Monitoring practical science in schools and colleges

Appendix 2: Sample Definition

Durham University

Prepared for the Gatsby Charitable Foundation and the Wellcome Trust

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1 Contents

2 Introduction

Appendix 2: Sample definition is a technical appendix providing: detailed information on the inclusion criteria for each sample; details of investigations into handling multiple responses within an institution; representativeness and weighting of the data; and tables detailing the composition of the samples after cleaning of the data. Details of the instruments used for data collection in this study are provided in Appendix 1: Research Method.

3 School staff survey sample

3.1 Inclusion criteria for institutions responding to the School staff survey

Institutions

- The institution was identifiable on Get Information About Schools (GIAS, formerly known as EduBase) (GOV.UK, 2018). If the institution was not identifiable on GIAS then it was excluded from the analyses.

Country

- Only institutions in England and Scotland are included in the analysis.
- Respondents indicating 'Other' or 'Not specified' (or Wales or NI in year 1) are excluded from all analyses.

School type

- Only respondents that have given the response Academy/Free, LA/State-funded or Independent are included the analyses. Academy/Free, and LA/State-funded have been combined into a single 'State school' value.
- Respondents that gave the answer 'Other' or 'Funding not specified' are excluded from all analyses.
- Only state school data are included for Scotland as there are only a few independent schools so there is not a large enough sample to preserve anonymity of respondents.

Institution age range

- Respondents who indicated their school age range had a highest leaving age of less than 14 have been excluded from all analyses.

Subject

- Only respondents (science teachers and heads of science) who were teaching a class studying biology, chemistry or physics at ages 11 – 14, 14 – 16 or post-16 and 'science' at age 11 – 14 have been included in the analyses.
- Responses stating 'Other' or 'Not specified' science subject have been excluded from all analyses within that age range (i.e. if they are teaching biology, chemistry or physics in a different age range in addition to the age range where they stated 'Other' or 'Not Specified' then their responses to the general questions about the school and questions about themselves remain in the analyses)

Teaching age ranges

14 – 16

- In England, the main analysis is for staff teaching GCSE (including IGCSE) in England. Responses for all other qualifications have been excluded.

Post-16

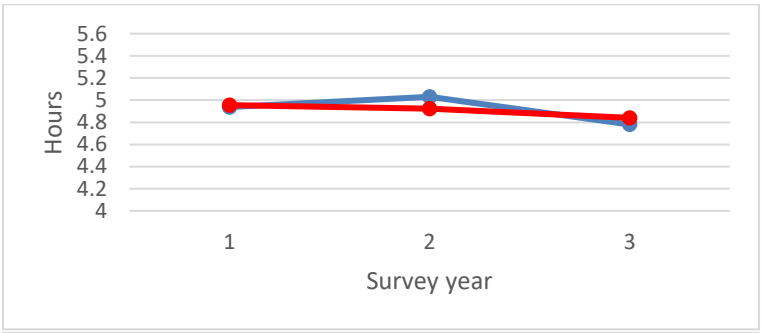
- In England, the main analysis is for staff teaching A level or AS level in England. Responses for all other qualifications have been excluded from the analyses.

Further Education colleges

This section is concerned with assessing if the inclusion of data from Further Education (FE) colleges in the main state school sample (rather than treating them as a separate school type) will skew the results of the analysis. To assess this, a comparison of means analysis is undertaken across the three survey years between state schools and FE colleges in England. Hedges' g effect size calculations are utilised to compare means when there is a substantial difference in the size of the two samples. The sample size difference between the FE college sample and the state school sample presented as large enough for this to be an appropriate measure. It is also slightly preferred to Cohen's d measurement for small samples, as is the case in these calculations, particularly with the FE sample means[1]. The closer the statistic is to 0, the smaller the effect size between the means.

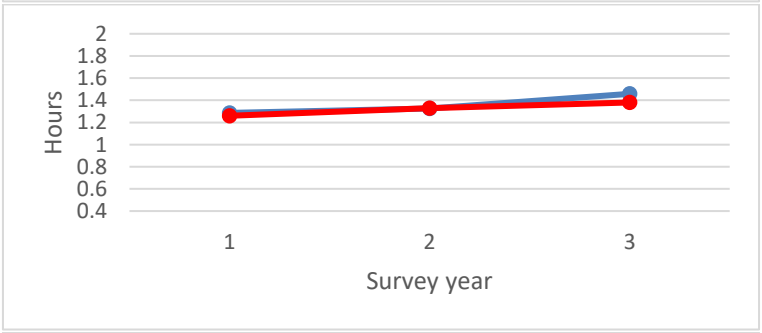
Figure 1. a) Science lesson time per week, b) time spent on practical work in science lessons per week, c) proportion of science lesson time spent on practical work per week.

a



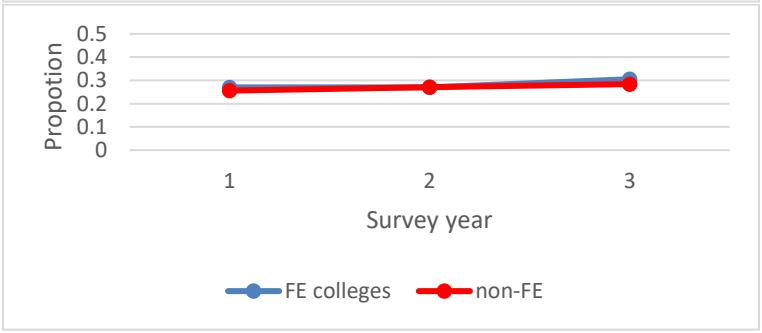
Hedge's g measurements:
Year 1=.011
Year 2=.061
Year 3=.090

b



Hedge's g measurements:
Year 1=.035
Year 2=.006
Year 3=.063

c



Hedges' g measurements:
Year 1=0.10
Year 2=.007
Year 3=.087

Without exception, Hedges' g calculations for total science hours, practical work hours, and proportion of practical work hours are below 0.12 (see Figure 1). The calculations for these three variables are principle components of this report. With effect sizes this small, the decision has been made that the responses from FE colleges remain in the main state school sample for analysis and are not treated as a separate school type.

