

# Comparing progression routes to post-16 Science qualifications

**Carmen Vidal Rodeiro** Research Division

## Introduction

At present, awarding bodies in England provide schools and students with a wide choice of Science qualifications, aiming to ensure that pupils study Science that is relevant and up-to-date and that there is choice in the courses to prepare them for different routes post-16.

The most recent programme of study for Science at level 2<sup>1</sup> allows students to study a single GCSE<sup>2</sup> in Science. This single Science GCSE, which has great emphasis on scientific literacy, is intended to provide a good foundation to study the subject at AS or A level<sup>3</sup>, and a good background for specialism in other sciences (Millar, 2006).

Additionally, pupils can take one of two complementary GCSEs: GCSE Additional Science or GCSE Additional Applied Science in order to cover a more comprehensive programme of study in Science. Additional Science, which has a more academic focus, prepares pupils further for progression to study AS and A levels in the Sciences. The Additional Applied Science has a strong focus on work-related learning.

Pupils can also study separately GCSE Biology, GCSE Chemistry and GCSE Physics to gain three full GCSEs in Science. In 2009 a change was introduced to the level 2 Science curriculum in England: all pupils who achieved over a certain threshold in Science tests at age 14 would be entitled to study the three separate Sciences at GCSE (Biology, Chemistry and Physics). The main motivation for establishing this entitlement was to get more students to study more Science at level 2, with the long term aim of increasing the supply of scientists, engineers and technologists in the workforce (Fairbrother and Dillon, 2009; HM Treasury *et al.*, 2009).

Since 2010, the international GCSE, or IGCSE, has been accredited and funded in maintained schools in England and therefore maintained schools can offer this qualification in Biology, Chemistry and Physics to their students (independent schools in England had been offering IGCSEs in the Sciences prior to and in 2009). The IGCSE prepares students for further academic work, including progression to AS/A level study and to the International Baccalaureate programme.

There is also a vocational route in Science offered at level 2: Applied Science GCSE. This qualification, a double award, is designed to offer students the opportunity to widen their participation in vocationally

related learning. The course is intended to provide students with the technical knowledge, skills and understanding needed in the workplace, in further education or training. In particular, it aims to provide students with the ability to apply their Science knowledge and skills to solving scientific problems in a variety of vocational contexts.

There are other Science qualifications at level 2, equivalent to one or more GCSEs, that account for a small percentage of the Science qualifications offered in schools (e.g. BTEC<sup>4</sup> First in Applied Science or Cambridge Nationals in Science). They are an alternative to the courses mentioned above and they intend to provide students with the technical knowledge and skills needed in the workplace, in further education or in training. Percentages of candidates taking them have been increasing over the last few years (Vidal Rodeiro, 2012b).

According to a report from the Office of Qualifications and Examinations Regulation (Ofqual, 2009), all Science subjects should give students opportunities to develop their interest in Science, develop a critical approach to scientific evidence and methods, acquire and apply skills, knowledge and understanding of 'how Science works' and its essential role in society and acquire scientific skills, knowledge and understanding necessary for progression to further learning. However, it has been argued recently (e.g. Wolf, 2011; Homer, Ryder and Donnelly, 2013) that some level 2 Science courses may not prepare students for the study of Science subjects at level 3. Consequently some students may decide not to pursue a Science subject post-16, or if they continue to study it they may drop the subject or not fulfil their potential in terms of the grades they achieve.

In recent years, there have also been some claims about Science options being restricted in some schools and the effect that this could have on students' futures (e.g. Banner *et al.*, 2010). In fact, some young people have reported that they had compromised their choices by tailoring their options to what the schools could make available (e.g. Vidal Rodeiro, 2007; BBC News, 2009).

Due to the diversity in the level 2 Science curriculum, with a range of choices for students with different attitudes towards Science available, it is important to explore the different pathways taken by students who succeeded in the different options at level 2 in order to gain a better understanding about how level 2 qualifications are contributing to the supply of people with STEM<sup>5</sup> skills. In fact, a recent area of considerable interest in educational research has been the supply of young people gaining good A level grades in Science subjects, so that they would be eligible to continue on to university to study these subjects and to take up careers in Science or related fields.

Furthermore, in light of the Wolf review of vocational education (Wolf, 2011) evidence is needed to show if applied level 2 courses such as the BTEC First in Applied Science and the Cambridge National in Science provide meaningful pathways for studying Science at level 3 or whether

1. Each regulated qualification in England has a level between entry level and level 8. Qualifications at the same level are a similar level of demand or difficulty. To find out more about qualification levels visit <http://www.ofqual.gov.uk/help-and-advice/comparing-qualifications/>.

2. General Certificates of Secondary Education. These are the qualifications taken by the majority of 16 year olds in England.

3. AS and A levels are qualifications taken by students between the age of 16 to 18 in England. A levels are usually spaced out over two years and made up of two components: AS and A2 levels. AS levels can stand as a qualification on their own or can be carried on to A2 to complete a full A level qualification.

4. BTEC stands for *Business and Technology Education Council*, which used to award the qualification. BTECs are now awarded by the Edexcel exam board.

