION

This report provides the results of the independent evaluation of the Stimulating Physics Network: a Department for Education funded programme led by the Institute of Physics and National Science Learning Centre. The report documents the two waves of research which comprise the evaluation.

1.1 Background and Objectives

The following section provides a brief overview of the background and objectives to the Stimulating Physics Network (SPN) and to the independent evaluation of the SPN.

1.1.1 The Stimulating Physics Network

The Stimulating Physics Network was developed in response to the declining take-up of physics courses beyond GCSE, a trend that will subsequently have a deleterious impact upon the numbers of physics graduates and upon the supply of physics qualifications within the STEM workforce.

The aim of the Stimulating Physics Network is to achieve a significant change in the teaching of physics in England through the dissemination of a programme of inspiring and accessible resources and activities, resulting in increased numbers of students studying A-level physics courses.

The Stimulating Physics Network operates on two levels:

- **'Intensive support'** – a network of regionally-based Teaching and Learning Coaches who specialise in physics, working closely with approximately 275 identified secondary schools to provide a range of bespoke in-school physics support (e.g. CPD) tailored to the needs of the school. These schools were identified because of the low uptake of physics.
- **'Global support'** - available to all secondary schools in England, and including:
  - access to one of 37 local Physics Network co-ordinators who run workshops and organise meetings
  - access to the talkphysics.org - community website
  - IOP teaching and learning resources
  - physics update courses for teachers
  - free youth membership of the IOP
  - enrichment and enhancement activities
  - careers resources
  - access to www.physics.org.

The objectives of the Stimulating Physics Network include:

- to improve student perceptions of, and engagement with, physics
- to increase the number of students expressing a desire to take A-level physics and to increase the numbers of students participating in A-level physics in partner schools
- to increase the proportion of Year 11 girls (in targeted schools) saying they are likely or very likely to choose physics A-level
- to create a better appreciation of physics careers amongst students
- to increase physics-based Enrichment and Enhancement (E&E) activities in partner schools
- to attain higher standards of physics teaching
- to improve the engagement of senior management in schools and increase the value given to physics and subject-based CPD.

1.1.2 Independent Evaluation of the Stimulating Physics Network

Babcock Research was commissioned through competitive tender to provide a two-stage independent evaluation of the SPN, on behalf of the Institute of Physics and the National Science Learning Centre.

The brief provided was to provide an evaluation that was both formative and summative, in order to determine whether the initiative has been successful as a whole, as well as whether individual activities have met their aims.

The greatest focus was required on the impact of the partner support to the partner schools (taking a census approach) with comparison to a sample of control schools receiving global support.

Success of the SPN will ultimately be measured by an increase in the numbers of young people studying physics at A-level. However, interim measurement and documentation is required to track student attitudes and monitor the effectiveness of the teaching in the 'partner' targeted schools, as well as some measures of impact of global support.

A baseline was required as near to the start of the SPN operation as practically possible (originally scheduled for autumn 2009), with follow-up research in autumn/winter 2010/11.

Specifically, the evaluation was required to measure a number of Key Performance Indicators (KPIs) and to assess progress towards the following goals:

- More positive student perceptions of physics.
- Increased participation in physics A-level in partner schools.
- Increase in number of students expressing a desire to take A-level physics.
- Increase in proportion of Year 11 girls (in targeted schools) expressing the view that they are likely or very likely to choose physics A-level.
- A better appreciation of physics careers and a more positive general interest in the subject.
- Higher standards of teaching.
- Marked increase in physics-based E&E activities in all partner schools
- Improved attitude and engagement of students
- Improved engagement of senior management and an increase in value given to physics and subject-based CPD.

1.2 About This Report

Throughout this report, the following conventions have been followed:

Stimulating Physics Network – SPN
Teaching and Learning Coach – TLC
Physics Network Co-ordinator – PNC

Intensive Support (within the Stimulating Physics Network), and the partner schools taking part in this support – 'partner' and abbreviated to 'P' in some tables and graphs
Global Support (within the Stimulating Physics Network), and the control schools taking part in this support – 'control' and abbreviated to 'C' in some tables and graphs

Enrichment and Enhancement – E&E
Continuous Professional Development – CPD

Key Performance Indicators - KPIs

The baseline survey findings are referred to as Wave 1 (or W1 in some tables) and the follow-up research findings are referred to as Wave 2 (or W2 in some tables).

All tables and graphs show both the unweighted base and weighted base (where weighting has been used). The weighted data is used for all calculations that aim to represent the Wave 1 and Wave 2 partner school student population for the whole survey.

Tables and graphs are all labelled with a simple sequential 'Figure Number' and title. All tables and graphs have clearly labelled base sizes (for all sub-groups) and textual definitions of bases. The total of percentages shown in a table may vary from 100% due to rounding to the nearest percentage point, in such cases the total is marked *.

Where statistics of less than 0.5% occur in tables they are shown as '-', to distinguish from zero.

Further information about weighting and response levels can be found in the methodological appendix.

1.3 Evaluation Methodology Overview

A summary of the evaluation methodology is presented below. A more detailed methodological description is presented in Appendix 1.

1.3.1 Design

A documentary (literature) review and a series of qualitative consultations with key stakeholders including physics students undertaken in Autumn 2009, were used to inform the development of four companion questionnaires. These questionnaires were piloted in January 2010 via web-survey with the following groups:

- Year 10/11 students in 'partner' schools
- Year 10/11 students in 'control' schools
- Science teachers, subject leaders and school leaders in 'partner' schools
- Science teachers, subject leaders and school leaders in 'control' schools

The survey questionnaires were refined in light of data and feedback from the pilot and further consultation with the client.

1.3.2 Baseline Web Surveys

Babcock Research launched the web surveys as soon as possible after recruitment of partner schools to the SPN, Summer term 2010. By the start of April 2010, 202 of the projected 276 partner schools to receive 'intensive' support had been identified and had agreed to participate in the SPN. These schools were invited to participate in the evaluation. A separate sample of 179 'control' schools was selected (through a random stratified approach) and invited to participate.

All schools selected were invited to submit responses to the 'teaching staff' survey from teachers of physics (specialist and non-specialist), Heads of Science, and School Leaders (i.e. Head Teachers and Deputy Head Teachers). The same schools were asked to invite their students in Years 10 and 11, undertaking a science course enabling them to progress to A-level physics, to participate in the ‘student’ survey.

The evaluation team contacted the schools by telephone throughout the summer term to encourage participation and offer technical guidance if required. A targeted email was also sent directly to school leaders. Please see Appendix 1 for more detail of the support and incentives offered to schools.

1.3.3 Follow-up Web Surveys

Babcock Research launched the Wave 2 web surveys in early December 2010 to the 270 partner schools comprising the population receiving SPN intensive support. A separate sample of 172 ‘control’ schools was selected (through a random stratified approach) and invited to participate.

The methodology was similar to the first wave: all schools selected were invited to submit responses to the ‘teaching staff’ survey from teachers of physics (specialist and non-specialist), Heads of Science, and School Leaders (i.e. Head Teachers and Deputy Head Teachers). The same schools were asked to invite their students in Years 10 and 11 undertaking a science course enabling them to progress to A-level physics to participate in the ‘student’ survey.

The evaluation team contacted the schools by telephone throughout the Winter and Spring terms to encourage participation and offer technical guidance if required. A targeted email was also sent directly to school leaders. Please see Appendix 1 for more detail of the support and incentives offered to schools.

1.3.4 Qualitative Research

A programme of qualitative research was undertaken in the Summer term 2010.

Face to face and telephone consultations were undertaken with teachers and subject leaders.

Telephone consultations were undertaken with teachers from schools receiving either ‘intensive’ or ‘global’ support from the SPN, and who indicated in their survey response that they were willing to take part in further research.

Day-long visits to six ‘partner’ schools were also arranged. Two researchers visited each school and consulted school leaders, subject leaders, teachers and support staff, as well as students (predominantly in Years 10 and 11).

In total, 41 teachers, subject leaders and school leaders, and 170 students participated in the qualitative research.

2 PROFILE OF RESPONDENTS

The following sections describe the profile of staff and students who participated in the two waves of surveying. Response rates were affected by the timing of the research. In Wave 1, some schools reported that they were unable to participate, or participate fully, in Summer term due to Year 11 study leave and exam schedules making the arrangement of internet access sessions for groups of students more difficult. During the second wave of research, in the Spring term, some schools reported that students were taking mock examinations.

2.1 Teachers and School Leaders

For the baseline surveys (Wave 1), 103 teachers and school leaders responded to the web-surveys: 77 from partner schools and 26 from control schools. These responses came from a total of 59 schools (45 partner and 14 control).

Four fifths (79%) of staff responding from partner schools and more than 9 out of 10 staff from control schools (96%) were from co-educational schools. All but one of the single sex schools were for girls. The single sex boys' school was a partner school.

Figure 1: Profile of Teachers and School Leaders – Wave 1
Base: All teachers and school leaders

WAVE 1	Partner (77) %	Control (26) %
Single sex – girls' school	20	4
Single sex – boys' school	1	0
Mixed school	79	96
Total	**100**	**100**
School has post-16 provision	68	89
School does NOT have post-16 provision	33	12
Total	**101***	**101***
Physics teacher (specialist) #	14	42
Biology or Chemistry teacher[2] (non-specialist) #	21	12
Science teacher (non-specialist) #	25	8
Subject leader ##	29	31
Head teacher ###	4	0
Other school leader ###	8	8
Total	**101***	**101***
Teachers (inc subject leaders)	(68) %	(24) %
Less than 2 years	22	29
2-5 years	19	17
6-10 years	24	33
10 years +	35	21
Total	**100**	**100**

*Totals deviate from 100% due to rounding
Teachers (any teacher teaching some physics modules)
Subject leader
School leader

[2] Only Biology and Chemistry teachers who teach some modules of physics were surveyed

The majority of teacher and school leader respondents were from schools with post-16 provision (68% of those from partner schools and 89% of the control schools respondents), see Figure 1.

As Figure 1 also shows, almost a third of respondents described themselves as subject leaders for physics or science (29% from partner and 31% of those from control schools). One in seven (14%) partner school respondents and two fifths of control school respondents (42%) were specialist physics teachers. Almost half (46%) of those teaching physics from partner schools were non-specialist classroom teachers teaching some physics modules (21% Biology and Chemistry teachers and 25% Science). The corresponding figures for control school respondents were 12% and 8% (low base). The teacher data for the first survey therefore reflected the difference between teacher type (specialist and non-specialist) between control and partner schools. Whether the low take up of physics for which schools were selected as partner schools in the SPN is correlated to the lower proportion of specialist teachers is outside the analytical scope of this project's data.

Just over half of the teachers/subject leaders had been teaching science for 6 years or more. A over a third (35%) of those in partner schools had more than ten years' science teaching experience, compared with a fifth (21%) of those in control schools.

In Wave 2, 131 teachers and school leaders responded to the web-surveys: 93 from partner schools and 38 from control schools. These responses came from a total of 97 schools (66 partner and 31 control).

Four fifths (83%) of staff in Wave 2 responding from partner schools and nearly 9 out of 10 staff from control schools (89%) were from co-educational schools. The partner single sex schools were exclusively girls' schools and the control single sex schools were boys' schools only.

Figure 2: Profile of Teachers and School Leaders – Wave 2
Base: All teachers and school leaders

WAVE 2	Partner (93) %	Control (38) %
Single sex – girls' school	17	0
Single sex – boys' school	0	11
Mixed school	83	89
Total	**100**	**100**
School has post-16 provision	70	61
School does NOT have post-16 provision	30	39
Total	**100**	**100**
Physics teacher (specialist) #	12	18
Biology or Chemistry teacher[3] (non-specialist) #	12	11
Science teacher (non-specialist) #	17	13
Supply teacher (non-specialist)#	1	0
Subject leader ##	39	50
Head teacher ###	9	3
Other school leader ###	10	5
Other role:	1	0
Total	**100**	**101***

[3] Only Biology and Chemistry teachers who teach some modules of physics were surveyed

Teachers (inc subject leaders)	(76) %	(35) %
Less than 2 years	12	6
2-5 years	22	14
6-10 years	20	20
10 years +	46	60
Total	**100**	**100**

*Totals deviate from 100% due to rounding
Teachers (any teacher teaching some physics modules)
Subject leader
School leader

In Wave 2, the majority of teacher and school leader respondents were from schools with post-16 provision (70% of those from partner schools and 61% of the control schools respondents), see Figure 2.

Over four in ten respondents in Wave 2, (45%) described themselves as subject leaders for physics or science (39% from partner and 50% of those from control schools). Over one in eight (12%) partner school respondents and around one in five of control school respondents (18%) were specialist physics teachers. Around a third (30%) of those teaching physics from partner schools were non-specialist classroom teachers teaching some physics modules (12% Biology and Chemistry teachers, 17% Science and 1% Supply). The corresponding figures for control school respondents were 11% Biology/Chemistry and 13% Science (low base).

Two thirds (66%) of teachers in partner schools had been teaching for 6 years or more, compared with 80% of teachers in control schools. Nearly half (46%) of those in partner schools had more than ten years' science teaching experience, compared with 60% of those in control schools. The profile of specialist teachers and subject leaders in Wave 2 was therefore more experienced than that in Wave 1, probably due to the higher proportion of subject leaders who responded.

2.2 Students

In Wave 1, 1034 students responded to the web surveys: 748 from 'partner' schools and 286 from control schools. In Wave 2, 1019 students responded to the web surveys: 797 from partner schools and 222 from control schools. For both waves, a small proportion of student respondents were following a 'core science' curriculum only which would not qualify them to progress to A-level physics study, hence these students were filtered out of the datasets used for analysis.

Figure 3: Profile of Student Respondents – Wave 1 and Wave 2
Base: All students (**Weighted**-Unweighted)

WAVE 1	**Partner** **(748-**748) %	**Control** (286) %
Male	51	52
Female	49	48
Total	**100**	**100**
Year 10	78	96
Year 11	22	4
Total	**100**	**100**

White	77	88
Mixed	3	1
Asian	7	2
Black	4	1
Chinese	2	1
Prefer not to say	4	5
Other	4	2
Total	**101**	**100**
WAVE 2	**(797-**797) **%**	(222) **%**
Male	51	51
Female	49	49
Total	**100**	**100**
Year 10	58	44
Year 11	42	56
Total	**100**	**100**
White	81	89
Mixed	3	2
Asian	7	2
Black	2	1
Chinese	2	2
Prefer not to say	2	4
Other	3	0
Total	**100**	**100**

*Total deviates from 100% due to rounding

For both waves female students were over-represented in the partner school respondents: in Wave 1 making up over two thirds (66%) and in Wave 2, 65%. The data in Figure 3 and throughout this report have therefore been weighted (see the Methodology appendix for further details about weighting). The over-representation is a reflection of the higher proportion of girls-only schools taking part in the partner school surveys (see Figures 1 and 2 in the teacher data above).

Figure 3 also shows that the majority of students responding were from Year 10 (except in Wave 2 control school respondents). However, the proportion of Year 11 students was higher for the second wave (42% in partner schools in Wave 2 compared with 22% in Wave 1; and 56% in control schools compared with just 4% in Wave 1. The timing of the baseline research (Summer term) meant that Year 11 students tended to be busy with revision sessions, study leave and exams during the first survey period.

A majority of students for both Waves described their ethnicity as ‘White’. In Wave 1, almost nine in ten (88%) students from control schools compared with fewer than eight in ten (77%) students from partner schools. In Wave 2, 89% of students from control schools described themselves as ‘White’ compared with 81% of students in partner schools. Of the partner school students, 7% self-declared as ‘Asian’ for both Waves, 3% mixed ethnicity, the same as in Wave 1, 2% Black, compared with 4% in Wave 1, 2% Chinese for both Waves and 3% ‘other’ compared with 4% in Wave 1.

Students were asked to indicate the occupation of the highest earning member of their household. To increase response, this question was changed from Wave 1, when students were requested to describe parental occupation in open text. In Wave 2, a list of occupational classifications was provided. Figure 4 below shows the data from Wave 2. Over half (57%) of partner school respondents were from households where the highest earning member was in a professional occupation (modern, 22%; traditional, 14%) or a senior manager (21%). This compares with 56% of control school respondents with parents in a professional or senior role. Over one in ten (13% partner, 17% control) said their parents were in technical and craft occupations. Less than 2% of partner school and control school students were in households where the highest earning member was unemployed or unable to work.

Figure 4: Standard Occupational Classification (SOC) of Parents – Wave 2
Base: All students (**Weighted**-Unweighted)

WAVE 2	**Partner** (**797**-797) %	**Control** (222) %
Modern professional occupations	22	23
Senior Managers or administrators	21	20
Traditional professional occupations	14	13
Technical and craft occupations	13	17
Middle or junior managers	8	7
Clerical and intermediate occupations	7	8
Semi-routine manual & service occupations	5	4
Routine manual and service occupations	5	4
Other	3	2
Student	1	1
Unemployed	-	-
No response/insufficient info to code	1	1
Total	**100**	**100**

*Total deviates from 100% due to rounding

For both Waves, almost nine out of ten of the students were planning to stay in education after GCSE (89% of partner school students in Wave 2 and 85% in Wave 1; and 86% of those from control schools in Wave 2, 85% in Wave 1), see Figure 5 below. Around one in ten students did not know (8% [Wave 2] and 11% [Wave 1] partner; and 10% [Wave 2] and 12% [Wave 1] control).

Figure 5: Students' Choices about staying in Education after GCSE
Base: All students (**Weighted**-Unweighted)

WAVE 1	**Partner** (**748**-748) %	**Control** (286) %
Staying on after GCSE	85	85
Not staying on after GCSE	4	3
I don't know	11	12
Total	**100**	**100**
WAVE 2	(**797**-797) %	(222) %
Staying on after GCSE	89	86
Not staying on after GCSE	3	4
I don't know	8	10
Total	**100**	**100**

2.3 Profile of Qualitative Research Participants

Thirty-four teachers and heads of science were consulted, along with seven school leaders. The teachers and school leaders were drawn from 26 schools, of which seven schools were in the South East, seven in the West Midlands, six were in Yorkshire and Humber, two were in the North West, and one each in London, East of England, South West and East Midlands. The majority of teachers worked in co-educational schools, but three of the schools were girls only. The majority of teachers and subject leaders worked in schools with a sixth form, with seven of the schools being 11-16 only.

Schools participating in full-day visits from researchers were recommended by TLCs, and were not necessarily representative of any locality. Three were in the West Midlands, two in the North West and one in Yorkshire and Humber. 5 of the schools visited were co-educational comprehensives and 1 was a girls' only grammar school. The ethnic mix within these 6 schools (and by extension, the discussion groups) reflected the local communities within which the schools were located. The schools in the West Midlands were majority Asian, with some White and Afro-Caribbean students. The schools in Yorkshire and Humber and the North West had mainly White students.