[1] For explanation and analysis of Hedges' g effect size calculations see Hedges and Olkin (1985).

Missing responses

Respondents have not been excluded from the data set if they have not given a response to questions other than those stated above. If the analysis required data to be broken down by that measure, their response is missing from that particular finding, but is included when analysed by other measures, for which they provided responses.

3.2 Longitudinal vs cross-sectional sample

Due to anonymous nature of the survey, there is the possibility that responses from the same institution over the three years of the study are from different members of staff within the institution. The purpose of this section is to assess the intra-school variability between responses from multiple members of staff within an institution (in a single year). The analysis hypothesises that members of staff within the same school should give similar responses to fact based questions about their institution (e.g. number of students in the school, number of science prep rooms etc.) and that if a large variation in responses is observed within a year, then it should be assumed that there will also be large variations in responses from a single institution year-on-year. If this is the case, then restricting the sample to only schools that have responded in all three years (i.e. a longitudinal sample) is not the most appropriate sample to choose, and a cross-sectional sample (using responses from all institutions in each year) is more suitable.

To investigate this variation, mean standard error measurements were calculated between the response values from factual questions for each institution that had multiple responses in any of the three survey years. The hypothesis from which this analysis proceeds is that responses from each year and each school should have equivalent response values to factual questions. As seen in Table 1, this hypothesis is not unfounded, as respondents for independent schools answering the question about the number of prep rooms showed zero variance in response between respondents from the same school, in the same year.

Table 1 shows the total instances of schools that have multiple responses in any of the three years and the mean standard error measurements of that variability. Standard error measurements are used for both consistency and ease of readership. The use of variance statistics was considered but foregone for these two considerations. However, in general, variance statistics present even higher values than the measures for standard error.

For a quick and simple example of how these measures were calculated, let us take the variable for number of students. Actual values from four schools in the sample are included in this example:

School one: 450, 500, 550, 650, 1150 – mean = 660, standard error = 126.89
School two: 1200, 800, 1000 – mean = 1000, standard error = 115.47
School three: 950, 2000, 2500 – mean = 1816.67, standard error = 456.74

Therefore, the mean of the standard errors for these three schools is 233.03, for a mean error range of 466.06. In addition to the examples of these three schools, all of which had more than two responses from the same school in the same year, there were more schools that only had two values. Examples of the values from these schools include, 1200/2000, 800/1000, and 1000/1500, amongst many other larger and smaller discrepancies, all adding to the mean standard error measurements.

Table 1. Mean standard error values for a range of survey responses for state and independent schools in England.

England		Number of schools with multiple responses per school in any survey year (Y1/Y2/Y3=Total)	Mean std. error range (95% CI)
State	Budget	0 / 5 / 2 = 7	£2,121.4
	# of FTE technicians	2 / 7 / 4 = 13	0.18
	# of students	8 / 31 / 42 = 81	432.4
	# FTE science teachers	1 / 8 / 4 = 13	0.71
	# of prep rooms	3 / 0 / 13 = 16	0.58
Independent	Budget	2 / 2 / 0 = 4	£4,375
	# of FTE technicians	2 / 2 / 2 = 6	0.22
	# of students	3 / 10 / 25 = 38	80.6
	# FTE science teachers	2 /2 / 2 = 6	0.50
	# of prep rooms	0 / 0 / 13 = 13	0.00

The factual question with the highest response rate was the question that asked about the number of students in the school. This question produced high standard error values, particularly for state schools. The standard error being 216 students, the standard error range for state school respondents is an average of 432 for both sides of the mean. For a question with a high level of responses, this is quite a high variability within responses from the same school, from the same year. Therefore, the validity and efficacy of using the longitudinal sample, as was previously proposed, might need to be re-considered.

The outcome of this analysis is that there was a high variation between responses within some institutions and as such, the validity and efficacy of using the longitudinal sample is not valid. Therefore, a cross-sectional sample using data from all institutions that responded to the survey in each of the three years is used for the analysis.

When handling responses to factual questions, if multiple responses have been provided by an institution, the response from the head of science has been taken as the definitive response. If there are responses from multiple heads of science, or no head of science (only multiple responses from teachers and technicians), the variation in responses has been analysed for that question. In cases where there is only a small variation in responses, a response has been selected at random to represent the institution. Where there is a large variation, the response for that institution has been excluded for that question. For questions where the data is in conflict and the data may exist in an alternative location (e.g. Edubase), a definitive response has been sourced from this location.

Where the data from the survey relate to an opinion based question (e.g. impact of factors on choice of practical work), all responses from staff within the institution have been analysed. The expectation is that these responses will vary as staff will be teaching groups comprising of different students (e.g. one teaching top set, one bottom set, one teaching post-16s, the other 14 – 16 year old students and 11 – 14 year old students; one teaching chemistry, the other biology; teaching on two different sites, etc).

3.3 Institutions responding to the school staff survey

Table 2 shows the number of complete responses returned from individual schools and colleges in England and Scotland in each of the three years of the study. Heads of science and science teachers were surveyed in all three years of the study. Science technicians were only asked to respond to the survey in years 1 and 3.