5. Science, Technology, Engineering and Mathematics.

students taking more academic pathways are better prepared for further study.

A recent report by the Royal Society (The Royal Society, 2011) recommends: 1) that the increasing diversity of Science qualifications needs to be reviewed and its impact on the numbers of students taking Science post-16 evaluated; and 2) that awarding organisations should make available detailed data on the participation, attainment and progression of students taking their specifications in Science.

This research carries out an in-depth statistical analysis of examination data from level 2 and level 3 Science qualifications, focusing on participation, attainment and progression. The central questions to be addressed in this article are:

- What is the provision of level 2 Science qualifications in English schools?
- What are the characteristics of the candidates taking level 2 Science qualifications?
- To which level 3 Science qualifications do students with level 2 qualifications in Science progress?
- What is the performance at level 3 of candidates progressing from different level 2 Science qualifications? Do some progression routes produce better outcomes than others?

## Data and methods

### Data

To answer these research questions, data from the National Pupil Database on uptake and performance at levels 2 and 3 for the examination years 2008/09 and 2010/11 were used.

The National Pupil Database (NPD), compiled by the Department for Education, is a longitudinal database for all children in schools in England, linking student characteristics to school and college learning aims and attainment. The NPD holds pupil and school characteristics such as age, gender, ethnicity, level of deprivation, attendance and exclusions, matched to pupil level attainment data (Key Stage 2 to Key Stage 5 assessments and other external examinations). Students who start in a school/college are only recorded on the NPD if they enter for a qualification; those who leave school/college after a short time or do not sit examinations are not present in the data.

### Methods

The analyses presented in this article were carried out in two stages:

- Stage 1 consisted of a comprehensive analysis of the provision of level 2 Science in English schools and the characteristics of the candidates taking each level 2 Science qualification;
- Stage 2 investigated the progression from level 2 Science qualifications to level 3 study.

#### STAGE 1

##### *Provision of level 2 Science subjects*

The research addressed this issue through descriptive analyses that looked into schools' characteristics such as their type and their level of deprivation.

School type information was obtained from the NPD and schools were classified according to the following types:

- comprehensive schools
- academies
- independent schools
- selective schools
- secondary modern schools
- other.

A deprivation score for each school was calculated as the average score on the Income Deprivation Affecting Children Index (IDACI)<sup>6</sup> of the students attending it. This score, available in the NPD, shows the percentage of children in the Lower Super Output Area (LSOA)<sup>7</sup> in which the student resides who live in families that are income deprived.

The schools' deprivation variable was continuous and therefore was divided into three equal-sized groups (low, medium, high) using percentile values, and schools were classified accordingly.

##### *Characteristics of the candidates taking Science qualifications at level 2*

The research addressed this issue through descriptive analyses that focussed on:

- prior attainment of candidates;
- socio-economic background of candidates (level of deprivation);
- type of centre where the level 2 qualifications were obtained.

The prior attainment of candidates taking Science qualifications at level 2 was measured by the total marks obtained in the Science Key Stage 3 tests taken at age 14. Key Stage 3 refers to the three years of schooling when pupils are aged between 11 and 14. All pupils in this Key Stage must follow a programme of education in at least 15 areas. At the end of this stage, pupils are tested and are awarded attainment levels depending on what they are able to do. These tests cover English, Mathematics, Science and ICT<sup>8</sup>.

The socio-economic background of the students was measured by the Income Deprivation Affecting Children Index (IDACI), available in the NPD (see above for details about this index).

Students were classified into six different groups depending on the type of school in which they obtained the Science qualification at level 2 (as above).

#### STAGE 2

The second stage of the research looked into the progression from level 2 Science qualifications to level 3 study. This involved a follow-up of candidates who completed level 2 Science qualifications in 2009 and a series of descriptive analysis looking into their progression routes to level 3.

It should be noted that there is a limitation regarding the data used for this research. The linking between candidates with Science qualifications in 2009, and candidates recorded in the Key Stage 5 extract of the 2011 NPD, was carried out using a unique pupil number common to both

6. See page 19 of <http://www.communities.gov.uk/documents/communities/pdf/733520.pdf> for a detailed explanation of this index.

7. A LSOA is a conglomeration of a number of census output areas (each output area has about 150 households). They usually have a minimum population size of 1000 and an average of 1500. There are over 34000 LSOAs in England.

8. It should be noted that until 2008, performance at Key Stage 3 was assessed by a series of externally-marked tests. However, from 2009, results from the Key Stage 3 tests have no longer been available for the entire cohort of students in maintained schools in England.

datasets. However, some candidates did not have this unique identifier and therefore matching in this way was not possible for them. As a result, some candidates who progressed to qualifications at level 3 might not have been included in the analyses.

More detailed analyses on progression to the traditional A level qualifications in Biology, Chemistry and Physics (which make up the majority of Science level 3 qualifications) were also carried out and are reported in Vidal Rodeiro (2012a). In particular, uptake and performance of the three individual A level subjects were investigated for different groups of students using background student and school variables. Among candidates' features, Vidal Rodeiro (2012a) looked at gender, overall attainment at level 2, level of deprivation, uptake of GCSE Mathematics alongside Science qualifications and attainment in Science at level 2. In terms of schools, it looked at attributes such as the type, the attainment, the composition with respect to gender and whether the school had a sixth form or not.