Across the six schools visited, researchers spoke with a total of 170 students, predominantly from Year 10, but including small numbers from Year 9 and Years 11-13. Both male and female students participated.

3 SCHOOL LEADERSHIP AND PHYSICS

The focus of this section is the ‘physics culture’ of the school as perceived by school leaders and teaching staff. One of the key performance strands of the Stimulating Physics Network is in ‘reinvigorating the school ethos’ which includes increasing the average engagement of school leaders with physics.

3.1 School Leaders and Physics

School leaders were the most difficult to engage in the evaluation. More participated in Wave 2 than Wave 1 (see Figure 6 below). In Wave 1, of the 10 senior leaders that did participate, the majority (including the two from ‘control’ schools) had non-science backgrounds. In Wave 2, there were more senior leaders with scientific backgrounds: 8 of the 17 leaders from partner schools had scientific degrees, 2 of them in physics; the three control school respondents all had scientific degrees.

One of the Key Performance Indicators (KPIs) for the SPN is the measurement of the engagement of senior leaders. Hence leaders were asked to rate the value they placed on the subject of physics on a 4-point scale (where ‘1’ is low value and ‘4’ is high value).

Figure 6: Level of Value given to the Subject of Physics
Base: School leaders

Note: This table shows counts, not %s **WAVE 1**	**Partner** (9)	**Control** (2)
One (low value)	0	0
Two	1	0
Three	1	0
Four (high value)	6	2
Not stated	1	0
WAVE 2	(17)	(3)
One (low value)	0	0
Two	0	0
Three	2	0
Four (high value)	15	3
Not stated	0	0

The KPI below shows that the value school leaders say they give to physics met the target required in partner schools. The value that subject leaders think their school leaders give to physics also rose, although not quite enough to meet the target.

KPI: Strand 2 'Reinvigorating the School Ethos'

Increase average engagement of senior leaders, as measured on a 4 point scale measuring value given to physics (their own perception and that of their subject leader in science)

Baseline: 3.6 out of 4 (partner school leaders)
3.0 out of 4 (partner school subject leaders)

Success factor: Reduce the deficit between baseline figure and maximum possible rating by at least half by 2011. (x + (4-X)/2):
Target = 3.8 out of 4 (partner school leaders)
Target = 3.5 out of 4 (partner school subject leaders)
Achieved at Wave 2:
3.9 out of 4 (partner school leaders)
3.1 out of 4 (partner school subject leaders)

As Figure 6 above shows, school leaders tend to say they place a high level of value on physics as a subject, ranking it as 'high value'. This finding is perhaps not a surprising result in a piece of physics-focussed research. As the qualitative research uncovered, school leaders often report that they value all subjects highly when not asked to prioritise or compare with other subjects. One respondent from a partner school gave a relatively low value (2 on a 4 point scale) to physics. It is impossible to tell from this question whether respondents are thinking absolutely or comparatively.

Thus, the researchers and the IoP felt that more detailed questioning was required to try to establish the extent to which physics is valued and prioritised by school leadership. Therefore, a number of 'proxy' KPI questions were added to the survey.

First, school leaders were asked to indicate on a five-point scale the extent to which they agreed or disagreed with a series of statements about physics teachers and teaching. Figure 7 below reveals the results. See Appendix 2 for details about the counts.

Figure 7: Response to Statements about Physics Teachers/Teaching
Base: School leaders (W1 -10; W2 - 20)

WAVE 1 Note: this table is based on counts, normalised to count per 10, not %s	Strongly disagree	Disagree	No opinion	Agree	Strongly agree	Don't Know
Physics should always be taught by someone with a physics degree	0	5	0	2	3	0
It is preferable to have physics graduates teaching physics	0	0	0	6	4	0
If teachers enthuse their students, this can make up for a lack of specialist knowledge	0	1	0	4	5	0
All science teachers should be equally capable of teaching any of the sciences	0	2	0	6	2	0
If the school lost a physics teacher, the school would aim to replace them with a specialist physics teacher	0	0	0	5	5	0
WAVE 2 Note: this table shows counts, normalised to count per 10, not %s						
Physics should always be taught by someone with a physics degree	0	4.5	2	2	1.5	0
It is preferable to have physics graduates teaching physics	0	0.5	1	4.5	4	0
If teachers enthuse their students, this can make up for a lack of specialist knowledge	0	1.5	0.5	2.5	5	0.5
All science teachers should be equally capable of teaching any of the sciences	0	3.5	0	3	3	0.5
If the school lost a physics teacher, the school would aim to replace them with a specialist physics teacher	0	0	0	3	7	0

Figure 7 above shows that response for Wave 1 and Wave 2 was broadly similar. However, the responses to this KPI proxy question reveal some seemingly contradictory results.

So, while the preference of all these school leader respondents for both Waves is to replace a physics teacher with a specialist, half of the respondents (5 out of 10 in Wave 1 and 9 out of 20 in Wave 2) disagree that physics should always be taught by a specialist. Furthermore, a majority (8 of 10 in Wave 1 and 12 of 20 in Wave 2) also states that all science teachers should be equally capable of teaching any of the sciences and that the ability of teachers to enthuse students can compensate for lack of specialist knowledge (9 of 10 in Wave 1, and 15 of 20 in Wave 2). The difference in the results of these questions may reveal the realities of operating in a tight physics labour market within which a desire or preference for a physics specialism is not easily fulfilled. Please refer to Appendix 2 for a table showing 'partner' and 'control' responses.

Another KPI proxy question was added to provide a comparative view on the school leaders' value of physics. School leaders were asked to prioritise the use of extra resources across subject areas: that if extra resources were available, to which five subject areas they would allocate additional resources. They were also asked to rank those five subjects, on a 5 point scale.

A majority of school leaders for both Waves indicated that English and Maths were their top priorities for the receipt of additional resources. In Wave 2, 6 school leaders from partner and 1 school leader from a control school listed physics as a priority, but no-one gave it top priority. In Wave 1, of the 2 school leaders who said they would prioritise physics, one gave it first priority and the other fourth priority. Please see Appendix 2 for control and partner school responses.

Figure 8 below shows that school leader respondents tended to select ‘core subjects’ – English, maths and general science, as priority areas for resources. When we allocate a score to the ranking, Physics scores 5th for both Waves. The rise of foreign languages in the ranking to fourth in Wave 2 may be attributed to the recent emphasis placed by government on the English baccalaureate, encouraging students to take a balance of more traditional academic subjects. This change in government policy may well be positive for science and physics, as traditional academic subjects, which may be reflected by the closeness of general science in ranking to English in Wave 2. See Appendix 2 for tables showing rankings by partner and control schools, separately and combined.

While there was a high value placed on physics by school leaders in a non-comparative KPI question (see Figure 6), we see that when asked to prioritise resources, school leaders' commitment to physics is lower than would be expected, prioritising various other subjects ahead of physics.

Figure 8: Top Five Subjects (Ranked) to which School Leaders would allocate extra Resources – Count per 10

Base: School leaders (W1 - 10; W2 - 20)

WAVE 1	Count (no. of respondents allocating value)	Assigned Point Value	Rank of Value 5 (top)	4	3	2	1 (low)
Maths	10	**36**	2	5	1	1	1
English	8	**32**	5	1	0	1	1
Science - general	8	**25**	0	2	5	1	0
ICT	5	**12**	1	0	1	1	2
Engineering	3	**7**	0	1	0	1	1
PE	2	**7**	1	0	0	1	0
Science - physics	2	**7**	1	0	0	1	0
Foreign language(s)	3	**6**	0	1	1	0	1
Science - chemistry	2	**5**	0	0	1	1	0
Design & technology	2	**3**	0	0	0	1	1
History	2	**3**	0	0	0	1	1
Other	1	**3**	0	0	1	0	0
Food science/technology	1	**1**	0	0	0	0	1
Science - biology	1	**1**	0	0	0	0	1
Other subjects (Art, Geography, Music, PSHE, RS)	0	**0**	0	0	0	0	0
Normalised to count per 10							
WAVE 2	**Actual count (Normalised)**						
Maths	15 (7.5)	**29.5**	2.5	3.5	0	1.5	0
English	11 (5.5)	**21**	2	1.5	0.5	1	0.5
Science - general	12 (6)	**20**	1	2	2	0	1
Foreign language(s)	9 (4.5)	**12.5**	0.5	0.5	1.5	1.5	0.5
Engineering	7 (3.5)	**8.5**	0.5	0.5	0.5	0.5	1.5
Science - physics	7 (3.5)	**8.5**	0	0.5	1	1.5	0.5
Science - chemistry	7 (3.5)	**8.5**	0.5	0	1	1	1
Music	5 (2.5)	**7.5**	0	1	1	0	0.5
Design & technology	6 (3)	**7**	0.5	0	0.5	1	1
PE	4 (2)	**6**	1	0	0	0	1
History	4 (2)	**5**	0.5	0	0.5	0	1
Science - biology	4 (2)	**5**	0	0.5	0.5	0.5	0.5
ICT	2 (1)	**4**	0.5	0	0.5	0	0
Other	2 (1)	**3**	0.5	0	0	0	0.5
Geography	3 (1.5)	**2.5**	0	0	0	1	0.5
Religious Studies	1 (0.5)	**1.5**	0	0	0.5	0	0
Art	1 (0.5)	**1**	0	0	0	0.5	0
Other subjects (Food Science, PSHE, RS)	0 (0)	**0**	0	0	0	0	0

3.2 Perceptions of the Role and Influence of School Leadership in Physics

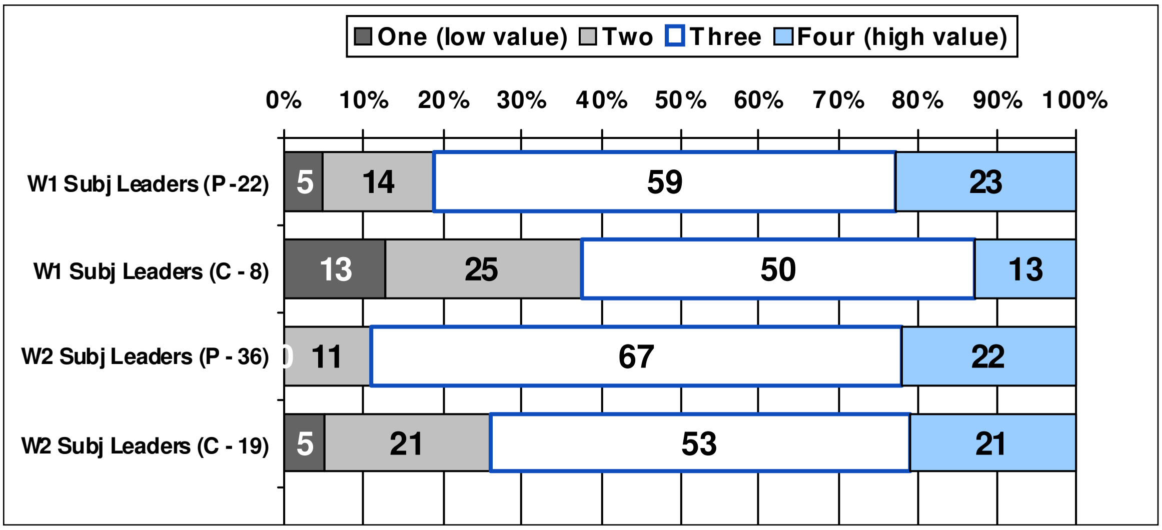
This section examines subject leaders' and teachers' views of the level of value placed on physics by their school leaders in general and practically, for example, through provision of subject-specific CPD.

Figure 9 below reveals subject leaders' perceptions of the extent to which school leadership values physics.

A majority of subject leaders across both Waves of the survey believe that school leaders have a medium-high level of value for physics (3) rather than a high value of 4 stated by the majority of school leaders. This is particularly marked in Wave 2 subject leaders where two thirds (67%) of subject leaders believed that school leaders would place a value of 3 on Physics. Subject leaders in partner schools are more likely than those in control schools to perceive school leaders placing a higher value on physics.

The proxy questions seem to show that the closer the question mimics action or prioritisation, rather than theoretical value, the further physics seems to slip in the hierarchy of subjects or in intrinsic value.

Figure 9: Perceptions of the Value that School Leaders place on Physics
Base: Subject leaders and teachers



As a proxy measurement of the perception of the value of physics in a school, we used the extent to which subject leaders feel their school leaders prioritise physics teaching and the development of physics teachers, subject leaders and science teachers through the provision of subject-based CPD for teachers of physics. Figure 10 below shows subject leaders' perceptions of the priority given to physics-based CPD.

Figure 10: Perceptions of the Priority placed on providing Physics-Based CPD by Subject Leaders

Base: Subject leaders - partner – W1 – 22; W2 – 36; control – W1 – 8; W2 - 19

WAVE 1	Partner (22) %	Control (8) %
1-Not a priority	9	0
2-Low priority	23	38
3-Medium priority	32	50
4-High priority	32	0
5-Top priority	5	0
I don't know	0	13
Total	**101***	**101***
Mean Score (base excludes 'don't know')	3.0	2.6
WAVE 2	(36) %	(19) %
1-Not a priority	0	21
2-Low priority	8	11
3-Medium priority	47	47
4-High priority	36	16
5-Top priority	8	5
I don't know	0	0
Total	**100**	**100**
Mean Score (base excludes 'don't know')	3.4	2.7

*Total deviates from 100% due to rounding

In Wave 2, the mean score out of five given by subject leaders in partner schools for the level of priority given to providing physics-based CPD is higher than that of Wave 1 (3.4 compared with 3.0), potentially reflecting the greater length of time they have been with the Stimulating Physics Network. The mean scores for subject leaders in partner schools are higher in both waves than those for subject leaders in control schools (in Wave 2, 3.4 compared with 2.7, and in Wave 1, 3.0 compared with 2.6). Subject leaders therefore have a more positive perception of the priority given to providing physics-based CPD in schools that have received intensive support from the SPN.

Summary

- The baseline level (mean) of value that ‘partner’ school leaders say they place on physics (measured on a four-point scale, where 4 is the highest value) is 3.6 out of 4. Therefore the KPI target mean value is 3.8 out of 4. The mean score achieved in Wave 2 is 3.9 out of 4.
- However, science subject leaders’ estimations of their school leader’s/leaders’ value of physics was generally lower (3.0 out of 4). The mean target value for subject leaders’ opinions is 3.5 out of 4. The KPI mean value achieved in Wave 2 for subject leaders’ views rose slightly to 3.1 out of 4.
- In Wave 1, subject leaders’ perception of how their school leader would prioritise physics-based CPD was lower than their perceived level of value of the subject (‘medium’ priority – a mean score of 3.0 out of 5). In Wave 2 the mean score rose, to 3.4 out of 5 – a ‘medium’ priority.
- For both Waves, additional KPI proxy questions found that school leaders tended to select ‘core subjects’ – English, Maths and General Science, as priority areas for additional resources (suggesting a high value to them). When scores were allocated to rankings, physics scores fifth for both Waves.
- The proxy questions seem to indicate that the closer a question was to an action or prioritisation regarding physics, the lower the ranking or value placed on the subject.
- Seemingly contradictory views were expressed by school leaders about physics teaching for both Waves of the evaluation. All respondents agreed that they would aim to fill a physics position with a specialist physics teacher and most respondents that it is preferable to have physics graduates teaching physics. Yet, the majority also agreed that all science teachers should be equally capable of teaching any of the sciences; and also that the ability of teachers to enthuse students can compensate for a lack of specialist knowledge.

4 TEACHING PHYSICS

This section focuses on the experiences of teachers and subject leaders and will show the impact of the Stimulating Physics Network across the two Waves. Areas covered include: the extent to which teachers are enabled through CPD to deliver the physics curriculum; teachers' confidence in delivering the subject; the culture of the physics department; and the provision of Enrichment and Enhancement (E&E) and how it has an impact upon students.

4.1 Teaching and CPD for Physics Teachers

In a labour market in which specialist physics teachers are in short supply, physics-based CPD is important for non-specialist teachers of physics in particular, but also for specialist physics teachers who may become isolated from their peers or the specialist physics community. It appears, however, that there is more emphasis on generalist or 'whole school' CPD in comparison with physics-based CPD. Figures 11 and 12 show the volume of 'all CPD' offered to teachers in the previous academic year, compared with subject-based CPD offered for the same period. Please note that in Wave 1 these figures relate to the year prior to the SPN intervention. Wave 2 figures relate to the year of SPN intervention.

Figure 11: Number of CPD Sessions in Previous Year – Total and Physics- Related
Base: Teachers and subject leaders

	Partner		Control	
WAVE 1	**All CPD** (68) %	**Physics CPD** (68) %	**All CPD** (24) %	**Physics CPD** (24) %
None	3	34	8	33
One	10	24	13	25
Two	13	10	4	21
Three	9	15	17	17
Four	10	6	13	0
Five	16	1	13	0
More than Five	28	3	25	0
Not stated	10	7	8	4
Total	**99***	**100**	**101***	**100**
Mean	**5.0**	**1.5**	**4.1**	**1.2**
Ratio of Physics CPD to all CPD	**0.3**		**0.29**	
WAVE 2	(76)	(76)	(35)	(35)
None	8	28	6	51
One	3	26	9	26
Two	5	12	6	11
Three	16	8	17	3
Four	9	11	3	6
Five	17	4	20	0
More than Five	41	12	40	3
Not stated	1	0	0	0
Total	**100**	**100**	**100**	**100**
Mean	**8.0**	**2.6**	**5.7**	**1.0**
Ratio of Physics CPD to all CPD	**0.33**		**0.18**	

* Total deviates from 100% due to rounding
NOTE: A 'session' was defined as one themed activity: a full day or a half day on a given theme, was classed as one session.

Figure 11 shows that in partner schools the mean figure for all CPD and physics-based CPD has risen during the year of SPN intervention. In fact, there was an increase in the number of physics-related CPD sessions, and in the proportion of these sessions in relation to general CPD in Wave 2. In partner schools, in Wave 2, the average number of physics-based CPD sessions is 2.6 out of an average total CPD sessions of 8; compared with 1.5 out of an average total CPD sessions of 5 in Wave 1. For both Waves, the average number of CPD sessions is slightly lower in control schools: an average of 1.0 physics-based sessions out of 5.7 total CPD sessions in Wave 2; and an average of 1.2 physics-based sessions out of 4.1 total CPD sessions in Wave 1. The ratio of subject-related CPD to general CPD for physics teachers and subject leaders in partner schools has improved slightly between Wave 1 and Wave 2 (0.3 Wave 1, 0.33 Wave 2). The ratio of subject-related CPD to all CPD in partner and control schools has changed between Wave 2 and Wave 1. In Wave 1 there was a similar ratio for partner schools and control schools (0.3 subject-specific CPD as a ratio of all CPD in partner schools, and 0.29 in control schools) and in Wave 2, the ratio has worsened in control schools, with the gap between partner and control schools widening (partner school CPD sessions, 0.33, and 0.18, control). It seems that resources are far more likely to be committed to general CPD than subject-related (physics) for control schools. For partner schools this ratio is improving.