Table 3 shows institutions broken down by school size and nation, whilst Table 4 shows institutions broken down by school/college age range, school type and nation. The analysis of the representativeness of the sample is discussed in Section 3.5.

Table 2. Institutions responding to the school staff survey by school type and nation in each of the three years of the study.

Nation	School type	Year 1	Year 2	Year 3
England	State schools	425	212	912
	Independent schools	163	121	218
Total		**588**	**333**	**1130**
Scotland	State schools	34	44	69
	Independent schools	9	0	0
Total		**43**	**44**	**69**
Grand total		**631**	**377**	**1199**

Table 3. Institutions responding to the school staff survey by school size and nation in each of the three years of the study.

		School/College size					
Nation	**School/ College type**	**Not stated**	**0-300**	**301 - 600**	**601 - 900**	**901 - 1500**	**>1500**
England	State schools (Y1)	39	5	40	81	173	54
	State schools (Y2)	44	4	15	34	93	27
	State schools (Y3)	131	26	72	185	401	97
	Independent schools (Y1)	5	24	55	40	37	2
	Independent schools (Y2)	3	18	44	32	22	2
	Independent schools (Y3)	9	20	74	59	52	4
Total (Y1)		**44**	**29**	**95**	**121**	**210**	**56**
Total (Y2)		**47**	**22**	**59**	**66**	**115**	**29**
Total (Y3)		**140**	**46**	**146**	**244**	**453**	**101**
Scotland	State schools (Y1)	34	0	0	0	0	0
	State schools (Y2)	44	0	0	0	0	0
	State schools (Y3)	69	0	0	0	0	0
Total (Y1)		**34**	**0**	**0**	**0**	**0**	**0**
Total (Y2)		**44**	**0**	**0**	**0**	**0**	**0**
Total (Y3)		**69**	**0**	**0**	**0**	**0**	**0**
Grand total (Y1)		**78**	**29**	**95**	**121**	**210**	**56**
Grand total (Y2)		**91**	**22**	**59**	**66**	**115**	**29**
Grand total (Y3)		**231**	**46**	**146**	**244**	**453**	**101**

*Table 4a. Distribution of responding institutions by nation, age range and school type in year 1 of the study. E denotes England, S denotes Scotland. *"Other age range" was an option available for respondents to choose in the questionnaire. Examples of this option included 2 – 19, 3 – 16, 13 – 18 age ranges.*

Institution age range	State schools		Independent schools		Total
	E	S	E	S	
11 - 16 Secondary	101	4	7	0	**112**
11 - 19 Secondary	246	28	68	0	**342**
16 - 19 Secondary	22	1	5	0	**28**
5 -19 Primary and Secondary	4	1	55	8	**68**
FE College	31	0	5	0	**36**
Other age range*	18	1	23	1	**43**
Age range not specified	3	0	0	0	**3**
Total	**425**	**35**	**163**	**9**	**632**

*Table 4b. Distribution of responding institutions by nation, age range and school type in year 2 of the study. E denotes England, S denotes Scotland. *"Other age range" was an option available for respondents to choose in the questionnaire. Examples of this option included 2 – 19, 3 – 16, 13 – 18 age ranges.*

Institution age range	State schools		Independent schools		Total
	E	S	E	S	
11 - 16 Secondary	17	0	4	0	**21**
11 - 19 Secondary	3	4	37	0	**44**
16 - 19 Secondary	40	2	4	0	**46**
5 -19 Primary and Secondary	118	37	52	0	**207**
FE College	20	0	3	0	**23**
Other age range*	15	1	20	0	**36**
Age range not specified	0	0	1	0	**1**
Total	**213**	**44**	**121**	**0**	**378**

*Table 4c. Distribution of responding institutions by nation, age range and school type in year 3 of the study. E denotes England, S denotes Scotland. *"Other age range" was an option available for respondents to choose in the questionnaire. Examples of this option included 2 – 19, 3 – 16, 13 – 18 age ranges.*

Institution age range	State schools		Independent schools		Total
	E	S	E	S	
11 - 16 Secondary	250	9	7	0	**266**
11 - 19 Secondary	504	50	99	0	**653**
16 - 19 Secondary	40	1	8	0	**49**
5 -19 Primary and Secondary	23	4	70	8	**105**
FE College	56	0	5	0	**61**
Other age range*	39	5	29	1	**74**
Age range not specified	0	0	0	0	**0**
Total	**912**	**69**	**218**	**9**	**1208**

3.4 Individuals responding to the school staff survey

Table 5 provides information about individual respondents. Staff were asked to provide details of their gender, age and highest qualification in their specialist science subject (note: technicians were asked for the highest level of formal education they had completed in a science subject).

Table 6 shows a breakdown of the percentage of heads of science and science teachers reporting specialisms in each subject.

Regional distribution of individuals responding to the survey is shown in Table 7. The representativeness of the year 3 sample is discussed in Section 3.5.

Table 5. Individuals responding to the school staff survey by occupation, gender, age and qualification level in their specialist science subject*

Occupation	Gender			Age						Highest qualification in their specialist* science subject							
	M	F	Other/Not stated	21 – 29	30 – 39	40 – 49	50 – 59	60+	Not stated	Doctorate degree	Masters degree	Bachelor degree	PGCE**	Post 16	Other	No formal qualification	Not stated
Technician (Y1)	78	194	2	23	38	60	111	42	0	9	19	105	15	103	7	3	0
Technician (Y3)	280	936	8	132	167	321	473	133	0	43	124	431	62	421	17	16	0
Teacher (Y1)	84	126	4	6	16	55	62	61	0	41	30	48	93	2	0	0	0
Teacher (Y2)	146	192	9	59	101	94	80	13	0	49	63	216	N/A	12	7	0	0
Teacher (Y3)	255	323	6	110	170	160	128	22	0	85	92	371	N/A	38	6	0	0
Head of science (Y1)	137	130	1	1	11	75	91	78	0	41	42	58	125	2	0	0	0
Head of science (Y2)	121	114	0	10	49	98	67	11	0	34	44	144	N/A	10	2	0	0
Head of science (Y3)	122	125	15	13	72	101	59	5	0	23	43	171	N/A	10	4	0	0
Total (Y1)	**299**	**450**	**7**	**30**	**65**	**190**	**264**	**181**	**0**	**91**	**91**	**211**	**233**	**107**	**7**	**3**	**0**
	756			**730**						**743**							
Total (Y2)	**267**	**306**	**9**	**69**	**150**	**192**	**147**	**24**	**0**	**83**	**107**	**360**		**22**	**9**	**0**	**0**
	582			**582**						**581**							
Total (Y3)	**657**	**1384**	**29**	**255**	**409**	**582**	**660**	**160**	**0**	**151**	**259**	**973**		**469**	**27**	**16**	**0**
	2070			**2066**						**1895**							

Technicians were asked for the highest level of formal education they had completed in a science subject.PGCE was only a response option for the year 1 question to teachers and heads of science, and for technicians in both year 1 and year 3.*

*Table 6. Specialisms of Individuals responding to the school staff survey by occupation. These questions were not compulsory and so totals may not sum to the same total number of respondents stated in other questions. *Percentages denote the percentage of each occupation who are specialists in that subject area e.g. the percentage of heads of science who stated biology as a specialism.*

	Biology		Chemistry		Physics		Other		Total
	N	%*	N	%*	N	%*	N	%*	N
Heads of science (Y1)	84	32	99	38	73	28	8	3	**264**
Heads of science (Y2)	76	33	84	36	70	30	3	1	**233**
Heads of science (Y3)	85	34	84	34	76	30	5	2	**250**
Teacher (Y1)	63	30	83	39	60	28	7	3	**213**
Teacher (Y2)	130	38	125	37	75	22	11	3	**341**
Teacher (Y3)	211	36	195	33	169	29	14	2	**589**
Total (Y1)	**147**		**182**		**133**		**15**		**514**
Total (Y2)	**206**		**209**		**145**		**14**		**574**
Total (Y3)	**296**		**279**		**245**		**19**		**839**

Table 7 Individuals responding to the school staff survey by region and occupation.

	Year 1				Year 2				Year 3			
Region	**HoS**	**Teach**	**Tech**	**Total**	**HoS**	**Teach**	**Tech**	**Total**	**HoS**	**Teach**	**Tech**	**Total**
Scotland	22	13	10	45	14	36		50	16	43	42	101
England												
North East	10	16	20	46	17	23		40	21	41	46	108
East Midlands	13	13	19	45	7	11		18	15	40	100	155
North West	30	14	33	77	23	28		51	31	50	148	229
South West	33	26	29	88	24	37		61	37	70	171	278
West Midlands	32	19	27	78	26	17		43	24	40	95	159
East of England	35	30	29	94	41	45		86	26	82	170	278
South East	45	36	53	134	35	68		103	34	76	212	322
Yorkshire and the Humber	19	18	21	58	26	34		60	16	59	101	176
London	35	30	35	100	23	48		71	31	91	142	264
Total	**274**	**215**	**276**	**765**	**236**	**347**		**583**	**251**	**592**	**1227**	**2070**

3.5 Representativeness of the sample

The representativeness of the sample has been analysed for state schools and independent schools in England and state schools in Scotland. The sample has been compared to the national population on the measures listed below. The comparison is presented as tables and charts and where appropriate the differences are discussed in terms of effect sizes (Cohen's D).

For institutions in England, representativeness has been analysed for each of the three years of survey by the following measures:

- Geographical distribution
- IDACI (based on school post code)
- Academic achievement (GCSE 5A*-C) – state schools only
- Population density
- No. of students eligible for FSM (state schools only)
- School size (breakdown by state and independent)

Representativeness of the individuals responding to the survey are analysed for each of the three years of survey by the following measures:

- Subject specialism
- Gender
- Age
- Qualifications

For institutions in Scotland, representativeness has been analysed for each of the three years of survey by the following measures:

- Percentage of students eligible for FSM
- Academic achievement
- Population density
- School type

3.6 Weighting

Following the calculation of representativeness of the sample, the sample for state schools in England has been weighted by deprivation. A measure of deprivation was calculated for each respondent's school by combining the school's FSM and the IDACI value for the school's postcode. This measure was then split into 10 national deciles. Further Education Colleges do not have FSM data so this group of institutions was treated as an entirely separate group, giving 11 groups in total. Weights were then calculated and applied so that within each type of respondent's role (Head of science, Teacher or Technician) and within each year of the survey, the sample was nationally-representative in terms of the proportions falling into each of the 11 groups.

4 Higher Education staff and student surveys

4.1 Inclusion criteria for the HE staff and student surveys

Institutions

- Responses from staff or students from any institutions who have an entry requirement of below CCC at A level (or equivalent) have been excluded from all analyses.
- Responses from HE students studying at any institutions that did not also have a member of staff respond from that institution have been excluded from the analyses.

Country

- Only staff at institutions in England and Scotland are included in the analysis of the HE staff survey data.
- Respondents indicating 'Other' or 'Not specified' have been excluded from all analysis of the HE staff survey data.
- Students attending a university outside England have been excluded from the analysis of the HE student survey

Subject

- Only respondents who were teaching a class or studying laboratory courses in biology, chemistry or physics have been included in the analysis.
- "Other" or "Not specified" science subject have been excluded from all analyses.