General CPD is largely based on: general pedagogical knowledge; knowledge of the learner and the catchment of the school; wider educational knowledge to be used alongside subject related CPD in: subject content knowledge and pedagogical content knowledge. While general pedagogical knowledge will be transferable to various subjects, it is training in physics content and physics pedagogical content which will be of most use to physics teachers. However, subject-based CPD is more resource-intensive than general CPD.

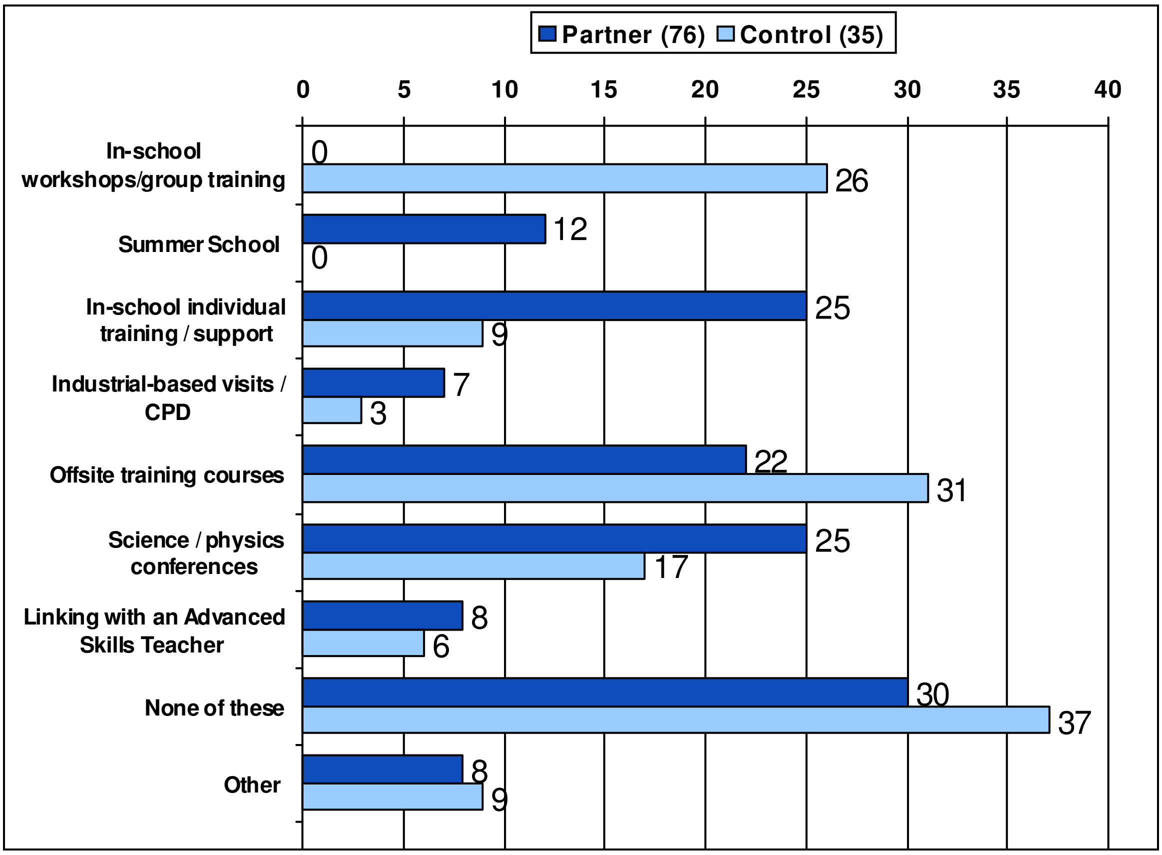
In Wave 1, a third of teachers and subject leaders reported experiencing no physics-based CPD in 2008/9 (34% partner and 33% control). In Wave 2, a lower proportion of teachers and subject leaders in partner schools reported having no physics-based CPD in the previous year (28%) compared with half (51%) of those from control schools. In Wave 2, over a quarter (27%) of teachers/subject leaders in partner schools had received four or more physics CPD sessions during the year they received support from SPN, compared with just 10% in Wave 1, and 9% of Wave 2 teachers/subject leaders in control schools.

Teachers were also asked about the kinds of physics CPD in which they had participated during the previous academic year, with the resulting data presented in Figure 12 (over the page).

In Wave 2, teachers in partner schools were more likely to have experienced in-school individual training or support (25% partner compared with 9% control); have attended science/physics conferences (25% partner compared with 17% control); have attended Summer school (12% partner compared with 0% control); have experienced industrial-based visits/CPD (7% partner compared with 3% control); and to have linked with an Advanced Skills Teacher (8% partner compared with 6% control). The proportion of partner teachers for each of these categories had risen since Wave 1: for in-school individual training or support (25% Wave 2 compared with 13% Wave 1); for science/physics conferences (25% Wave 2 compared with 12% Wave 1); for Summer school (12% Wave 2 compared with 1% Wave 1) control); for industrial-based visits/CPD (7% Wave 2 compared with 1% Wave 1); and for links with an Advanced Skills Teacher (8% Wave 2 compared with 0% Wave 1).

In both Waves, teachers in control schools were more likely to have received offsite training courses (in Wave 2, 31% control compared with 22% partner), and in Wave 2 no teachers from partner schools had experienced in-school workshops/group training compared with 32% in Wave 1, and 26% of teachers in control schools in Wave 2.

Figure 12: Types of Physics-based CPD in Previous Year – Wave 2
Base: Teachers and subject leaders



One of the main issues thought to affect the quality of teaching is the confidence of teaching staff, particularly when a member of staff is not specialist in the subject area. One of the aims of the Stimulating Physics Network is to work with non-specialist teachers of physics to increase their confidence in delivering the subject.

Classroom teachers (excluding subject leaders) were asked to indicate how confident they felt in a range of scenarios using a four-point scale. Figure 13 summarises these responses using mean scores for specialist and non-specialist teachers.

While care must be taken in interpretation due to the low bases from which most of the mean scores are calculated, the data illustrate that specialist physics teachers in partner schools may be more confident in the classroom in all categories than non-specialist physics teachers. In control schools, confidence is more evenly spread between specialist physics teachers and non-specialist physics teachers (low bases).

The difference in mean scores between Wave 1 and Wave 2 (see Figure 13) shows that non-specialist teachers in partner schools gained confidence in all areas related to planning and delivering physics teaching.

In Wave 2, non-specialist physics teachers in partner schools indicate that they have relatively low confidence in ‘teaching more complex physics theories and giving relevant examples’, with a mean score of 2.4 on the four point scale, with 1 indicating ‘not confident at all’, and 4 indicating ‘very confident’. However, the mean scores for non-specialist physics teachers in partner schools were higher in all categories than in Wave 1 (see Appendix 2 for the Wave 1 scores).

Non-specialist physics teachers in partner schools indicate that they have low confidence in designing practicals/experiments (mean 2.6), with non-specialists in control schools also indicating relatively low confidence (mean 2.6). Confidence of non-specialist teachers in both partner and control schools is also relatively low for devising physics lessons that truly excite students (mean scores of 2.8 and 2.7 respectively). The student research revealed that students want more practical work and want more enjoyable lessons.

Figure 13: Mean Levels of Confidence in Planning and Delivering Physics Teaching – Difference in Mean between Wave 1 and Wave 2

Base: Teachers (excluding subject leaders)

Scale: 1=not confident at all; 2=not very confident; 3=fairly confident and 4=very confident.

	Partner#				Control#			
	Specialists (11)		Non-specialists (29)		Specialists (7)		Non-specialists (9)	
	1	2	1	2	1	2	1	2
Teaching physics lessons from a scheme of work	3.7	-0.2	3.5	+0.1	3.7	0	3.7	-0.1
Devising physics lessons that truly engage students	3.2	-0.3	3.0	+0.5	3.3	0	2.9	-0.1
Devising physics lessons that truly engage girls	3.0	-0.5	2.7	+0.3	3.6	+0.4	3.0	0
Devising physics lessons that truly excite students	3.1	0	2.8	+0.6	3.1	+0.4	2.7	-0.1
Teaching physics lessons that can be applied to the everyday lives of the majority of students	3.3	-0.6	3.0	+0.1	3.1	0	3.6	+0.4
Designing practicals/experiments	3.3	-0.3	2.6	+0.2	2.9	-0.1	2.6	-0.4
Explaining the scientific principles behind practicals/experiments	3.8	+0.2	3.2	+0.2	3.4	-0.2	3.1	-0.3
Answering unexpected and complicated questions in class	3.7	+0.1	2.7	+0.2	2.9	-0.6	2.9	-0.3
Demonstrating physics ideas using apparatus	3.7	+0.1	3.0	+0.4	3.0	-0.3	3.3	-0.3
Show students what it is like to think like a physicist	3.3	-0.3	2.6	+0.2	2.7	-0.5	2.9	+0.1
Teaching more complex physics theories and giving relevant examples	3.5	0	2.4	+0.2	2.9	-0.7	2.3	-0.5
NET INCREASE/DECREASE:	N/A	**-1.8**	N/A	**+3.0**	N/A	**-1.6**	N/A	**-1.6**

1 = mean; 2= increase/decrease since Wave 1
# Caution low bases

Confidence in answering unexpected and complicated questions in class is low in partner non-specialist teachers (mean 2.7) and control non-specialists (2.9), with specialists in control schools also only posting a mean of 2.9 on this variable. These three groups also showed relatively low confidence in ‘showing students what it is like to think like a physicist’.

These areas of relatively low confidence are physics content and physics pedagogical content related. While confidence has risen for non-specialist teachers in partner schools receiving intensive SPN support, there is still more work to be done

4.2 Culture of the Physics/Science Department

To assess the extent to which staff in physics departments are engaging in a range of positive activities to contribute to a stimulating departmental culture, teachers and subject leaders were asked to indicate how frequently their department engages in various activities. They were also asked to comment on the extent to which the status of physics compares with other subjects.

Figure 14 (overleaf) shows the frequency of physics-related activity in partner and control schools from a five-point scale. Figure 15 compares the frequency of physics-related activities in partner schools in Wave 1 and Wave 2. See Appendix 2 for the Wave 1 chart of physics-related activity.

In Wave 2, for partner schools in all categories, except one (lessons involving practicals - 43% regularly/always compared with 46% in Wave 1), there is a rise in the proportion of teachers and subject leaders reporting more regular physics support activities since Wave 1.

In addition, teacher and subject leader respondents from partner schools were also less likely to teach physics lessons driven by text books in Wave 2 than Wave 1 (45% state fairly often, regularly or always compared with 56% in Wave 1). This is the same proportion as teachers in control schools in Wave 2. Also, only 7% of Wave 2 partner school teachers and subject leaders stated that their physics lessons only rarely contain practicals/experiments, which this is a lower proportion than for control school respondents (11%). This indicates that although some teachers (particularly non-specialist teachers in partner schools have relatively low confidence in practical work, that practical work is still undertaken.

Perceptions of the status of physics have risen for partner school respondents since Wave 1. A much higher proportion of Wave 2 respondents from partner schools believe that physics is not at all or not very often given lower status than other subjects than at Wave 1 (85% compared with 60% in Wave 1). This proportion is also higher than for respondents from control schools (85% compared with 69% for control school respondents). A higher proportion of Wave 2 partner school respondents think that physics is regularly or always given equal status compared with all subjects (49% in Wave 2, compared with 39% in Wave 1). The proportion of partner school respondents believing this is also higher than control school respondents in Wave 2 (49% compared with 37%). A slightly higher proportion of Wave 2 teacher and subject leaders from partner schools also think that physics is regularly or always given equal status with biology and chemistry than those in control schools (68% compared with 63% in control schools). The proportion of respondents from partner schools believing this at Wave 2 is slightly higher than in Wave 1 (68% compared with 65%).

Perception of physics' status as a distinct subject taught by subject experts has also risen since Wave 1 for partner schools. 53% of Wave 2 partner school respondents believe that their school regularly or always views physics as distinct compared with 43% of Wave 1 partner school respondents. In Wave 2, this was also a higher proportion than control school respondents (53% partner, 40% control).

Frequency of activities in the physics department has also improved since Wave 1 for partner schools. 34% of partner schools respondents say that their department subscribes to a physics journal regularly or always, compared with 19% in Wave 1. This proportion is also higher than in Wave 2 control school respondents (34% partner, 29% control). 31% of Wave 2 partner school respondents also report that staff regularly or always discuss physics teaching in the prep room, compared with 23% in Wave 1. This Wave 2 proportion is also slightly higher than in Wave 2 control school respondents (31% partner, 29% control).

Figure 14: Frequency of Physics Support Activities within the Department – Wave 2

Base: Teachers and subject leaders (P = partner; C= control)

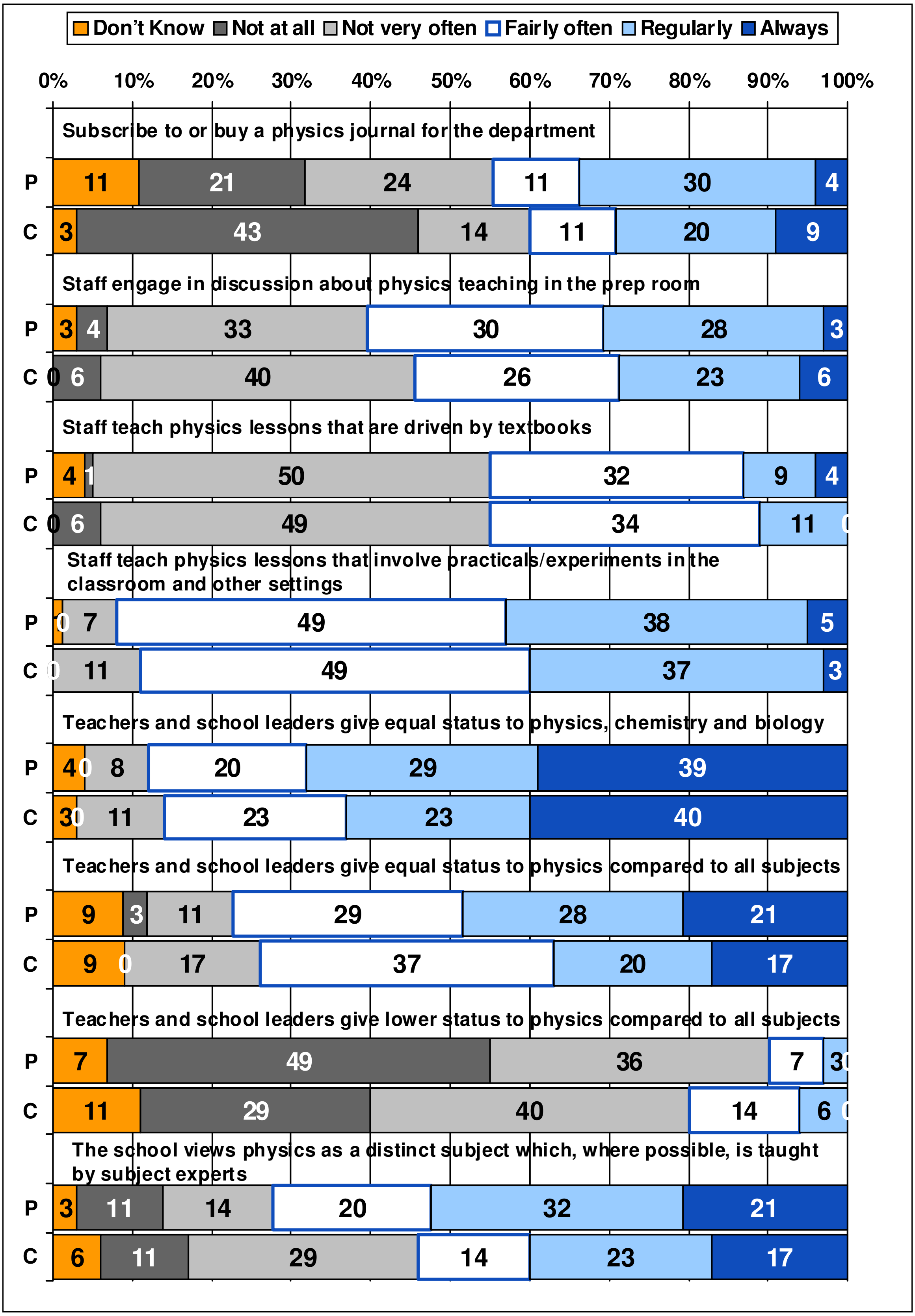
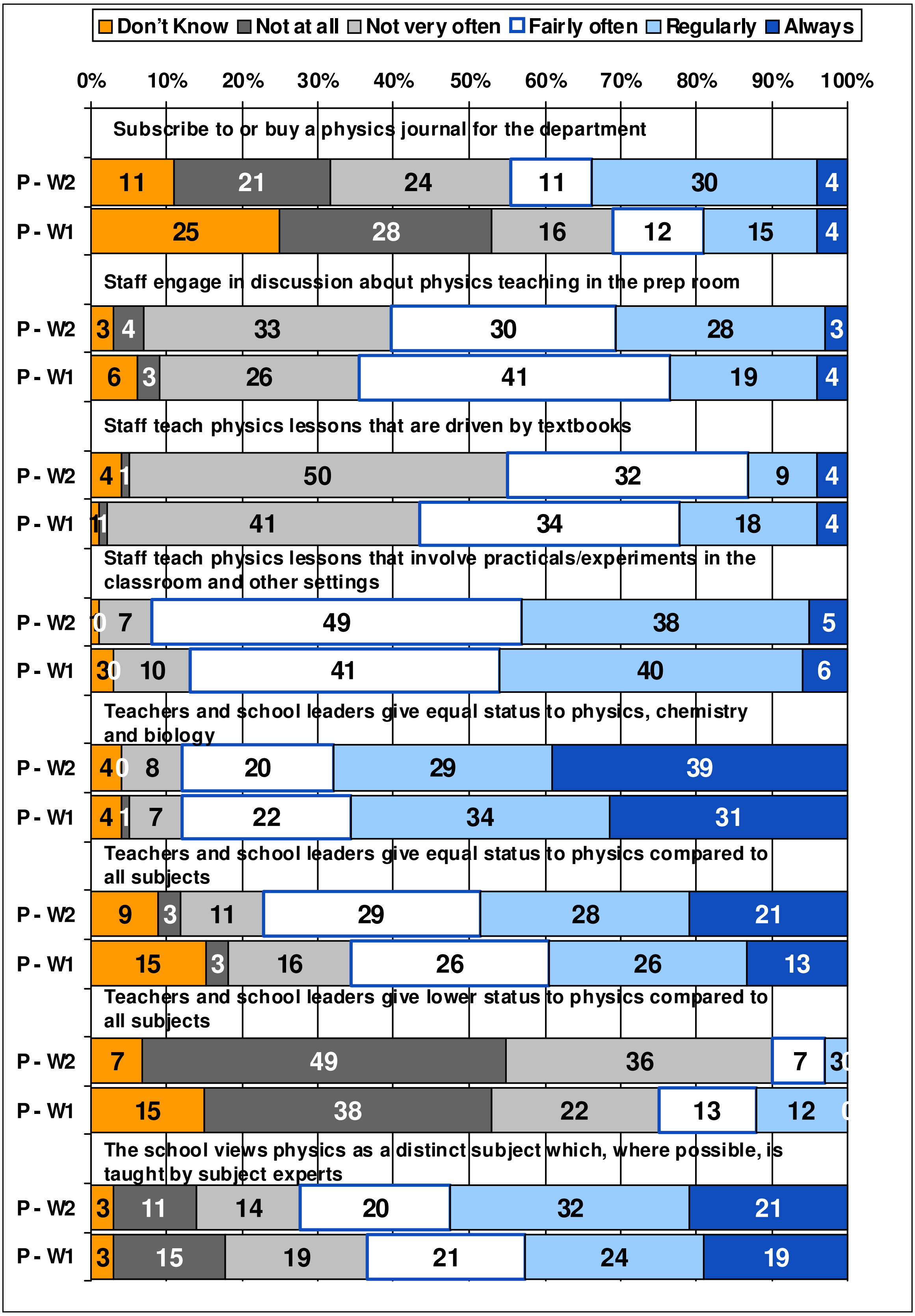


Figure 15: Frequency of Physics Support Activities within the Department – Partner Schools Wave 1 and Wave 2

Base: Teachers and subject leaders (P = partner)



4.3 The Role of Enrichment and Enhancement

Teachers and subject leaders were asked how many physics-based E&E activities their school provided to students across the whole school (Y7-11) during the last academic year, the responses are summarised in Figure 16 below.