Post-16 education

- Students who meet the following criteria will be excluded:
  - Studied for their post-16 qualifications outside England
  - Studied on a university foundation course
  - Studied in an international school/college

Other missing responses

- Respondents have not been excluded from the analyses if they have not given a response to any other questions. If data are broken down or analysed by that measure, their response is missing from that particular finding, but has been included when analysed by other measures, for which they provided responses.

4.2 Longitudinal vs cross-sectional sample

Due to anonymous nature of the survey, there is the possibility that responses in each year are from different members of staff within a department. Therefore, the purpose of this section is to assess the intra department variability between responses in a single year. This has been done in order to determine if the inter-response variability from departments in Higher Education institutions in the longitudinal sample is too high to be considered uniform.

Three factual questions were investigated to assess how consistent responses were within the same department and survey year. On the students' entry tariff the respondents were reasonably consistent. For the most part they were within one grade of each other, e.g. BBC compared to BBB, though there was one example that was over two grades different. However, two other factual questions were less consistent. On the question of whether the department took account of applicants' Extended Project Qualifications (EPQ) or CREST Award/Nuffield Research Placement experience in their entry requirements, 25% of the departments with more than one respondent gave inconsistent replies. Similarly, on the question of whether departments require a pass in a practical endorsement as part of their offer, 50% of the departments with more than one respondent gave inconsistent replies. The outcome of this analysis is that there was a high variation between responses within some departments and as such, the validity and efficacy of using a longitudinal sample is not valid. Therefore, a cross-sectional sample using data from all respondents to the survey in each of the three years is used for the analysis.

4.3 Institutions and individuals responding to the Higher Education staff survey

The number of survey responses from individuals working in biological sciences, chemistry and physics departments in institutions in England and Scotland is shown below. Participating in the survey did not include any incentive or direct benefit to the respondent.

Table 8 shows the number of responses to the Higher Education staff survey broken down by the department in which the respondent stated they taught and by nation.

Table 9 shows the number of unique departments that respondents to the Higher Education staff survey stated that they taught in. Section 4.1 provides the inclusion criteria for the sample.

Table 10 provides a breakdown of whether the department HE staff were teaching in was part of a Russell Group institution.

Table 11 provides information about individual respondents. Respondents could hold multiple roles within a department. The number of years teaching experience of the staff participating in the survey is shown in Table 12.

Table 13 provides a breakdown of respondents to the HE staff survey by average tariff score for first year undergraduates in their department. Table 14 shows a breakdown of respondents to the HE staff survey by percentage of students UK-domiciled prior to course entry for staff affiliated to a single department.

Table 8. Respondents to the Higher Education staff survey broken down by the departments in which they stated that they taught, by survey year and by nation.

Nation	Year	Biological Sciences	Chemistry	Physics	More than 1 subject	Total
England	Year 1	14	11	13	1	**39**
	Year 2	21	21	15	2	**59**
	Year 3	19	12	12	1	**44**
	Total	**54**	**44**	**40**	**4**	**142**
Scotland	Year 1	1	3	0	0	**4**
	Year 2	2	5	2	0	**9**
	Year 3	5	4	2	0	**11**
	Total	**8**	**12**	**4**	**0**	**24**
Total	**Year 1**	15	14	13	1	**43**
	Year 2	23	26	17	2	**68**
	Year 3	24	16	14	1	**55**
	Total	**62**	**56**	**44**	**4**	**166**

Table 9. Number of unique departments that respondents to the Higher Education staff survey stated that they taught in.

Nation	Year 1	Year 2	Year 3	Total no. unique institutions
England	22	28	24	34
Scotland	3	5	6	7
Total	**25**	**33**	**30**	**41**

Table 10. Respondents to the Higher Education staff survey broken down by whether the department in which they stated that they taught is based in a Russell Group institution.

		Biological Sciences	Chemistry	Physics	More than 1 subject	Total
Russell Group	Year 1	5	6	11	1	23
	Year 2	12	16	14	1	43
	Year 3	10	10	12	0	32
	Total	**27**	**32**	**37**	**2**	**98**
Other institutions	Year 1	10	8	2	0	20
	Year 2	11	10	3	1	25
	Year 3	14	6	2	1	23
	Total	**35**	**24**	**7**	**2**	**68**
All	Year 1	15	14	13	1	43
	Year 2	23	26	17	2	68
	Year 3	24	16	14	1	55
Total		**62**	**56**	**44**	**4**	**166**

Table 11. Roles of respondents to the staff survey by department. Note, some respondents reported carrying out multiple roles, hence the total sums to greater than the number of respondents.

		Biological Sciences	Chemistry	Physics	More than 1 subject	Total
First year undergraduate laboratory coordinator	Year 1	4	10	10	1	25
	Year 2	5	13	12	0	30
	Year 3	5	13	9	0	27
	Total	**14**	**36**	**31**	**1**	**82**
First year undergraduate course director	Year 1	2	0	1	0	3
	Year 2	9	4	3	0	16
	Year 3	8	3	1	0	12
	Total	**19**	**7**	**5**	**0**	**31**
Laboratory demonstrator	Year 1	9	8	6	1	24
	Year 2	9	12	10	1	32
	Year 3	9	9	6	0	24
	Total	**27**	**29**	**22**	**2**	**80**
Admission tutor	Year 1	4	1	0	0	5
	Year 2	5	0	1	0	6
	Year 3	0	1	0	0	1
	Total	**9**	**2**	**1**	**0**	**12**
Other	Year 1	3	7	0	1	11
	Year 2	9	8	4	1	22
	Year 3	7	4	3	1	15
	Total	**19**	**19**	**7**	**3**	**48**

Table 12. Individuals responding to the Higher Education staff survey by number of years teaching experience.