Figure 16: Number of Physics-based E&E Activities provided in the Previous Academic Year – Wave 1 and Wave 2

Base: All teachers and subject leaders

	Partner		Control	
WAVE 1	**Sub Lead** (22) %	**Teacher** (46) %	**Sub Lead** (8) %	**Teacher** (16) %
No E&E activities	23	20	13	19
One	0	24	0	25
Two	14	22	25	0
Three	27	7	0	0
Four	5	2	25	6
Five	0	2	13	19
More than five	27	11	13	13
Not stated	5	13	13	19
Total	**100**	**100**	**100**	**100**
Mean number of activities (where stated)	**5.1**	**2.4**	**3.9**	**2.7**
WAVE 2	(36)	(40)	(19)	(16)
No E&E activities	14	23	16	38
One	6	20	16	6
Two	14	13	21	25
Three	6	15	5	13
Four	14	5	11	6
Five	19	10	5	6
More than five	28	15	26	6
Not stated	0	0	0	0
Total	**100**	**100**	**100**	**100**
Mean number of activities (where stated)	**7.4**	**5.4**	**5.8**	**1.9**

Teachers and subject leaders were asked to type in the number of E&E activities provided in their school during the previous year. This data indicates that subject leaders are aware of, or remember, more E&E activities provided within their school than other teachers are.

In Wave 2, for subject leaders in partner schools the average number of activities reported was 7.4 compared to 5.8 reported by control subject leaders. Figure 17 below shows the change in the number of physics-based E&E activities reported between Wave 1 and Wave 2.

Figure 17: Change in the Number of Physics-based E&E Activities provided in the Previous Academic Year – Wave 1 and Wave 2

Base: All teachers and subject leaders

Change in Proportion between Wave 1 and Wave 2	Partner Sub Lead %	Partner Teacher %	Control Sub Lead %	Control Teacher %
No E&E activities	–9	+3	+3	+19
One	+6	+4	+16	–19
Two	0	–9	–4	+25
Three	–19	+8	+5	+13
Four	+9	+3	–14	0
Five	+19	+8	–8	–13
More than five	+1	+4	+13	–7
Not stated	–5	–13	–13	–19

Bases: Wave 2: partner school subject leaders–36; partner school teachers–40; Control school subject leaders–19; control school teachers–16; Wave 1: partner school subject leaders–22; partner school teachers–46; control school subject leaders–8; control school teachers–16

The proportion of subject leaders and teachers in partner schools reporting four, five and more than five E&E sessions in the previous year rose between Wave 1 and Wave 2.

A Key Performance Indicator (KPI) for the Stimulating Physics Network is the measurement of the average number of physics-based Enrichment and Enhancement (E&E) activities in partner schools. Specifically:

KPI: Strand 2 'Reinvigorating the School Ethos'

Marked increase in physics-based E&E activities in all partner schools

Baseline:
Average of A activities per year = 3.3 (partner subject leaders and teachers)
Average of A activities per year = 5.1 (partner subject leaders only)

Success factor:
Average of A+1.5 activities per year per school = 4.8 (partner subject leaders and teachers)
Average of A+1.5 activities per year per school = 6.6 (partner subject leaders only)

Achieved at Wave 2:
Average of E&E Activities: 6.3 (partner subject leaders and teachers)
Average of E&E Activities: 7.4 (partner subject leaders only)

Figure 18 below shows the types of physics-based E&E activities that teachers said their schools had provided in the previous year.

In Wave 2, two thirds (67%) of partner school teachers and subject leaders said they had provided science clubs, compared with 49% in control schools and 57% in Wave 1 partner schools. Nearly half (47%) of teachers in partner schools said they had provided lectures outside the classroom compared with 46% in control schools and 43% in Wave 1 partner schools. A higher proportion of partner school respondents in Wave 2 than Wave 1 reported their schools taking part in national science competitions (28% Wave 2, 16% Wave 1); in HE taster days (21% Wave 2, 13% Wave 1); in national or regional science competitions (15% Wave 2, 4% Wave 1); work placements (16% Wave 2, 12% Wave 1); Summer schools (7%

Wave 2, 3% Wave 1); and in e-mentoring (5% Wave 2, 1% Wave 1) – though this was lower than control schools (17% in Wave 2).

Figure 18: Types of Physics-based Enrichment and Enhancement (E&E) Activities Provided in the Previous Academic Year

Base: Teachers and subject leaders

	Partner		Control	
	W1 (68) %	W2 (76) %	W1 (24) %	W2 (35) %
Science clubs	57	67	58	49
National science competitions	16	28	21	29
Schools and colleges 'lecture' outside the classroom	43	47	17	46
National or regional science competitions (e.g. SciCast Physics)	4	15	25	29
Lab in a Lorry	7	9	0	0
HE Education taster days	13	21	25	11
e-mentoring	1	5	0	17
Work placements in a science-related industry	12	16	8	6
Summer schools	3	7	0	11
In school E&E sessions incl. visitors to school	9	0	4	0
'Visits' to science related E&E	7	0	0	0
Others	18	18	13	40
None of these	12	9	8	11
I don't know	7	9	8	0

% exceeds 100% because of multiple activities reported

Teachers consulted in the qualitative research described some of the E&E activities undertaken by their schools including: science clubs; roadshows; astronomy shows; an in-school Forensics day (where students had to solve a mystery CSI-style); making rockets; demonstrating the solar system using balls; 'blowing things up'; taster days for A-level physics; speakers coming into school to talk about job opportunities and science at university; trips out to space school; physics activities organised by universities; trips to employers; taking girls on physics-related trips; and a trip to Alton Towers, where students were given a physics lecture and then went on rides related to physics (velocity, forces, circular motion etc.).

We also explored the barriers that teachers and subject leaders perceive to exist in the provision of E&E in their schools. As Figure 19 shows, lack of time within the curriculum; lack of money; lack of cover/rarely cover policy; and school location/travel were barriers to delivering E&E activities. Subject leaders especially saw lack of time (86% partner, 84% control) and lack of cover (61% partner, 53% control) as an issue. Only a tiny minority suggested that there are no barriers to the provision of E&E.

Figure 19: Barriers to Providing Enrichment and Enhancement (E&E) Activities in the Curriculum for Science Students – Wave 2

Base: Teachers and subject leaders

	Partner		Control	
	Sub Lead (36) %	Teacher (40) %	Sub Lead (19) %	Teacher (16) %
Lack of knowledge of 'what to do'	8	30	5	6
Lack of awareness of where to get ideas/information for E&E	17	33	11	25
Lack of practical resources to support the planning and/or delivery of E&E	22	25	42	25
Lack of time to deliver E&E within the curriculum	86	53	84	50
Lack of financial resources to deliver E&E	44	38	79	63
Lack of support from school leadership	3	5	16	6
Location of school/travel arrangements	44	28	58	38
Lack of cover/rarely cover	61	8	53	6
Other barriers	3	10	5	13
No barriers to providing E&E	3	3	11	13
I don't know	3	15	5	6

% exceeds 100% because of multiple barriers

The qualitative research provided some detail on the curriculum problems. Some teachers stated that it was difficult to 'squeeze in' all the content of the GCSE curriculum and still have time for practicals and activities which might engage students. Furthermore, some areas of the curriculum were perceived as hard to teach in an interesting way.

> *"There are a couple of areas of what I call 'semi-desert' on the curriculum as they are so dry. However much I stand at the front and enthuse about renewable energy resource, they aren't interested. There's also not many practicals you can do with nuclear power stations! I find the back-to-back lessons where they sit and write notes the hardest."*
> Teacher 11-18 Mixed Comprehensive School

Teachers and subject leaders were also asked about the careers resources that they had used over the previous two years with physics/science students. Figure 20 shows that a range of resources, including posters, talks, careers days and websites have been used. In Wave 2, a higher proportion of teachers and subject leaders in partner schools indicated that they had used careers-related publications (24% Wave 2, 12% Wave 1) and websites (50% Wave 2, 35% Wave 1) than in Wave 1.

Figure 20: Careers-related Resources used in the last two Years – Waves 1 and 2
Base: Teachers and subject leaders

	Partner		Control	
	W1 (68) %	**W2** (76) %	**W1** (24) %	**W2** (35) %
Posters	68	68	67	80
Publications	12	24	8	29
Websites	35	50	21	43
Talks – group events or online	26	28	21	23
Events	7	17	13	11
Careers Days	N/A	25	N/A	31
Others	4	13	13	9
None of these	24	5	29	11

% exceeds 100% because of multiple resources used

As would be expected, the qualitative and quantitative research with students found that the careers being considered by students had an influence on the subjects they would take at A level (see also Figure 36). A number of students in the qualitative groups indicated that their decision to continue physics at A-level was linked to their career decisions. However, students' knowledge of the types of careers they can enter having physics A-level was limited – most suggested careers that were branches of physics (such as astronomer, nuclear physics) or scientifically related, such as engineering or medicine. A number of students admitted that they were unclear about the full range of careers on offer to them if they take physics. So, while choice of future career was seen by students to be a very important influence on subject choice, there was a lack of knowledge about physics-related careers. Furthermore, the careers choices linked to taking physics were mostly scientific or physics related, unlike the attitude of those considering arts or social science A-levels who seem more likely to consider a wider range of non-subject related careers.

In addition, qualitative feedback from teachers suggests that time limitations in the classroom because of the pressure of the curriculum, and lack of resource or expertise prevents detailed class discussion or one to one discussion about careers.

> *"It would be good to get more people in to talk about their jobs and what jobs physics can open up to them. It would also be good to talk a little about salaries as that may be a motivator for some. Fitting in careers advice is difficult though. It's difficult finding the right people and the right links and information to give to pupils. There's just one exam after another. Taking them to a work place would be good but there's no time and not all are free - there's the transport to consider and the cost of teaching cover ...basically a lot of red tape! There is access to a careers adviser in school but we don't really have time to work with them. Students all get a one-off slot with the adviser and then that's it. There's no scope to help students out and develop their career plans."*
> Teacher, 11-18 Mixed Comprehensive School

In the quantitative student survey, we found that no, or only a tiny minority of, students expressed agreement that salary would encourage them to take up physics. In addition, although many teachers stated that physics-related careers resources might be useful, the evaluators' view is that putting physics on a level playing field with other subjects should involve widening the careers information to all careers open to those with physics, not just those that are specifically physics-related. As the SPN develops over time, informing and providing teachers with a wider variety of resources would give greater opportunity to explain the breadth of careers available for students taking physics at A-level and beyond.

4.3.1 Student Experiences of Enhancement & Enrichment

Students were asked about their experiences of E&E. The results show that in both partner and control schools they had engaged in a variety of E&E activities (see Figure 21). However, more than half of students in both Waves (both partner and control schools) said they had experienced *none* of the E&E activities (options for 'other' and 'don't know' were also provided). The results demonstrate that E&E activities, despite their variety have a low take up and/or transfer ratio. Little difference can be seen between the experiences of Y10 and Y11 students, except that a greater proportion of Y11 students had taken part in a schools and colleges 'lecture' outside the classroom. In Wave 2, around a fifth of students in partner schools have been on field trips, a marked increase from Wave 1.

Figure 21: E&E Activities in which Year 10 and Year 11 Students have participated
Base: Base: Students (**Weighted** – Unweighted)

	Partner		Control	
WAVE 1	**Y10** (**585**-581) %	**Y11** (**163**-167) %	**Y10** (275) %	**Y11** (11) %
Science clubs	10	10	7	9
National science competitions	3	2	3	0
Lectures outside the classroom	9	16	9	18
National or regional science competitions	3	1	3	0
Lab in a Lorry	4	6	3	0
HE Education taster days	4	3	3	9
e-mentoring	3	5	1	0
Work placements in sci-related industry	8	7	6	9
Field trips	3	0	0	0
Others	5	2	1	0
None of these	65	58	68	55
I don't know	15	11	14	9
WAVE 2	(**466**-471) %	(**331**-326) %	(98) %	(124) %
Science clubs	10	10	6	6
National science competitions	6	4	11	5
Lectures outside the classroom	16	23	14	10
National or regional science competitions	3	2	14	2
Lab in a Lorry	6	6	1	4
HE Education taster days	4	8	1	2
e-mentoring	2	3	0	1
Work placements in sci-related industry	5	10	0	12
Field trips	23	20	14	18
None of these	54	50	52	59
I don't know	8	7	8	6
Others	3	4	6	4

% exceeds 100% because of multiple E&E activities experienced

The majority of activities in which students had taken part were science-based, rather than purely physics-based, in both partner and control schools (see Figure 22 below). Around a third of students in partner schools had taken part in the following physics-based activities: National or regional science competitions (33%); field trips (31%); lab in a lorry (31%); and lectures outside the classroom (29%).

Figure 22: Types of E&E Activities (Science-based or Physics-based)
Base: Students who participated in physics E&E activities (**Weighted –** Unweighted)

WAVE 2	Partner			Control#		
	Physics %	Science %	Don't Know %	Physics %	Science %	Don't Know %
Science clubs (P– **81**-75; C–14)	14	82	5	14	57	29
National science competitions (P – **44**-39; C–17)	22	69	8	24	71	6
Lectures outside the classroom (P – **151**-136; C–26)	29	62	9	12	85	4
National or regional science competitions (P – **22**-20; C–17)	33	67	0	6	82	12
Lab in a Lorry (P – **47**-44; C–6)	31	59	9	0	50	50
HE Education taster days (P – **44**-38; C–3)	15	67	18	0	100	0
e-mentoring (P – **21**-19; C–1)	14	68	18	0	100	0
Work placements in a science-related industry (P – **55**-48; C–15)	16	72	12	27	73	0
Field trips (P – **170**-153; C–36)	31	60	8	36	58	6

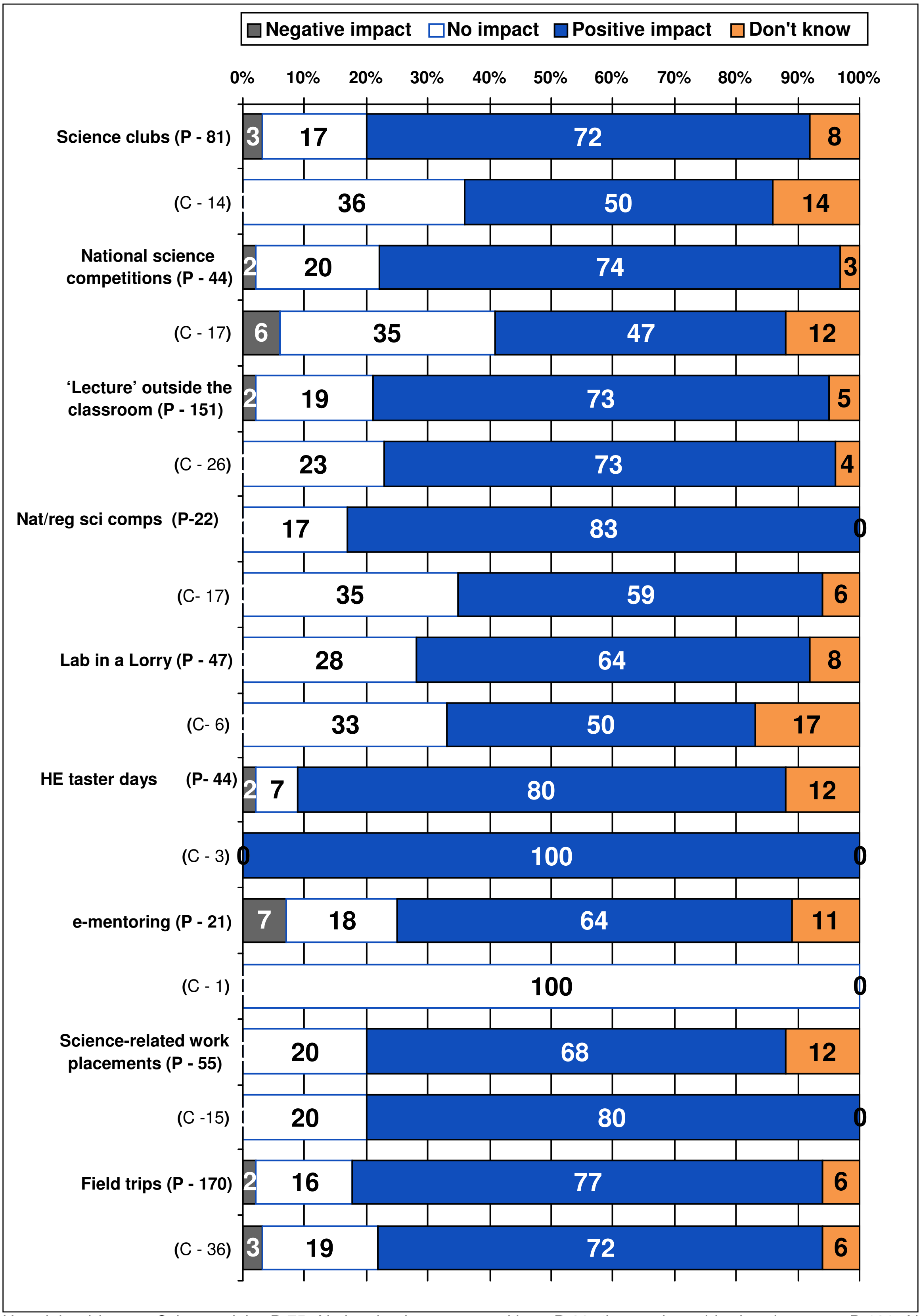
Caution low bases

Students who had stated that they had participated in some form of E&E activity generally saw them as having a positive impact, as Figure 23 below shows. Students were more likely to state that science competitions, HE taster days, and field trips had a positive impact. In Wave 2, partner school students were more positive about almost all activities than in Wave 1. Girls were more likely than boys to say that activities had no impact on them and were less likely to say that the activities had a positive impact. This is the case for most categories, except for national or regional science competitions where 88% of girls from partner schools indicated these had a positive impact compared with 80% of boys; and work placements in a science-related industry where 71% of girls from partner schools reported a positive impact compared with 66% of boys. Some caution must be applied to this interpretation due to low bases in these categories. See Appendix 2 for further information.

Views on the amount and quality of E&E activities that students had the opportunity to participate in varied from school to school in the qualitative research. However there was a consensus that students who received more E&E tended to have better perception of the subject. Activities mentioned by students included: visiting the Natural History Museum and National Space Centre; going to Alton Towers, where they were given a physics lecture and then went on rides related to physics (velocity, forces, circular motion etc.); an in-school Forensics day (where students had to solve a mystery CSI-style); and a mobile planetarium brought into the school.

Figure 23: Impact of E&E Activities on Enjoyment and Understanding of Physics – Wave 2

Base: Students who participated in physics E&E activities (**Weighted –** Unweighted)



Unweighted bases: Science clubs P-75; National science competitions P-39; 'Lecture' outside the classroom P-136; Nat/reg science competitions P-20; Lab in a Lorry P-44; HE Education taster days P-38; e-mentoring P-19; Science-related work placements P-48; Field Trips P-153.

4.4 Teachers' Experiences and Expectations of the SPN

At the time of the first round of research, SPN had already started, although levels of direct support from the SPN were still fairly low, with around a third (33%) of staff indicating their school had had contact with a Physics Network Co-ordinator and two fifths (42%) reporting their school had had contact with a Teaching and Learning Coach for needs analysis, see Figure 24 below. By Wave 2, contact levels had increased, with over half (53%) of respondents reporting they had had contact with a TLC, 44% having had contact with a PNC; and 41% experiencing support to non-specialist physics teachers. Nearly a quarter (23%) of respondents had attended physics summer schools, compared with just 5% in Wave 1, and twice as many respondents had attended regional physics network meetings (16% Wave 2, 8% Wave 1).

Figure 24: Schools' Experience of Stimulating Physics Network Activities
Base: School leaders, subject leaders and teachers in partner schools

	Partner	
	Wave 1 (77) %	Wave 2 (92) %
Contact with a TLC to review the requirements of the school in relation to SPN support	42	53
Direct support in the physics classroom from a TLC (e.g. as a 'guest' teacher)	17	22
Direct support to non-specialist physics teachers from a TLC	25	41
Contact with a PNC	33	44
A visit from a Teaching and Learning Ambassador	12	10
Local physics-based networking	14	16
Physics summer schools	5	23
Regional physics network meetings	8	16
Networking with other schools/colleges/businesses/peers	22	19
None of these	5	2
I don't know	22	17

% exceeds 100% because of multiple types of contact with SPN

In Wave 2, a new question was included to understand how much effect SPN has had on awareness of the need to recruit specialist physics teachers. Around one in six respondents (16%) had become more aware of this need, since joining SPN.

Figure 25: Awareness of need to recruit specialist Physics Teachers since joining SPN
Base: School leaders, subject leaders and teachers in partner schools

	Partner Wave 2 (93) %
Yes, we are more aware	16
No, we were aware before	76
No, we don't agree	6
Not stated	1

Staff were asked to indicate what their desired and achieved outcomes were from being part of the SPN. Figure 26 below shows that teachers' aspirations have not always been met, especially relating to activities to engage students. However, over half (53%) of teachers in Wave 2 indicated that higher standards of physics teaching had been attained through teacher CPD; and while only 20% of teachers in Wave 1 stated the desire to achieve further engagement of senior management with physics, 41% believed that further engagement of senior management had been achieved in Wave 2. While a lower proportion (10%) of teachers in Wave 2 stated there was an increase in E&E physics activities than for Wave 1 (46%), Figure 16 shows that the mean number of activities had risen to meet the SPN target. The results indicate that only 2% of teachers, school leaders and subject leaders believe that none of the outcomes stated had been met. The gap between teachers' desired and achieved outcomes will need to be considered as current gains are embedded and as SPN goes on into the future.

Figure 26: Desired/Achieved Outcomes from Involvement in SPN
Base: Teachers, subject leaders and school leaders in partner schools

	Teachers	
	W1 (77) %	**W2** (92) %
Higher standards of physics teaching through teacher CPD	62	53
Greater student engagement through teacher CPD	75	22
Further engagement of senior management with physics	20	41
Improved engagement and interest of students with physics as a subject	68	44
An increase in the number of physics E&E activities undertaken across the school	46	10
A better appreciation of physics careers among students	55	16
Increase in students who are interested in progressing to A-level physics	64	23
Increase in number of students progressing to A-level physics	60	16
Increase in number of girls progressing to A-level physics	58	19
None of the above	3	2
Something else	4	17

% exceeds 100% because of multiple desired outcomes

While a number of teachers consulted in the qualitative research conducted during the Summer term felt it was too early to see an impact from SPN support, some teacher consultees reported a positive impact from the support from the TLCs: increasing their confidence, feeling supported, and giving variety to teaching methods and new ways to convey key concepts to pupils.

> *"I've found them [the TLC's] sessions inspiring. It is nice to spend some time talking about the subject itself. We don't often have time for that and it helps give us some confidence. It has given me an understanding about what I need to know to teach the kids which helps me feel more confident when I'm teaching. I would say that I feel more confident teaching physics than chemistry now."*
> Teacher, 11-18 Mixed Comprehensive

> *"The SPN contact has had a noticeable impact on the teaching the staff do. It has made them much more confident. The written evaluations of SPN are always positive. Students also liked the Rocket sessions."*
> Teacher 11-18 Mixed Comprehensive School

Teachers were also more likely to be open about their insecurities about teaching physics with an outside consultant than their Head of Science. One teacher commented on the usefulness of the resources provided by SPN, including: KS3 physics tutorials, lesson ideas, common misconceptions (video clips for teachers), and some clips for children, including animations.

Summary

- There was an increase in the number of physics-related CPD sessions, and in the proportion of these sessions in relation to general CPD. In Wave 2, teachers and subject leaders in partner schools reported an average of 8.0 CPD sessions in the previous year, including 2.6 physics-based. This is an increase from Wave 1 where they reported 5.0 CPD sessions in the previous year, including 1.5 physics-based. Fewer CPD sessions were reported in 'control' schools, in Wave 2, an average of 5.7 sessions, including 1.0 physics-based. For partner schools, the ratio of physics-related CPD sessions in relation to general CPD also rose slightly from 0.3 in Wave 1 to 0.33 in Wave 2.
- In Wave 2, 27% of teachers/subject leaders in partner schools had received four or more physics CPD sessions during the year they received support from SPN, compared with just 10% in Wave 1, and 9% of Wave 2 teachers/subject leaders in control schools.
- The difference in mean scores between Wave 1 and Wave 2 shows that non-specialist teachers in partner schools gained confidence in all areas related to planning and delivering physics teaching.
- In Wave 2, a higher proportion of teacher respondents in partner schools see physics as having equal status with other subjects, than in Wave 1. 53% of Wave 2 partner school respondents also stated that their school regularly or always views physics as a distinct subject taught by experts compared with 43% in Wave 1.
- In Wave 2, for partner schools in all categories but one, there is a rise in the proportion of teachers and subject leaders reporting more regular physics support activities since Wave 1. A third (34%) of partner school respondents say that their department subscribes to a physics journal regularly or always, compared with 19% in Wave 1. A third (31%) of Wave 2 partner school respondents also report that staff regularly or always discuss physics teaching in the prep room, compared with 23% in Wave 1.
- In Wave 2, teachers and subject leaders in partner schools reported an average of 6.3 E&E activities in the previous year, compared with 3.3 in Wave 1. Subject leaders reported a higher number of activities than classroom teachers – a mean of 7.4 activities compared with 5.1 in Wave 1. For both Waves, in partner schools the most commonly reported types of E&E activity were science clubs, and lectures outside the classroom. Lack of time within the curriculum; lack of money; lack of cover/rarely cover; and school location/travel were the most commonly cited barriers to E&E activities. In Wave 2, partner school students were more positive about almost all E&E activities they had undertaken than in Wave 1.
- In Wave 2, levels of contact and SPN activities generally increased from those at Wave 1. 53% of teachers, subject leaders and school leaders had had contact with a TLC compared with 42% in Wave 1; and 44% had had contact with a PNC compared with 33% in Wave 1.
- The outcomes most teachers and leaders want from SPN involvement are better teaching and greater student engagement, leading to greater interest in physics A-level, outcomes which dovetail with the SPN's KPIs.

5 BEING A PHYSICS STUDENT

The perceptions and experiences that students have of physics as a subject will inevitably influence decisions about whether to study the subject at A-level and beyond. This section covers the perceptions, experiences, and influencing factors on decisions relating to the study of physics as expressed by students in partner and control schools and any changes over the two waves of research.

5.1 Students' Perceptions of Physics

Students' understanding and perceptions of a variety of aspects of physics affect their uptake of that subject at AS/A-level. The surveys asked students to identify physics modules from a list that included topics (such as motion, and electricity) from all three branches of science (see Figure 27). Three quarters of students in both partner and control schools identified all the physics modules from the topics listed.

Figure 27: Students' Understanding of Physics – Wave 2
Base: Students – P= partner (**797**-797); C= control (222)

	Wave 2	
	Partner (**797-**797) %	**Control** (222) %
Identified all Physics modules	74	75
Identified some Physics modules	23	23
Identified no Physics modules	3	2

Figure 28 shows students' understanding of physics modules by the type of science course they have taken. A majority of students studying different types of science course identified all physics modules. For partner schools, a higher proportion of students identified all physics modules than students in control schools, except for those studying Core Plus Additional Science.

Figure 28: Students' Understanding of Physics by Type of Science Courses Taken– Wave 2
Base: Students – P= partner (**797**-797); C= control (222)

WAVE 2	Core + Additional Science %		Core + Additional Applied Science %		Double Award %		Triple Science %	
	P	C	P	C	P	C	P	C
Identified all Physics modules	50	78	86	71	80	57	84	76
Identified some Physics modules	43	22	14	14	17	36	15	22
Identified no Physics modules	7	0	0	14	3	7	1	2

The surveys asked students to indicate their agreement/disagreement with a set of statements about physics, using a five point scale to indicate their strength of feeling, with 1 denoting 'strongly disagree' and 5 denoting 'strongly agree'. While the results are of interest in themselves, unfortunately the length of the questionnaire did not allow us to ask questions about comparator subject areas.

Figure 29: Students' Perceptions of Physics – Wave 2

Students – P= partner (**797**-797); C= control (222)

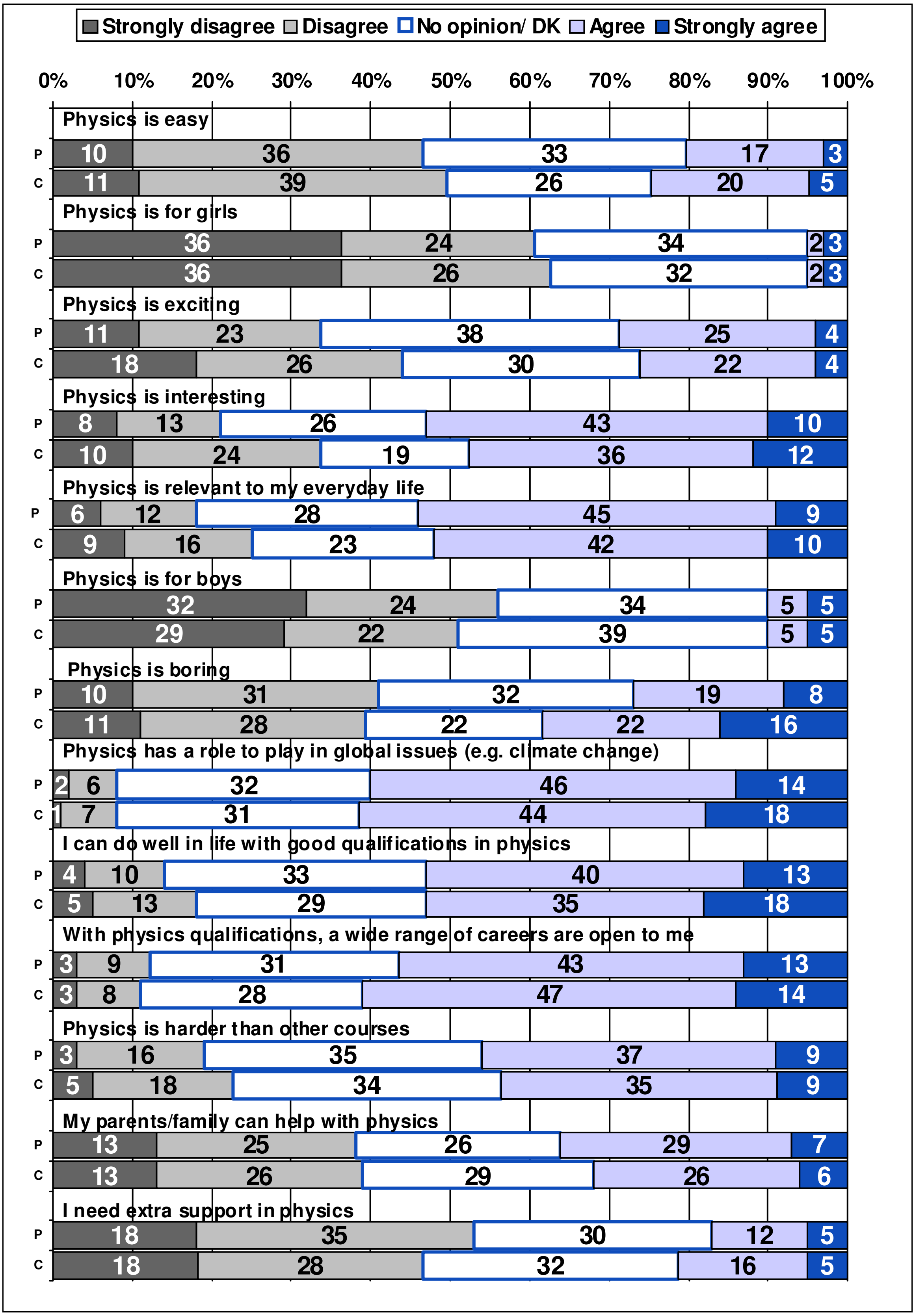
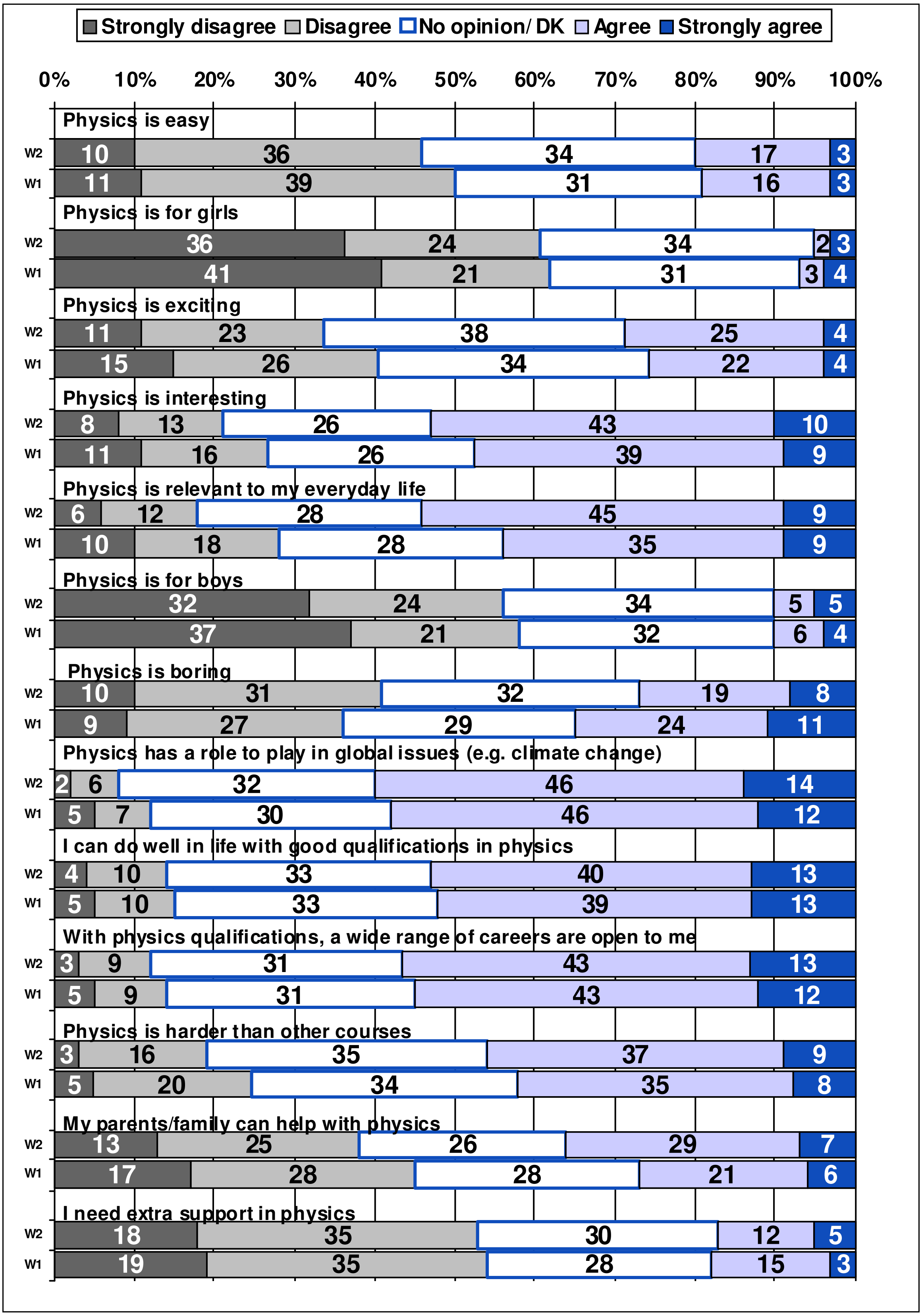


Figure 30: Students' Perceptions of Physics in Partner Schools – Waves 1 and 2

Students – W2 partner (**797**-797); W1 partner (**748-**748)



Figures 29 and 30 above indicate that between a quarter and over a third of students from both partner and control schools chose to give no opinion on each statement about physics (similar to Wave 1).