Years taught	Survey year	Biological Science	Chemistry	Physics	More than 1 subject	Total
1 - 5	Year 1	5	3	4	0	12
	Year 2	7	0	2	0	9
	Year 3	1	3	3	0	7
	Total	**13**	**6**	**9**	**0**	**28**
6 - 10	Year 1	3	5	2	1	11
	Year 2	7	11	6	0	24
	Year 3	11	10	5	0	26
	Total	**21**	**26**	**13**	**1**	**61**
11-15	Year 1	2	0	0	0	2
	Year 2	4	6	3	1	14
	Year 3	3	0	1	0	4
	Total	**9**	**6**	**4**	**1**	**20**
16 - 20	Year 1	1	0	2	0	3
	Year 2	2	2	1	0	5
	Year 3	4	1	1	0	6
	Total	**7**	**3**	**4**	**0**	**14**
More than 21	Year 1	4	6	5	0	15
	Year 2	3	7	5	1	16
	Year 3	5	2	4	1	12
	Total	**12**	**15**	**14**	**2**	**43**

*Table 13. Respondents to the Higher Education staff survey by average tariff score for first year undergraduates in their department, as provided by HESA, for staff teaching biological sciences, chemistry or physics. Calculation of UCAS points is based on the 2016-17 UCAS points tariff system (Note: 240 points equates to CCC at A Level, 300 points to BBB, 360 points to AAA and 420 points to A*A*A*.)*

Survey year	Average tariff score of first year undergraduates (UCAS points)	Biological Science	Chemistry	Physics	Total
Year 1	Less than 240	0	1	0	1
	240 to 300	2	1	3	6
	300 to 360	5	2	1	8
	360 to 420	3	2	1	6
	420 to 480	0	4	5	9
	Greater than 480	0	1	2	3
	Total	**10**	**11**	**12**	**33**
Year 2	Less than 240	2	2	0	4
	240 to 300	3	1	2	6
	300 to 360	7	4	1	12
	360 to 420	5	6	3	14
	420 to 480	0	6	4	10
	Greater than 480	0	2	2	4
	Total	**17**	**21**	**12**	**50**
Year 3	Less than 240	4	0	0	4
	240 to 300	5	0	1	6
	300 to 360	7	4	3	14
	360 to 420	1	4	3	8
	420 to 480	0	4	5	9
	Greater than 480	0	1	2	3
	Total	**17**	**13**	**14**	**44**
Total	**Less than 240**	**6**	**3**	**0**	**9**
	240 to 300	**10**	**2**	**6**	**18**
	300 to 360	**19**	**10**	**5**	**34**
	360 to 420	**9**	**12**	**7**	**28**
	420 to 480	**0**	**14**	**14**	**28**
	Greater than 480	**0**	**4**	**6**	**10**
	Total	**44**	**45**	**38**	**127**

Table 14. Respondents to the Higher Education staff survey by percentage of students UK-domiciled prior to course entry, as provided by HESA, for staff affiliated to a single department.

	Percentage of students UK-domiciled prior to course entry	Biological Science	Chemistry	Physics	Total
Year 1	Less than 80	1	1	5	7
	80 to 85	0	0	0	0
	85 to 90	2	3	2	7
	90 to 95	3	4	3	10
	95 to 100	4	3	2	9
	Total	**10**	**11**	**12**	**33**
Year 2	Less than 80	1	2	3	6
	80 to 85	5	3	0	8
	85 to 90	4	3	4	11
	90 to 95	4	8	4	16
	95 to 100	3	5	1	9
	Total	**17**	**21**	**12**	**50**
Year 3	Less than 80	2	1	4	7
	80 to 85	5	2	0	7
	85 to 90	2	3	5	10
	90 to 95	3	4	4	11
	95 to 100	5	3	1	9
	Total	**17**	**13**	**14**	**44**
Total	**Less than 80**	**4**	**4**	**12**	**20**
	80 to 85	**10**	**5**	**0**	**15**
	85 to 90	**8**	**9**	**11**	**28**
	90 to 95	**10**	**16**	**11**	**37**
	95 to 100	**12**	**11**	**4**	**27**
	Total	**44**	**45**	**38**	**127**

4.4 Institutions and individuals responding to the Higher Education student survey

Table 15 shows the number of students responding to the HE student survey, the number of departments is indicated in brackets. Section 4.1 provides the inclusion criteria for the sample.

Table 15. Number of students responding to the HE student survey. The number of departments is indicated in brackets. Respondents were students who remained in the sample for analysis after exclusions.

Survey year	Biological Sciences	Chemistry	Physics	Total
Year 1	26 (2)	22 (1)	69 (5)	117 (7)
Year 2	143 (12)	78 (9)	91 (7)	312 (16)
Year 3	50 (4)	46 (6)	50 (5)	146 (12)
Total	**219 (14)**	**146 (12)**	**210 (9)**	**575 (21)**