Figures 29 and 30 also show that over half of students from partner schools find physics relevant (54% Wave 2 compared with 44% in Wave 1) and interesting (53% Wave 2 compared with 48% in Wave 1). Over half also believe that physics opens up a wide range of careers and that they can do well in life with physics qualifications. Six in ten students in both partner and control schools indicate that physics has a role to play in global issues.

In Wave 2, we analysed by gender on some key questions in partner schools where we found significant disparities between the views of girls and boys (see Appendix 2). On the subject of the difficulty of physics, girls were less likely to prevaricate (by stating they had no opinion) but much less likely to agree that physics is easy with 15% strongly disagreeing with the statement and a further 45% disagreeing compared with 4% and 28% of boys respectively. While over a third of boys (39%) had no opinion compared to 26% of girls, 27% of boys agreed or strongly agreed that physics is easy compared to only 12% of girls.

Girls were more likely to disagree that physics is exciting (43% disagreeing compared to 24% of boys). Girls, however, are much more likely to agree that physics is boring (38% of girls agreeing compared to 17% of boys); and, conversely, disagree that physics is interesting (29% girls, 13% boys).

Half or more of both genders saw physics as relevant. Boys were more likely to see physics as relevant to their everyday lives than girls (59% boys, compared with 50% girls).

A significantly higher proportion of boys agreed that they can do well with a physics qualification than girls, with 64% of boys agreeing compared to under half (42%) of girls. This result may be linked to the fact that a higher proportion of boys agree that a wide range of careers are open to them with physics (62% boys compared to 50% of girls).

Over half of girls (52%) and over a third (40%) of boys agree that physics is harder than other courses but over half of partner school students (53%) disagree with the statement that they need extra support. Relatively few state that they agree they need extra support (17%) with a higher proportion of girls (23%) agreeing compared to boys (11%). In addition, a higher proportion of girls disagreed that their families can help them with physics (44%) compared to 31% of boys.

When analysed by the SOC code of the parents of students in partner schools, the results were less conclusive for a number of reasons. First, student reporting of their parental occupational type is less reliable; and secondly, the bases of some of the SOC groups are low. With these caveats in mind, the offspring of heads of household who are in the semi-routine manual and service occupations are much less likely to state that physics is relevant to their everyday lives (33%) compared to the average (54%). A lower proportion of students in this group also agreed that their parents could help them (19%) compared with the average (36%).

The next group of questions concerned students' perceptions of the teaching they receive in the subject. The results are displayed in Figure 31 below. Students were generally positive about their teachers' ability to explain concepts, be understandable, make examples relevant, and to encourage questions and ideas in class. However, students were more likely to agree that they learn more from practicals and experiments than from books; but that they did not do enough practical work. There is still clearly development required in the variety of practical work undertaken, in E&E activities and in the amount of information required about physics-related careers. This accords with the low proportion of teachers in partner schools who believe that SPN has engendered a better appreciation of physics careers among students (see Figure 26). The SPN project may need to be embedded for longer in schools to see a greater impact in these areas.

Throughout this phase of questions, a high proportion of students stated that they had no opinion.

Figure 31: Students' Perceptions of Teaching Methods for Physics – Wave 2
Base: Students in partner schools –(**797**-797); in control schools – (222)

%		Strongly disagree	Disagree	No opinion	Agree	Strongly agree	D/K
My teachers explain scientific ideas and theories well	**P**	5	9	19	52	13	1
	C	4	18	15	53	9	1
The practicals/experiments we do in physics are exciting	**P**	9	21	31	32	5	2
	C	12	27	25	28	6	2
I learn a lot more from practical/ experimental work than from textbooks	**P**	5	15	24	37	17	2
	C	5	17	24	32	22	1
Teachers use examples that are interesting to boys	**P**	13	21	44	13	2	7
	C	13	24	41	15	2	5
In group work, we often work in single-sex groups (all boys, or all girls)	**P**	13	26	23	18	15	5
	C	24	35	18	12	7	4
My teachers explain things in plain language that I can understand	**P**	5	12	24	50	8	1
	C	6	12	26	44	10	1
My teachers are good at explaining how things work	**P**	5	8	22	52	12	1
	C	8	13	19	45	14	1
We do not do enough practical/experimental work	**P**	4	15	24	34	22	2
	C	5	14	27	27	26	1
We don't often have the opportunity to learn in new ways (e.g. field trips)	**P**	3	9	15	39	32	2
	C	6	8	13	35	36	1
I have had some information in class about physics-related careers	**P**	16	35	25	17	3	4
	C	15	40	18	20	5	1
Teachers use relevant examples to explain physics concepts to the class	**P**	5	4	22	59	7	2
	C	5	10	18	55	9	3
Teachers use examples that are interesting to girls	**P**	12	17	49	13	2	7
	C	15	21	47	9	1	8
In group work, girls and boys often work together	**P**	13	15	29	30	7	6
	C	7	10	20	42	15	5
I am encouraged to express my own ideas in class	**P**	5	11	29	45	7	2
	C	5	15	23	47	7	3
I am encouraged to ask questions	**P**	5	9	23	50	11	2
	C	5	15	19	49	10	3
We do not do enough group work	**P**	4	26	30	29	9	2
	C	4	26	31	27	9	3
I feel like I can speak up if I don't understand something	**P**	5	8	21	48	14	3
	C	5	16	16	46	14	2
I can get extra help in physics if I need it	**P**	4	8	19	52	11	5
	C	4	12	22	44	11	7
I do not know which modules are physics-related	**P**	19	38	25	11	3	4
	C	25	38	21	8	2	7

Around 57% of students in partner schools disagreed with the statement 'I do not know which modules are physics-related'. A higher proportion of students from control schools disagreed (63%) with the statement. These results demonstrate a more pessimistic self-appraisal of physics knowledge than emerged from a separate question designed to ascertain if students can distinguish physics modules from chemistry and biology content, where three quarters of both partner and control school students identified all the physics modules listed (see Figure 27).

In partner schools, a higher proportion of girls (35%) than boys (23%) disagreed with the statement that teachers use examples that are interesting to girls, with a low agreement of both girls (14%) and boys at 16%.

On the other hand, a far higher proportion of partner school girls disagreed (44%) that teachers use examples that are interesting to boys than agreed with this statement (8%). Just over one fifth of boys (23%) agreed and disagreed with the proposition.

5.2 Influences and Experiences

Figure 32 below shows the statements regarding choosing GCSE physics with which students agreed. A majority of students in partner schools (56%, Wave 2) opted to study physics because they did not have a choice compared with only a fifth (22%) of those in control schools. This result may explain the differential between the two school types in the enjoyment of physics factor (see below).

Figure 32: Opting to study Physics as a separate GCSE – Wave 1 and Wave 2
Base: Students who took triple science (therefore separate physics GCSE) (**Weighted –** Unweighted)

Reasons for choice	Partner		Control	
	W1 (**552**-551) %	W2 (**523**-540) %	W1 (182) %	W2 (129) %
I enjoy the subject	23	25	36	35
I find physics interesting	29	28	37	42
I like the practical work	18	14	23	27
I want to work in a physics-related career	12	10	17	19
My teacher advised me to take it	18	9	21	23
I get good grades in sciences	35	28	43	48
I didn't have the choice	55	56	26	22
My parents wanted me to take physics	12	11	13	18
My teacher is good/I like the teacher	14	10	12	12
People in my family did science	7	7	11	13
My friends are studying physics	8	8	14	16
I thought I would get good grades in physics	22	20	30	45
I think it will look good on my CV	1	0	2	0
It is a part of triple science	4	4	6	3
I wanted to get an extra GCSE	1	–	2	5
Other	2	4	2	11

*The total is not 100% as the question was multi-response

In Wave 2, between a quarter and two fifths of physics GCSE students said they find physics interesting (28% partner and 42% control) and that they enjoy the subject (25% partner and 35% control). Only around one in ten in partner schools agreed that wanting a physics-related career was part of their reason for choosing physics GCSE, compared with one in five (19%) in control schools.

A higher proportion of students in control schools for both Waves (48%, Wave 2) opted for GCSE physics because they get good grades in science; and, similarly, in physics (45%, control, 20%, partner). The proportion of those in partner schools saying the former is smaller in Wave 2 than Wave 1 (28%, Wave 2; 35%, Wave 1). The proportion of partner school students reporting their teacher had advised them to take it also reduced (18%, Wave 1, 9%, Wave 2).

There were significant differences between the girls' and boys' responses in both Waves (see Figure 33). In Wave 2, while only 15% of females agreed that they chose physics because they enjoyed it, over a third of boys (38%) stated that this was a reason for their choice. Similarly, only 19% of females agreed they found physics interesting, compared with 38% of boys. A higher proportion of boys (23%) stated that liking the practical work was a reason for choosing the subject, compared to girls (8%); stated that they get good grades in science (39%) compared to girls (19%); and that they will get good grades in physics (30%) compared to girls (12%). A higher proportion of boys also agreed that their parents wanted them to take physics (16%) compared with 6% of girls. Conversely, a much higher proportion of girls (73%) agreed with the statement that they took physics because they had no choice compared with 36% of boys. A lower proportion of girls (5%) have opted for physics since they want to enter a physics-related career in the future compared to boys (16%).

Figure 33: Opting to study Physics as a separate GCSE by Gender – Wave 2
Base: Students who took triple science (therefore separate physics GCSE)

WAVE 2 **Reasons for choice**	**Male**		**Female**	
	Partner (**239-**277) %	Control (70) %	Partner (**284-**376) %	Control (59) %
I enjoy the subject	38	46	15	22
I find physics interesting	38	53	19	29
I like the practical work	23	37	8	15
I want to work in a physics-related career	16	29	5	7
My teacher advised me to take it	11	16	8	32
I get good grades in sciences	39	49	19	47
I didn't have the choice	36	13	73	32
My parents wanted me to take physics	16	19	6	17
My teacher is good/I like the teacher	12	19	8	5
People in my family did science	9	17	6	8
My friends are studying physics	12	20	4	12
I thought I would get good grades in physics	30	49	12	41
I think it will look good on my CV	0	0	0	0
It is a part of triple science	5	1	2	5
I wanted to get an extra GCSE	1	7	–	3
Other	4	11	3	10

*The total is not 100% as the question was multi-response

Students were then asked to rank the 5 reasons they took physics as a separate GCSE, with 1 denoting 'most important' and 5 'least important' (see Figure 34 below).

For those for whom having no choice was one of the reasons they took physics, a high proportion ranked it as 'the most important' reason (48% of partner school respondents and 14% of control students - 43% of control school students ranked this as 2nd most important). Of those who agreed that they want to work in a physics-related career, 40% of partner and control students ranked it as the most important. A third or more of those who say they enjoy the subject, ranked this as the most important (33% partner, 37% control).

Figure 34: Ranking of Reasons for choosing Physics as a separate GCSE – Wave 2

Base: Students who took triple science in partner schools (**Weighted**-Unweighted) **523**-540; in control schools - 222

Reasons for choice	Partner %					Control %				
	1 Most Imp.	**2**	**3**	**4**	**5**	**1 Most Imp.**	**2**	**3**	**4**	**5**
I enjoy the subject (Bases: Pnr-119-105; **Ctrl-**41)	33	21	23	16	7	37	17	17	20	10
I find physics interesting (Bases: Pnr-128-117; **Ctrl-**48)	23	30	25	15	7	17	31	27	19	6
I like the practical work (Bases: Pnr-48-44; **Ctrl-**26)	5	11	40	34	11	4	27	19	27	23
I want to work in a physics-related career (Bases: Pnr-43-36; **Ctrl-**20)	40	22	19	10	9	40	20	25	5	10
My teacher advised me to take it (Bases: Pnr-39-39; **Ctrl-**23)	17	27	15	29	12	13	26	26	17	17
I get good grades in sciences (Bases: Pnr-129-120; **Ctrl-**53)	24	34	17	17	7	34	23	17	11	15
I didn't have the choice (Bases: Pnr-56-61; **Ctrl-**14)	48	9	11	13	18	14	43	14	29	0
My parents wanted me to take physics (Bases: Pnr-43-39; **Ctrl-**16)	17	21	24	16	22	38	6	31	13	13
My teacher is good/I like the teacher (Bases: Pnr-36-38; **Ctrl-**9)	14	12	23	22	29	11	22	33	33	0
People in my family did science (Bases: Pnr-27-27; **Ctrl-**9)	3	30	14	24	30	0	22	22	22	33
My friends are studying physics (Bases: Pnr-28-24; **Ctrl-**12)	5	16	16	26	37	17	8	17	17	42
I thought I would get good grades in physics (Bases: Pnr-83-75; **Ctrl-**40)	21	29	27	11	13	13	25	23	15	25

We asked students about factors that may have an influence on their perceptions of physics, positively and/or negatively. Relatively low proportions of students felt that 'external' factors such as the media, films and video games, the internet, family and friends had an influence on their view of physics. However, school-based factors were important to students' views of physics: half (54% from partner and 52% from control schools) believed that science teachers made them think positively about physics, while around one in ten felt science teachers made them think more negatively. Similarly, nearly half (49% partner, 46% control) felt that science lessons made them feel more positive about physics. Figure 35 below shows the results. The results for Wave 1 are similar to those for Wave 2, see Appendix 2.

Figure 35: Factors Influencing Students' Views of Physics – Wave 2
Base: Students (**Weighted**-Unweighted)

- = Makes me think negatively about physics -/+ = Doesn't influence my view of physics + = Makes me think positively about physics V = It varies/depends DK = Don't know	Partner (**797**-797) %					Control (222) %				
	-	-/+	+	V	DK	-	-/+	+	V	DK
TV and news stories	3	48	18	26	6	4	55	17	20	4
Films and video games	4	56	17	17	7	2	61	19	13	5
Friends	7	59	11	16	6	12	61	7	15	5
Parents/family	3	50	25	15	6	2	62	20	10	6
Science teachers	8	17	54	18	3	10	21	52	13	4
Other teachers/ school staff	6	46	22	20	6	6	53	19	17	5
The internet	3	47	25	19	6	3	53	22	19	4
School	6	31	39	20	4	13	34	32	18	3
Science lessons	10	16	49	21	4	14	23	46	15	3

In the main, the results from the girls and boys show that boys were slightly more likely to state that various factors made them think positively about the subject. There were a few areas in which the views of girls and boys especially tended to differ:

Boys were more likely than girls to state that science teachers had a positive impact (60% boys, 48% girls); and also that science lessons make them think positively about physics (56% boys, 41% girls).

A higher proportion of boys (43%) stated that school made them think positively about physics compared to girls (34%); that the internet gave them a positive perception of the subject (31%) compared to girls (19%); and that films and video games had a positive impact (24% boys, 10% girls).

Twice the proportion of girls stated that friends (10% girls, 5% boys) and school (8% girls, 4% boys) had a negative impact on their perception of physics.

The results of the qualitative consultations with students found that the quality of teachers and teaching methods has a big impact on how students engage with physics. Within the discussion groups, there was a big contrast between students who had a positive attitude to their teacher and those who had a negative attitude.

> *"The teacher does affect if you like a subject or not, definitely."*
> Year 10 Triple Award Student

One group talked about a physics teacher who had issues keeping order in the classroom, who was perceived as dull and 'a joke'.

> *"For the first three years I would have considered taking physics and this year he's so much worse a teacher that I wouldn't at all."*
> Y10 Double Award Student

Summary

- A majority of students in both partner and control schools have sufficient understanding of physics to identify physics topics as opposed to topics from other branches of science.
- Over half of students from partner schools find physics relevant (54% Wave 2, 44% Wave 1) and interesting (53% Wave 2, 46% Wave 1). Over half (56%) also believe that physics opens up a wide range of careers and that they can do well in life with physics qualifications.
- Disparities were seen between the attitudes of male and female students on some key questions. Girls tended to have clearer views than boys (fewer expressed 'no opinion'), but were less likely to agree that physics is easy (60% of girls disagreed) or that physics is exciting (43% disagreed). These results are similar for both Waves.
- Students were generally positive about their teachers' ability to explain concepts, be understandable, make examples relevant, and to encourage questions and ideas in class. However, students were more likely to agree that they learn more from practicals and experiments than from books; but that they did not do enough practical work.
- When asked about factors that influence their opinion of physics (in both positive and negative ways) a relatively low proportion of students acknowledged the impact of external factors such as the media. School-based factors such as science teachers and science lessons were more commonly acknowledged as having an impact (more positive than negative).
- A much higher proportion of girls (73%) taking physics as a separate GCSE said that a reason that they were taking physics is that they had no choice (i.e. had to take triple science), compared with 36% of boys. This disparity was wider in Wave 2 than Wave 1.
- Student opinion suggests there is development work required in the variety of practical work undertaken and the amount of information available about physics-related careers. This accords with the low proportion of teachers in partner schools who believe that SPN has engendered a better appreciation of physics careers among students. The SPN project may need to be embedded for longer in schools to see a greater impact in these areas.

6 PROGRESSING TO A-LEVEL PHYSICS AND BEYOND

This section reports on results from both Waves regarding issues around encouraging students to study physics at A-level.