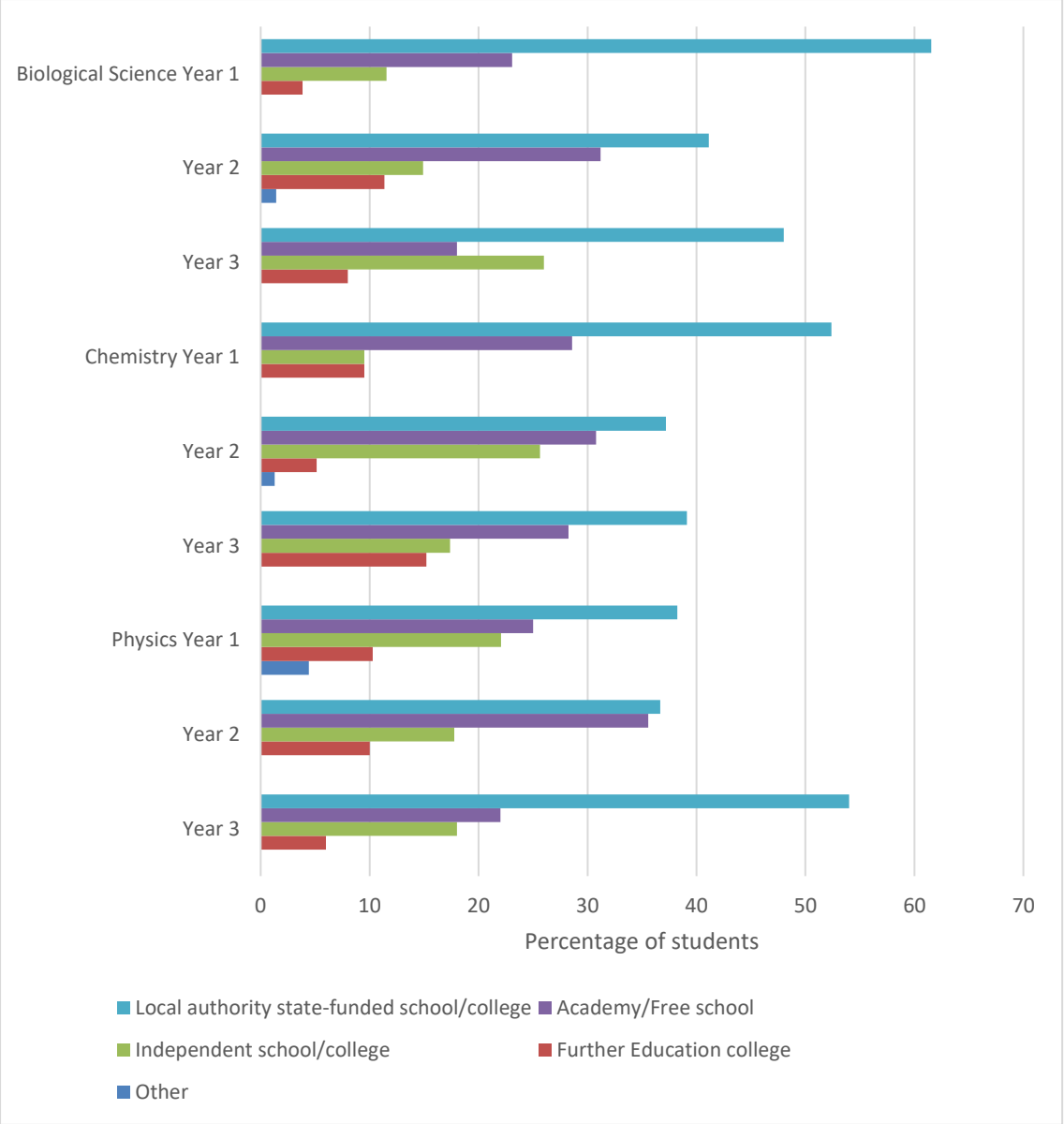
Table 16 presents the breakdown of respondents' identification of gender for the three years of the study. This gender balance follows a similar pattern to the national picture: in 2016-17, 63% of undergraduates studying biological sciences identified as Female, whereas in physical sciences (which includes chemistry, physics and other related areas), 59% of students identified as Male (HESA, 2018).

Table 16. Individuals responding to the Higher Education student survey by gender. Respondents were students who remained in the sample for analysis after exclusions.

Gender	Survey year	Biological Science	Chemistry	Physics	Total
	Year 1	11	11	48	70
	Year 2	34	41	58	133
	Year 3	12	22	30	64
Male	**Total**	**57**	**74**	**136**	**267**
	Year 1	15	10	20	45
	Year 2	107	37	31	175
	Year 3	37	24	19	80
Female	**Total**	**159**	**71**	**70**	**300**
	Year 1	0	0	0	0
	Year 2	0	0	0	0
	Year 3	0	0	1	1
Other	**Total**	**0**	**0**	**1**	**1**
	Year 1	0	1	1	2
	Year 2	2	0	2	4
	Year 3	1	0	0	1
Prefer not to say	**Total**	**3**	**1**	**3**	**7**
	Year 1	**26**	**22**	**69**	**117**
	Year 2	**143**	**78**	**91**	**312**
	Year 3	**50**	**46**	**50**	**146**
Total	**Total**	**219**	**146**	**210**	**575**

Figure 2 shows the institutions attended by respondents for their post-16 education for each of the three years of the study.

Figure 2. Institutions attended by respondents for their post-16 education. Respondents were first year undergraduate students studying biological sciences, chemistry and physics in Higher Education Institutions (N = 26, 141 and 50 for year 1, year 2 and year 3 for biological sciences, N = 21, 78 and 46 for chemistry, N = 115, 309 and 146 for physics).



5 Qualitative data

Qualitative data are used to provide additional, useful insights into the impact of changes in schools and Higher Education institutions. The qualitative data are triangulated with survey data to allow cautious generalisations to be made.

The combination of qualitative and quantitative data is not presented as full "case studies" in the main report. Instead, to help summarise qualitative data, vignettes are used, giving examples of the impact of changes within individual schools and departments within Higher Education institutions.