6.1 Factors Influencing Physics Uptake at A-Level

One of the main aims of the SPN is to increase participation in physics post-16. The evaluation investigated factors that may influence students' decision to carry on with their studies in physics at AS/A-level.

The group discussions with students and qualitative consultations with teachers in Wave 1 confirmed the complex and multi-faceted issues influencing uptake of physics at A-level. Students considering taking A-level physics were often influenced by their choice of career (while actually lacking knowledge about the breadth of careers available with physics qualifications); enjoyment and interest in the subject, teachers and teaching methods; lack of knowledge of A level content; and by family and peers.

The pressure on getting high grades for university course entrance, of particular note now that HE places are more limited, alongside the perception of physics as 'difficult' has an influence on physics uptake, especially for girls, who are more likely to perceive physics as difficult than boys. The fact that physics is no longer directly required for careers such as medicine, has resulted in more students stating that they will avoid the subject at A-level and avoiding the risk of a lower grade in the subject than they might get for other sciences and subjects.

Figure 36 (over the page) shows the factors that students believed would encourage them to study physics post-GCSE.

Around half of students indicated that factors relating to good teaching/teaching methods (including more inspiring practicals and making the subject more fun); getting good grades and career-related information would encourage them to take physics at AS/A-level. Of interest, no-one stated that they would be encouraged to keep studying physics if it led to a well-paid job.

While nearly half of students stated that more inspiring practicals would encourage them, we note from other results in the survey that a higher proportion of girls are less positive about practical work than boys.

Figure 36: Factors that would encourage Study of Physics Post-GCSE – Wave 2
Base: Students (**Weighted-**Unweighted)

	Partner		Control	
	Y10 (**466-**471) %	**Y11** (**331-**326) %	**Y10** (98) %	**Y11** (124) %
Making the subject more enjoyable/fun	58	43	51	50
More inspiring practicals/ experiments in the classroom	57	47	46	48
Chance of getting a good grade at a higher level (AS or A Level)	53	49	47	44
Good teaching of the subject	52	51	54	55
Getting the grades I need to progress beyond GCSE	44	37	47	34
More information about the jobs and careers I could go into	44	38	38	40
Needing physics to do a preferred University course	34	34	32	35
More science activities outside the classroom (e.g. science clubs)	28	27	19	22
More physics-related role models	26	24	21	20
Intellectual challenge	20	23	23	21
More female role models in physics	11	12	8	11
Make the subject more relevant to girls	9	10	3	11
More male role models in physics	6	10	3	4
Make the subject more relevant to boys	6	5	4	4
If good at it/enjoy it	1	1	0	0
Nothing will/don't like the subject	–	–	0	0
If I thought it would lead to a well paid job	0	0	0	0
None of these	15	15	16	17
Something else	2	5	5	11

% exceeds 100% because of multiple factors mentioned

The qualitative research revealed that the amount of support (to encourage them to take physics at A-level) that students reported they received from their school varied from school to school and was mainly linked to students' relationships with subject teachers and other science department staff.

Students' feedback about what would encourage them to take physics at A-level related to better teaching and teaching methods, including more practicals that students could do themselves; relevance to everyday life; more knowledge about the content of A-level physics; and more enrichment and enhancement activities, such as trips, sessions by externals, and access to roadshows and events.

> *"You don't know what physics can do for you. You're learning this, but you don't know what you're learning it for."*
> Y11 Triple Award Student

Feedback from the teacher consultations was consistent with students' views, and the teacher survey also pointed out the need for more practicals, more enrichment and enhancement activities, and interactive teaching methods. Role models were also seen as important, especially female role models for girls, although only about a tenth of students highlighted this as a factor in the quantitative survey. Several teachers mentioned that more information about physics-related careers was required, to give students a better understanding of the benefits of taking the subject (although the quantitative survey reveals that information about a *broad* spectrum of careers into which physics can lead is what is lacking).

One teacher had formed good links with local employers and took students on visits, which alongside more interactive teaching methods, had encouraged higher uptake of A-level physics. Another teacher was about to start working with the school's Maths department to synchronise content of maths and physics.

External changes suggested by teachers included: making the GCSE curriculum more interesting, while ensuring that the gap in knowledge between GCSE and A-level was reduced; and the possible introduction of awarding extra UCAS points for maths and physics at A-level.

Students who said that they were going to stay in education post-GCSE were asked for their views on the likelihood of their taking AS/A-level physics. Over a third (38%) of students from partner schools said that they might or would definitely do physics, compared with 34% of students from control schools. Less than a third (29%) of students from partner schools said they would definitely not choose to study physics post-GCSE, compared with four in ten (39%) of those from control schools and 31% in Wave 1. 16% of students at partner and 15% of control school students had considered physics post-GCSE and decided against.

As Figure 37 (below) indicates, in Wave 2, 40% of Year 11 students from partner schools either may do or will definitely do physics AS/A level, compared with 36% in Wave 1. A third (34%) of Year 11 partner school students in Wave 2 will definitely not choose physics AS/A level, a reduction from 43% in Wave 1. Around a fifth of Year 11 students in partner schools considered taking physics AS/A level but decided against (20% Wave 2, 18% Wave 1). For both Waves, over one third of Year 10 partner and control school students are thinking about doing physics at AS/A2.

Figure 37: Students' Views of the Likelihood of taking AS/A-Level Physics – Wave 1 and Wave 2

Base: Students who had not ruled out staying in education post GCSEs (**Weighted**-Unweighted)

	Partner		Control	
WAVE 1	**Y10** (**561**-560) %	**Y11** (**159**-163) %	**Y10** (267) %	**Y11#** (11) %
I will definitely not choose physics AS/A-level	27	43	26	18
I have thought about choosing physics AS/A-level, but have decided not to do it	11	18	13	9
I am thinking about choosing physics AS/A-level, I might do it	30	4	30	27
I will definitely do physics AS/A-level	6	32	8	27
I don't know / I haven't thought about it yet	26	2	23	18
Total	**100**	**100**	**100**	**99***
WAVE 2	(**450**-456)	(**323**-320)	(96)	(118)
I will definitely not choose physics AS/A-level	26	34	28	47
I have thought about choosing physics AS/A-level, but have decided not to do it	14	20	10	19
I am thinking about choosing physics AS/A-level, I might do it	31	20	31	16
I will definitely do physics AS/A-level	6	20	9	13
I don't know / I haven't thought about it yet	23	5	21	5
Total	**100**	**99***	**99**	**100**

Caution - small base

One of the Key Performance Indicators (KPIs) for the SPN is the measurement of the increase in Year 11 students in Partner schools saying they are likely or very likely to choose physics A-level.

KPI: Strand 2 'Reinvigorating the School Ethos'

Increase in Year 11 pupils (in targeted schools) expressing the view that they are likely or very likely to choose physics A-level

Baseline: P% of pupils = 36% (of those who had not ruled out education after GCSEs)

Success factor: Proportional increase of a quarter on the baseline figure.
(P' = 1.25 x P %) = 45%

Achieved at Wave 2:
P% of pupils = 40% (of those who had not ruled out education after GCSEs)

Looking at the Year 11 results in Wave 2 in more detail, we can see that girls are far more likely to rule out taking physics absolutely (47%) compared to boys (22%). Figure 38 below reveals that a higher proportion of male Year 11 students definitely intend to take physics at A-level compared with female students (25% males compared with 16% females in partner schools, and 22% males compared with 5% females in control schools). Overall, 27% of female students in partner schools said that they would definitely do, or might do physics post-GCSE, compared to 53% of boys. In Wave 2, a higher proportion of both genders were considering taking physics AS/A level than in Wave 1, and conversely a lower proportion of both genders were definite about taking physics than in Wave 1.

Figure 38: Students' Views of the Likelihood of taking AS/A-Level Physics (by Gender) – Wave 1 and Wave 2

Base: Y11 students who had not ruled out staying in education GCSEs

WAVE 1	Partner		Control#	
	Male (**73-**50) %	**Female** (**84-**113) %	**Male** (5) %	**Female** (6) %
I will definitely not choose physics AS/A-level	33	52	20	17
I have thought about choosing physics AS/A-level, but have decided not to do it	22	15	20	0
I am thinking about choosing physics AS/A-level, I might do it	1	6	20	33
I will definitely do physics AS/A-level	42	24	40	17
I don't know / I haven't thought about it yet	1	2	0	33
Total	99*	99*	100	100
WAVE 2	(**170-**117) %	(**154-**203) %	(55) %	(63) %
I will definitely not choose physics AS/A-level	22	47	35	59
I have thought about choosing physics AS/A-level, but have decided not to do it	17	23	16	21
I am thinking about choosing physics AS/A-level, I might do it	28	11	18	14
I will definitely do physics AS/A-level	25	16	22	5
I don't know / I haven't thought about it yet	8	3	9	2
Total	**100**	**100**	**100**	**101***

Caution - small bases
* % varies from 100% because of rounding

A Key Performance Indicator (KPI) for the SPN is the measurement of the increase in Year 11 female students in partner schools saying they are likely or very likely to choose physics A-level. Specifically:

KPI: Strand 2 'Reinvigorating the School Ethos'

Increase in proportion of Year 11 girls (in targeted schools) expressing the view that they are likely or very likely to choose physics A-level. (Weighting applied)

Baseline: G% of P are girls = 43%

Success factor: 5 percentage point increase in the proportion of girls progressing (G+5)% of P' are girls = 48%

Achieved at Wave 2:
G% of P are girls = 31%

Unfortunately, the proportion of girls as a proportion of all students stating that they would be likely to take physics has decreased. This is mainly because of the large increase in boys stating that they are likely to take physics while girls' views across the 2 waves stayed static.

Figure 39: Factors influencing Students' Decisions to study Physics AS/A-Level – Wave 2

Base: Students thinking about studying/decided to study physics A-level (**Weighted**-Unweighted)

	Partner		Control	
	Y10 (**167**-159) %	**Y11** (**131**-116) %	**Y10** (39) %	**Y11** (34) %
Enjoyment of physics	63	67	54	71
Getting good GCSE grades in physics	60	66	74	68
Physics opens up a range of career paths for me	49	53	67	56
I think I can get good grades in AS/A2 level physics	44	50	54	44
I can go into my chosen career with physics qualifications	31	50	41	47
A good experience of physics in school	49	47	51	50
Physics is a key requirement of the career path I've chosen	30	44	36	41
Physics is a key requirement of university course I want to do later on	27	39	36	38
Having had a good physics teacher at GCSE	44	38	41	47
The physics course has a broad and varied content	23	32	21	41
My parents want me to do physics	11	22	21	12
Physics is not too difficult	33	21	31	32
My friends choose physics	5	11	5	3
Other factors that may influence your decisions	4	7	3	12
I don't know/ not sure	0	0	0	0

* % exceeds 100% because of multiple factors influencing decisions

Young people who indicated that they had decided or were considering taking physics at AS/A2 were asked about the factors influencing their decision-making. Figure 39 above shows the results.

Between half and two thirds of students indicated that the following factors contributed to their choice to take physics A-level: enjoyment of physics (67% partner school Year 11 students; 71% control school Year 11 students); getting good GCSE grades in physics (66% of partner school Year 11 students; 68% of control school Year 11 students); a range of career paths (53% of partner school Year 11 students and 56% of control school Year 11 students); getting good grades in AS/A2 physics (50% of partner school Year 11 students and 44% of control school Year 11 students); and having a good experience in school (47% of partner school Year 11 students and 50% of control school Year 11 students).

Students who had definitely decided not to study physics A-level were asked about the influencing factors on their decision. Figure 40 below provides the detail. High proportions of partner school Year 11 students (who stated that they definitely were not going to continue studying physics post-16) indicated the following contributory factors in their decision: Difficulty of physics (66%); Lack of enjoyment (64%) and interest (60%) in the subject; not getting good enough grades to progress (41%); it not being relevant to them (49%) or their future career (58%), or required for entry to their HE course (37%).

Figure 40: Factors influencing Students' Decisions not to study Physics AS/A-Level – Wave 2

Base: Students who have definitely decided not to study physics A-level (**Weighted**-Unweighted)

	Partner		Control	
	Y10 (**117**-132) %	**Y11** (**110**-122) %	**Y10** (27) %	**Y11** (56) %
Physics is difficult	61	66	70	71
I don't enjoy it	61	64	78	71
Physics is boring	68	60	81	71
I don't need physics for my future career	60	58	63	63
The subject isn't relevant to me	48	49	74	63
I don't think I'll get good enough grades to progress	46	41	22	38
I don't need physics to get into my preferred University course	34	37	33	43
The subject isn't taught well	20	28	37	39
I'm predicted higher grades in other subjects	16	27	30	34
Don't know what I would do with physics in a career or job	40	24	52	27
I don't like the physics teacher	17	24	33	30
My friends aren't going to study physics	4	6	15	5
Physics is for boys	4	4	7	7
Physics is for girls	4	2	4	0
Other reasons	4	2	11	2

* % exceeds 100% because of multiple factors influencing decisions

There are differences between the factors that the girls in partner schools have stated have influenced their decision definitely not to do physics and those stated by boys. A much higher proportion of girls (73%) cited the difficulty of physics compared to boys (43%) as a factor in not continuing with physics. Related to this is the belief about getting the grades to progress with over half of girls (52%) stating that they won't get the grades compared to only one quarter of the boys (27%) who decided not to do physics.

Girls who have decided not to carry on with physics were more likely to state that not being taught well in physics is a contributory factor in their decision (28%) compared to boys in that category (18%).

All of the factors already alluded to may explain the fact that 69% of girls who state that they are definitely not carrying on with physics said that they don't enjoy the subject, compared to only 49% of boys in the same category. This is a lower proportion for both girls and boys in this category than for Wave 1 (80% of girls in Wave 1 and 62% of boys).

A further group of students were asked an open-ended question about their decision not to continue their study of physics – those who had considered physics but had then decided against it as an AS/A2 subject.

Figure 41: Factors influencing Students who considered Physics AS/A-Level but who decided not to – Wave 2

Base: Students who thought about studying physics A-level but decided not to (**Weighted**-Unweighted)

	Partner		Control	
	Y10 (**466**-471) %	Y11 (**331**-326) %	Y10 (98) %	Y11 (124) %
Another subject(s) appeal to me more	2	6	1	3
It's not relevant to my future career	4	5	3	9
I don't think I'm good enough at it	1	2	0	2
I don't enjoy it/ find it interesting	3	2		
I don't know enough about how it could help me in the future	–	–	0	1
I dislike/have little confidence in the teacher(s)	0	0	0	1
I don't know	2	2	4	2
Something else	–	1	2	1
Not answered	87	81	90	82
Total	**99***	**99***	**100**	**101***

*Total deviates from 100% due to rounding

In Wave 2, a large majority of respondents did not answer why they had decided not to study physics A level. Factors influencing the choice of students who had *considered* Physics AS/A-level but had decided not to do it were similar to factors cited by those who had decided categorically not to continue with physics.

6.2 Teachers' and School Leaders' Views on Physics A-Level Uptake

Teachers, subject leaders and school leaders were asked to express their opinion on the degree to which a range of recognised barriers to the delivery of exciting and engaging physics lessons (which encourage A-level take-up) might currently exist in their own school.

There was agreement from teachers, subject leaders and school leaders in control and partner schools that a lack of specialist physics teachers and lack of science technicians may be barriers to delivering engaging and exciting lessons. The data is presented in Figure 42 below. Most notable was the high degree of agreement about the barrier presented by the emphasis of teaching GCSE curriculum to ensure good results; and the barrier presented by students' perception of physics as a difficult subject.

There was a high level of disagreement with statements relating to the curriculum: that careers information is integrated into the curriculum; that the KS4 physics curriculum prepares students adequately for A level physics; and that the physics curriculum enables the delivery of innovative and exciting physics lessons.

It is worth highlighting that a higher proportion of teachers from partner schools agreed that there was a good level of subject-specific CPD provided for physics teachers than in control schools (42% partner, 18% control).

In Wave 2, a higher proportion of teachers agreed or strongly agreed with the following factors for engaging physics lessons than in Wave 1: a good level of physics-related CPD (42% Wave 2, 31% Wave 1); teachers know where/how to obtain physics-related careers information (49% Wave 2, 27% Wave 1); sufficient inclusion of group work in classes (50% Wave 2, 39% Wave 1); and examples or explanations of physics topics relevant to current social issues (44% Wave 2, 34% Wave 1).

Of interest to the evaluators also are the levels of responses in the no opinion response category, for example regarding explanations of physics topics that are relevant to current social issues or whether the curriculum enables innovative physics lessons.

Figure 42: Issues that may have an impact on delivering engaging Physics Lessons – Wave 2

Base: Teachers, subject leaders and school leaders - Partner (93); Control (38)

%		Strongly disagree	Disagree	No opinion	Agree	Strongly agree	D/K
a) Teachers lack knowledge about how/where to obtain physics teaching resources	P	9	42	23	23	2	2
	C	11	39	26	21	3	0
b) Teachers lack knowledge about how to use physics teaching resources	P	5	43	17	29	3	2
	C	13	45	11	26	5	0
c) There is a low availability of science technicians for physics lessons	P	13	32	14	26	11	4
	C	8	34	13	32	13	0
d) There is a lack of specialist physics teachers in the science department	P	17	25	13	30	14	1
	C	21	26	5	34	13	0
e) There is a good level of subject-specific CPD provided for physics teachers	P	0	29	26	39	3	3
	C	11	45	26	18	0	0
f) The department has a high staff turnover of physics teachers (specialist and non-specialist)	P	24	48	17	5	2	3
	C	16	47	24	8	5	0
g) There is adequate planning time for physics lessons	P	5	30	28	34	2	0
	C	13	37	29	21	0	0
h) An emphasis on teaching to produce good GCSE results inhibits innovation in teaching methods	P	1	20	17	41	19	1
	C	5	13	18	50	13	0
i) There is insufficient time for experiments/practicals in the physics classroom	P	3	42	13	34	8	0
	C	3	39	13	32	11	3
j) Teachers know where/how to obtain physics-related careers information	P	1	23	25	48	1	2
	C	3	21	24	47	3	3
k) Information about career options using physics qualifications is integrated into the curriculum	P	9	45	19	20	1	5
	C	3	55	18	21	0	3
l) The KS4 physics curriculum prepares students adequately for the level of knowledge and practical skills required to study A-level physics	P	8	31	12	35	3	11
	C	11	37	18	26	0	8
m) The physics curriculum enables the delivery of innovative and exciting physics lessons	P	5	35	33	20	3	2
	C	0	37	26	32	3	3
n) There is sufficient inclusion of group work in classes	P	0	18	28	45	5	3
	C	0	13	34	47	3	3
o) Examples/explanations of physics topics are relevant to current social issues	P	1	23	31	41	3	1
	C	3	13	26	47	8	3
p) Non-specialists tend to teach younger students (Yr 7-9)	P	3	13	12	49	22	1
	C	3	13	8	47	26	3
q) Students perceive physics to be difficult	P	1	9	1	52	38	0
	C	0	13	11	47	26	3

Teachers and school leaders were also asked for their opinion (multiple choice) on the actions that might be applied to increase take-up of physics at A-level (see Figure 43 below).

Figure 43: Actions that could increase Take-up of Physics A-Level – Wave 2
Base: Teachers, subject leaders and school leaders

	Teachers, subject leaders and school leaders	
	Partner (93) %	Control (38) %
Provide more physics-based Enrichment and Enhancement (E&E) activities in schools	67	76
More teachers with a background and expertise in physics and physics teaching	55	58
Increased mentoring and access to physics role models	48	29
Increase the amount of physics careers education in the physics classroom	47	42
Improved teaching methods	43	32
More time dedicated to subject-based CPD for non-specialist teachers	42	45
Change teaching methods for girls	40	24
Increase the amount of physics careers education in the wider curriculum (e.g. in PSHE)	38	29
Increase usage of physics careers-related resources in the classroom	34	37
Increased interaction between physics teachers in different schools	30	37
Greater engagement in physics of senior managers/school leaders	15	24
Change teaching methods for boys	14	8
None of these	2	5
Something else	12	18

% exceeds 100% because of multiple actions suggested

The results echo many of those found in earlier responses and in Wave 1, with teachers, subject leaders and school leaders stating that more E&E, physics-based CPD for non-specialist teachers, and more specialist teachers could increase take-up. More than two fifths (43%) of teachers and school leaders in partner schools felt that improved teaching methods would have a beneficial effect, and almost half (48%) thought that an increase in mentoring and access to role models would have a positive impact. Of note is that a higher proportion of respondents in partner schools thought that teaching methods should change for girls (40% partner, compared with 24% control). This implies that in schools receiving SPN intensive support awareness has been raised of the need to cater for girls in physics.

Feedback from the teacher consultations about barriers to progression to physics A-level was broadly consistent with the results from the teacher survey. Barriers mentioned included: physics being seen as difficult; a lack of physics specialists (both teachers and technicians); non-physics specialist teachers teaching physics lower down the school resulting in a lack of enthusiasm for the subject being communicated early in students' school career; and lack of dedicated time for physics affecting the time available for practicals. Teachers also mentioned a lack of resources, and new equipment; issues with the mathematical content of physics; and a lack of information about physics-related careers.

> *"I …find that however good they are at maths, they don't transfer those maths skills and most of the time I find I'm teaching maths to them rather than physics. They can do 'y=mx+c' in maths but as soon as the y and the x become currents and voltages they forget everything they know and see it as something completely different. Although they have studied these things in earlier years, by the time they arrive with*

us they make mistakes in calculating percentages that they could do in a maths context easily. So we have to spend quite a lot of time on those things."
Head of Physics, 11-19 Mixed Comprehensive School

Some teachers mentioned that the GCSE syllabus was an issue, it was not perceived as very exciting, while others felt there was a gap in content between GCSE and A-level physics. Some schools had recently introduced Triple Award Science, and teachers were hoping that this would reduce the content gap between GCSE and A-level.

In a number of schools, the uptake of students at physics A-level was limited by school policy – only taking students from the GCSE top sets, or those with A or B in physics at GCSE. These policies can serve to confirm students' belief that physics is a more difficult subject if other subjects are not subject to the same conditions.

"Physics is quite elitist as a subject really. Usually we require Bs in maths and physics."
Head of Physics, 11-19 Mixed Comprehensive School

Teachers reported more boys than girls taking A-level physics, ratios of 1 in 3 or 1 in 4 girls to boys were mentioned – in some cases, there were even fewer or no girls. Physics is seen as a 'male' subject. Examples in text books are often more masculine (e.g. cars, rockets). One female teacher (in a girls' school) had changed all the examples to be more accessible to girls – such as the forces when putting on mascara or nail varnish, and motion demonstrated by meerkats. Another teacher noted the importance of continuing to work on encouraging girls to take physics. The school had been involved in a WISE project, and more girls started to progress into physics, but later, the numbers fell back again.

"If you are a girl and you only have male teachers teaching physics then you only get it from a male experience point of view and I'm sure that is off-putting. You really need a good female role model."
Head of Science, 11-18 Mixed Comprehensive School

The qualitative findings of female role models and gender-specific examples seem to be stronger than those of the quantitative results. However, the much higher prevalence of girls thinking that physics is difficult and not enjoying the subject may be linked to these gender-related factors.

6.3 Factors Influencing Retention at AS/A2-Level Physics

A finding from the qualitative study that was not strong from the baseline quantitative surveys was the perception that there is a retention problem between AS and A2 levels. Several teachers mentioned this as an issue during the consultations. Teachers perceived there to be a 'gap' between GCSE and A-level in terms of knowledge and difficulty that caused retention issues.

"There has been a massive jump up from GCSE to A-level in terms of course content. As a consequence, while uptake of AS has been fairly good, retention to A2 has been poor - with about half the class dropping out."
Head of Physics, 11-18 Mixed Comprehensive school

"When we have the first AS exams in January, that first term is very stressful for the students and me, and the enjoyment of physics is lost. That needs to be looked at so we are creating young physicists who want to continue, rather than becoming disillusioned, when they don't do as well as they expected in the January exams.

There are some major issues with the AS that need to be addressed. 21st Century science has the best feed in to AS that's available, but there is not a good match between the two."
Head of Physics, 11-18 Mixed Comprehensive School

Teachers hoped that recent changes to the GCSE curriculum may help to improve retention at AS level and beyond.

One 11-16 year old comprehensive school was tracking the retention of students at physics A-level after they left the school. While the numbers of students taking AS-level physics had risen due to a concerted effort by the school to improve uptake, retention at AS-level in the colleges to which students moved on, was poor. Anecdotal feedback from students the teacher spoke to was that the different culture between school and college was having an effect on retention. They said there was a lot of handholding at GCSE, but at college, they were expected to learn from text books and felt thrown in at the deep end. A further issue is the propensity for some schools to encourage students to take 4 or 5 subjects at AS level to increase UCAS points, with the expectation that some students will drop certain subjects after the AS results.

Based on the findings from the qualitative research, the Wave 2 survey included additional questions relating to retention of students between physics AS and A2.

Figure 44: Proportion of Students retained between Physics AS and A2 – Wave 2
Base: Teachers, subject leaders and school leaders

WAVE 2	**Partner** (93) %	**Control** (38) %
None	8	5
1-9%	3	8
10-19%	4	0
20-29%	1	0
40-49%	2	3
50-59%	8	3
60-69%	19	13
70-79%	8	21
80-89%	5	5
90%	6	3
Not stated	35	39
Total	**99***	**100**
Mean	**50.4**	**54.0**

As Figure 44 shows, teacher, subject leader and school leader respondents estimate on average around half of students taking AS physics continue to A2.

Figure 45: Reasons why some Students do not continue to A2 Physics – Wave 2
Base: Teachers, subject leaders and school leaders

WAVE 2	Partner (93) %	Control (38) %
Find physics difficult	9	16
Prefer other subject(s) for university or career	4	3
Underperformance at AS level	15	13
School/ I do not teach Physics A level	5	3
Lack of maths skills needed for physics	9	8
Need more time to cover Physics course content	1	3
Difference between GCSE or AS and A level physics too large	3	3
Not a problem at the school	9	3
Don't know or other	3	3
No answer	1	47
Total	**100**	**100**

The reasons given by teacher respondents as to why students do not continue to A2 physics echo those given throughout this report. Physics being difficult and underperformance at AS level were cited by between one in ten and one in six teachers (see Figure 45).

Summary

- Around half of students indicated that factors relating to good teaching/teaching methods (including more inspiring practicals and making the subject more fun); getting good grades and career-related information would encourage them to take physics at AS/A-level. Of interest, for both Waves, very few or no students stated that they would be encouraged to keep studying physics if it led to a well-paid job.
- Over a third (38%) of students from partner schools said that they might or would definitely do physics, compared with 34% of students from control schools. Less than a third (29%) of students from partner schools said they would definitely not choose to study physics post-GCSE, compared with four in ten (39%) of those from control schools. 16% of students at partner and 15% of control school students had considered physics post-GCSE and decided against. Girls are far more likely to rule out taking physics absolutely (47% Year 11 girls) compared to boys (22% Year 11 boys).
- In Wave 2, 40% of Y11 students staying in education beyond GCSE are considering studying A level physics, compared with 36% in Wave 1. The target was 45%.
- The top reasons for taking physics A-level were: getting good GCSE and AS/A level grades in physics; enjoyment of physics; having a good experience in school; and range of career paths.
- The top reasons given for having decided against taking physics A-level were: difficulty of physics; lack of enjoyment of physics; lack of interest in the subject; physics not being relevant to them; and not being relevant to their future career. Each reason was mentioned by more than half of those who had ruled out studying for physics A-level.
- There was a high degree of agreement among teachers, subject leaders and school leaders that the emphasis of teaching GCSE curriculum to ensure good results was a barrier to encouraging take-up of A-level, and that students' perception of physics as a difficult subject was also a barrier. Also that a lack of specialist physics teachers and lack of science technicians may be barriers to delivering engaging and exciting lessons.
- In Wave 2, a higher proportion of teachers agreed or strongly agreed with the following factors for engaging physics lessons than in Wave 1: a good level of physics-related CPD (42% Wave 2, 31% Wave 1); teachers know where/how to obtain physics-related careers information (49% Wave 2, 27% Wave 1); sufficient inclusion of group work in classes (50% Wave 2, 39% Wave 1); and examples or explanations of physics topics relevant to current social issues (44% Wave 2, 34% Wave 1).
- Teachers' and leaders' most common suggestions for increasing take-up of physics A-level for both Waves were similar: more E&E, and more specialist teachers. In Wave 2, more than two in five teachers and leaders felt that improved teaching methods and more physics-based CPD for non-specialist teachers would have a beneficial effect. Around half thought that an increased in mentoring and access to role models, as well as more physics careers education would have a positive impact.
- Teachers estimated that only half of physics students are retained between AS and A2 physics. Reasons given included: underperformance at AS level; difficulty of the subject; and lack of mathematics skills.

Appendix 1 - Methodology

The background and objectives of the SPN and this independent evaluation are presented in Section 1.1 above.

The evaluation has two main stages: development of a baseline as close to the point of recruitment of 'partner' schools to the SPN as possible, with a 2nd wave of surveying to be undertaken in late 2010-early 2011 for comparison. Most data collection was conducted via large-scale quantitative web surveys (at baseline and follow-up) with smaller scale qualitative research to support interpretation of findings and for further exploration of issues emerging.

Due to unavoidable delays within the roll-out of the SPN programme, Babcock Research was unable to launch the web surveys until Summer term 2010 (although this baseline research had initially been planned to run throughout the Autumn/Spring terms of 2009/2010). Babcock Research launched the follow-up research (Wave 2) in December 2010, running until February 2011.

Design

A documentary review and a series of qualitative consultations with key stakeholders, undertaken in Autumn 2009, were used to inform the development of four companion questions for piloting via web-survey with the following groups:

- Year 10/11 students in 'partner' schools
- Year 10/11 students in 'control' schools
- Science teachers, subject leaders and school leaders in 'partner' schools
- Science teachers, subject leaders and school leaders in 'control' schools

These surveys were piloted with three schools in January 2010. The survey questionnaires were refined in light of feedback from the pilot and further consultation with the client. In Wave 2 some additional questions were included to reflect further feedback from the qualitative phase in Summer 2010, and after consultation with the client.

Sampling

All 'partner' schools identified by 8 April 2010 were invited to participate in the baseline research. This included schools that had either:

- already fully registered to participation in the SPN; or
- had agreed to participate and whose paperwork was being processed; or
- had confirmed that they would be participating but had not yet submitted paperwork to IOP.

This resulted in a sample of 202 identified/participating schools (with a further 74 schools still to be recruited to SPN, and thus unable to be invited to participate in the baseline surveys). Teachers, school leaders and students from 202 'partner' schools in total were invited to participate in the e-surveys. The geographic distribution of 'partner' schools was not even, but reflected the variable progress of recruitment to the SPN by early April 2009.

Regional Distribution of 'Partner' and 'Control' Schools available for Baseline Evaluation Research

	East Midlands	East of England	London	North East	North West	South East	South West	West Midlands	Yorkshire & Humber	Total
N – Partner	8	19	17	10	21	37	16	26	48	202
N - Control	15	18	22	13	26	27	17	23	17	178
% - Partner	4	9	8	5	10	18	8	13	24	100
% - Control	8	10	12	7	15	15	10	13	10	100

The sample of 'control' schools was selected using a random stratified sampling approach to broadly reflect the range and breadth of schools in England.

The researchers obtained a detailed database of all secondary schools in England (just under 3000) from the Department for Children, Schools and Families (now the Department for Education). The sample database was de-duplicated by cross-referencing with the partner sample of schools. Any duplicated (partner) schools were removed stratified by region and a random sample of 178 schools was selected.

For the follow-up research, the surveys were launched to 270 partner schools that had registered to participate in the SPN, and to 172 control schools.

Regional Distribution of 'Partner' and 'Control' Schools available for Follow-up Evaluation Research

	East Midlands	East of England	London	North East	North West	South East	South West	West Midlands	Yorkshire & Humber	Total
N – Partner	24	25	37	12	30	38	34	34	36	270
N - Control	14	18	22	13	26	26	16	22	15	172
% - Partner	9	9	14	4	11	14	13	13	13	100
% - Control	8	10	13	8	15	15	9	13	10	100

Baseline Web Survey Fieldwork

All web surveys were launched on Monday 26 April 2010, and remained open until Friday 2 July 2010.

All schools selected were invited to submit responses to the 'teaching staff' survey from teachers of physics (specialist and non-specialist), Heads of Science, and School Leaders (i.e. Head Teachers and Deputy Head Teachers), and to the 'student' survey from students in Year 10 and 11 who were undertaking a science course that would enable them to progress to A-level physics.

An email was sent to the main contact in all schools outlining the project background, the purpose of the evaluation and the intention to invite the schools to participate. Shortly thereafter, a further email was sent to the same contacts providing them with the e-survey links and accompanying guidance notes.

The evaluation team made contact with the schools by telephone to ensure that the key contacts had received the evaluation documentation and to encourage participation in the surveys. The telephone follow-up continued until half term (for most schools 28 May - 5 June 2010). A further reminder email was issued to the main school contacts after half-term, and a targeted email was also sent directly to school leaders. These emails were, again, followed up with telephone contact. The e-survey closed on Friday 2 July 2010.

As a further incentive to schools and an additional resource for students and teachers, the evaluators designed a bespoke learning resource for participating schools. The resource was designed to be used in a classroom setting, offering students an insight into the world of social and market research by setting them a team-based market research mission. A direct web-link to the resource was provided for all participating schools.

In addition, participating control schools were entered into a free prize draw to receive one of ten prizes of physics resources/equipment for the classroom worth £200 provided by the Institute of Physics. On completion of fieldwork 10 schools were randomly selected by the evaluators to receive a prize.

Followup Web Survey Fieldwork

All web surveys were launched on Monday 6 December 2010, and remained open until Friday 18 February 2011.

All schools selected were invited to submit responses to the ‘teaching staff’ survey from teachers of physics (specialist and non-specialist), Heads of Science, and School Leaders (i.e. Head Teachers and Deputy Head Teachers), and to the ‘student’ survey from students in Year 10 and 11 who were undertaking a science course that would enable them to progress to A-level physics.

An email was sent to the main contact in all schools outlining the project background, the purpose of the evaluation and the e-survey links and accompanying guidance notes.

The evaluation team made contact with the schools by telephone to ensure that the key contacts had received the evaluation documentation and to encourage participation in the surveys. The telephone follow-up continued until the end of term (20 December 2010 – 5 January 2011). Further reminder emails were then sent at the start of the New Year, and at the end of January, and a targeted email was also sent directly to school leaders. These emails were, again, followed up with telephone contact. The e-survey closed on Friday 18 February 2011.

In addition, participating control schools were entered into a free prize draw to receive one of five prizes of physics resources/equipment for the classroom worth £100 provided by the Institute of Physics. On completion of fieldwork 5 schools were randomly selected by the evaluators to receive a prize.

Response Rates

The table below shows the number of schools invited to participate in each survey, the numbers of school submitting some responses (regardless of how many/few) and the rate or response by schools.

School Response Rates to Surveys

	Teacher Survey		Student Survey	
Baseline Surveys	**Partner**	**Control**	**Partner**	**Control**
Schools invited to participate	202	178	202	178
Schools responding	23	10	47	16
Percentage response rate	11%	6%	23%	9%
Follow-up Surveys				
Schools invited to participate	270	172	270	172
Schools responding	66	31	22	11
Percentage response rate	24%	18%	8%	6%

A small proportion of students who responded to the baseline and followup surveys were beyond the scope of the research (those taking only core science, therefore unable to progress to A-level physics study), and their responses were removed before analysis was conducted. Hence 106 students (68 'partner' and 38 'control') in Wave 1 and 43 students (33 'partner' and 10 'control') began to complete the survey, but were screened out before the main questions were asked.

Weighting

Due to the number of 'girls only' partner schools that participated in Waves 1 and 2, partner school student data for the baseline and follow up surveys has weighting applied to the data throughout, except where analysis is conducted to compare students by gender. The weighting applied is based on the proportion of 11 to 15 year olds in English state-funded secondary schools taken from School census data in January 2010 (Table 1A). The proportion of males in this population is 50.7% compared with 49.3% females. Therefore the weightings applied for males in partner schools in Wave 1 is: 1.4921259; and for females is: 0.7469635 and in Wave 2 is: 1.458483755 for males and 0.75576923 for females.

Qualitative Evaluation

To explore the quantitative results further and to add value to the survey data and further insights from schools involved in the Stimulating Physics Network, the researchers undertook qualitative research in the summer term 2010.

Consultations were undertaken with teachers and subject leaders, face to face and by telephone. The face to face consultations took place during visits to six schools receiving intensive support from the Stimulating Physics Network. The telephone consultations were undertaken with teachers from schools receiving either intensive or global support from the Network who indicated in the quantitative survey that they were willing to take part in further research. In total, 41 teachers, subject leaders and school leaders were consulted throughout the qualitative evaluation.

Discussion groups with students were also conducted during the school visits. 170 students from across Years 9 to 13 were involved in the consultation.