5.1 Composition of School focus groups and telephone interviews

Table 17 to Table 21 detail the school type, age ranges, geographical distribution and gender selectivity of institutions participating in the focus groups and telephone interviews. The schools participating in the focus groups and telephone interviews were not selected to be representative based on the amount of time spent on practical work.

Of the focus groups in England, 21 of the schools participated in two years of focus groups, with 17 participating in all three years. In Scotland, one school participated in all three years of interviews and five schools participated in two years.

Table 17. Institutions participating in the focus groups and telephone interviews in year 1 by nation (E – England, S – Scotland), age range and funding arrangements. *"Other age range" was an option available for respondents to choose in the questionnaire. Examples of this option included 10 – 18, 13 – 19 and 14 – 19.

Institution age range	State		Independent		Total
	E	S	E	S	
11 - 16 Secondary	3	0	0	0	**3**
11 - 19 Secondary	8	2	4	0	**14**
16 - 19 Secondary	2	0	0	0	**2**
5 -19 Primary and Secondary	0	0	1	0	**1**
FE College	1	0	0	0	**1**
Other age range*	1	0	1	1	**3**
Total	**15**	**2**	**6**	**1**	**24**

Table 18. Institutions participating in the focus groups and telephone interviews in year 2 by nation (E – England, S – Scotland), age range and funding arrangements. *"Other age range" was an option available for respondents to choose in the questionnaire. Examples of this option included 10 – 18, 13 – 19 and 14 – 19.

Institution age range	State		Independent		Total
	E	S	E	S	
11 - 16 Secondary	3	0	0	0	**3**
11 - 19 Secondary	8	6	2	0	**16**
5 -19 Primary and Secondary	0	0	3	2	**5**
FE College	2	0	0	0	**2**
Other age range*	3	0	0	0	**3**
Total	**16**	**6**	**5**	**2**	**29**

Table 19. **Institutions participating in the focus groups and telephone interviews in year 3 by nation (E – England, S – Scotland), age range and funding arrangements. *"Other age range" was an option available for respondents to choose in the questionnaire. Examples of this option included 10 – 18, 13 – 19 and 14 – 19.**

Institution age range	State		Independent		Total
	E	S	E	S	
11 - 16 Secondary	4				4
11 - 19 Secondary	10	9	1		20
5 -19 Primary and Secondary		1	5	1	7
FE College	2				2
Other age range*	2				2
Total	18	10	6	1	35

Table 20. Institutions participating in the focus groups and telephone interviews by nation and type of location.

Region	Total no. of institutions (Y1)	Total no. of institutions (Y2)	Total no. of institutions (Y3)
Scotland			
Urban	1	3	5
Rural	0	2	1
Small town	2	3	5
England			
South, South West	6	6	7
London, East Anglia	6	5	7
North, Midlands	9	10	10
Total	24	29	35

Table 21. Institutions participating in the focus groups and telephone interviews by nation and gender. S – Single gender, M – Mixed gender.

	Y1			Y2			Y3		
	S	M	Total	S	M	Total	S	M	Total
Scotland	0	3	3	0	8	8	0	11	11
England									
South, South West	2	4	6	2	4	6	2	5	7
London, East Anglia	1	5	6	1	4	5	1	6	7
North, Midlands	2	7	9	2	8	10	9	1	10
Total	5	19	24	5	24	29	12	23	35

5.2 Composition of the HE telephone interviews

Table 22 provides a breakdown of the number of institutions participating in the HE staff telephone interviews by nation and department. The majority of departments only had a single member of staff participating in interviews, however in year 3, one department had two members of staff interviewed.

Fourteen individuals took part in interviews in Year 1, and nine of these individuals also took part in Year 2. Six of the nine continued to take part in Year 3. One interviewee in Year 3 had also taken part in Year 1 (but not Year 2) and four had taken part in Year 2 but not Year 1.

Table 22. Institutions participating in the telephone interviews split by department and nation. B – Biological sciences, C – Chemistry, P – Physics.

	Y1				Y2				Y3			
Nation	**B**	**C**	**P**	**Total**	**B**	**C**	**P**	**Total**	**B**	**C**	**P**	**Total**
England	3	5	5	**13**	3	6	5	14	4	5	3	**12**
Scotland	1	0	0	**1**	2	3	1	6	2	2	1	**5**
Wales	0	0	0	**0**	1	0	1	2	0	2	1	**3**
Total	**4**	**5**	**5**	**14**	**6**	**9**	**7**	**22**	**6**	**9**	**5**	**20**

Table 23 provides information about the roles of individual respondents. Note that many interviewees gave multiple roles.

Table 23 Roles of respondents to the staff survey by department. Some interviewees had more than one role and so the total is greater than the number of individuals. B – Biological sciences, C – Chemistry, P – Physics.

	Y1				Y2					Y3			
Role	**B**	**C**	**P**	**Total**	**B**	**C**	**P**	**Other**	**Total**	**B**	**C**	**P**	**Total**
First year undergraduate laboratory coordinator	2	4	5	**11**	3	6	6	0	**15**	2	8	4	**14**
First year undergraduate course director	1	0	0	**1**	2	2	1	1	**6**	1	5	0	**6**
Laboratory demonstrator (academic member of staff e.g. lecturer, teaching fellow, PDRA)	1	0	1	**2**	2	5	4	0	**11**	2	4	2	**8**
Admission tutor	0	0	0	**0**	1	0	1	1	**3**	0	1	0	**1**
Other	0	1	0	**1**	2	2	1	0	**5**	2	1	1	**4**
Total	**4**	**5**	**6**	**15**	**10**	**15**	**13**	**2**	**40**	**7**	**19**	**7**	**33**

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