## Results

### Provision of level 2 Science qualifications

In this article, provision of a subject or qualification was defined as the number or percentage of schools with at least one student entering for examination in the subject or qualification. It could be argued that this may not cover all of the provision as schools might offer a subject, but none of their students study it or take an examination in it. However, there was no data available that would allow capturing the definite subject/qualification offer in schools and only provision as defined above was considered.

Table 1 presents the provision of level 2 qualifications/subjects in Science offered for certification in the academic year 2008/09 in secondary schools in England. The table shows that GCSEs in Biology, Chemistry and Physics were offered in about 40% of the secondary schools. The provision figures for the GCSE in Science and the GCSE in Additional Science (about 80% and 70%, respectively) were higher than for the GCSEs in Biology, Chemistry and Physics. The provision figures for the Applied Science subjects were much lower than for the academic subjects. For example, the Additional Applied Science GCSE was offered in around 17% of the schools and the BTEC Firsts and the OCR Nationals<sup>9</sup> in Applied Science were offered, respectively, in around 11% and 3% of schools.

**Table 1: Level 2 Science related qualifications/subjects, June 2009**

Science qualification/ subject at level 2	Number of schools	Percentage of schools
GCSE Science	4331	80.4
GCSE Additional Science	3711	68.9
GCSE Additional Applied Science	935	17.4
Applied Science GCSE	382	7.1
GCSE Biology	2301	42.7
GCSE Chemistry	2182	40.5
GCSE Physics	2177	40.4
GCSE Biology: Human	101	1.9
GCSE Environmental Science	132	2.5
GCSE Geology	45	0.8
OCR National Applied Science	144	2.7
BTEC First Applied Science	574	10.7

9. Now called Cambridge Nationals.

Table 2 presents the percentages of schools offering Science subjects by the type of school. The provision of the three separate Sciences (Biology, Chemistry, and Physics) was higher in selective schools than in any other type of school. It should be noted that there might be some independent schools that offered the IGCSE in the separate Sciences rather than the GCSE for certification in 2009, despite IGCSEs not being accredited or funded for state maintained schools until 2010. Table 2 also shows that provision for the Science and Additional Science GCSEs was lower in independent and selective schools than in comprehensive schools, academies and secondary modern schools.

The percentages of selective and independent schools offering a BTEC First in Applied Science were very small (below 1%), compared to the percentages of comprehensive schools, academies or secondary modern schools doing so (around 20%). The provision figures for the OCR National in Applied Science were lower than the figures for the BTEC but the patterns of provision by school type were similar (about 5% of comprehensive schools and academies and fewer than 1% of selective and independent schools offered the qualification).

**Table 2: Level 2 Science related qualifications/subjects, June 2009 – by type of school**

Science qualification/ subject at level 2	Compre- hensive	Academy	Indepen- dent	Selective	Secondary Modern	Other
GCSE Science	98.6	95.0	73.0	85.6	96.8	48.5
GCSE Additional Science	97.3	93.3	67.1	81.1	94.2	12.7
GCSE Additional Applied Science	31.3	22.3	2.6	6.3	28.6	2.3
Applied Science GCSE	12.4	11.5	0.8	0.0	9.7	1.2
GCSE Biology	54.3	56.4	55.0	82.9	36.4	9.4
GCSE Chemistry	52.6	55.7	53.5	82.9	27.3	6.0
GCSE Physics	53.1	55.1	52.8	82.9	26.6	5.6
GCSE Biology: Human	2.1	1.4	0.3	0.9	3.2	2.6
GCSE Environmental Science	3.9	3.2	1.0	0.0	3.9	0.8
GCSE Geology	1.1	1.4	0.6	2.7	0.0	0.1
OCR National Applied Science	4.5	5.1	0.6	0.0	3.2	0.3
BTEC First Applied Science	17.6	20.0	0.9	0.0	18.8	1.9

There was a strong pattern in the provision of Science by school deprivation (see Table 3). Higher percentages of schools with pupils living in areas of low deprivation provided GCSEs in the three separate Sciences than schools with pupils living in areas of high deprivation (53% compared with 30%). Furthermore, the percentages of schools offering OCR Nationals and BTECs increased with increasing deprivation. This might lead to restricted options for high ability students who live or attend schools in deprived areas.

**Table 3: Level 2 Science related qualifications/subjects, June 2009 – by school level of deprivation**

Science qualification/ subject at level 2	Low deprivation	Medium deprivation	High deprivation
GCSE Science	87.5	89.2	85.0
GCSE Additional Science	76.9	79.0	72.8
GCSE Additional Applied Science	22.7	23.7	21.2
Applied Science GCSE	6.7	10.3	10.3
GCSE Biology	55.2	44.2	31.9
GCSE Chemistry	52.9	42.3	29.9
GCSE Physics	52.8	42.2	30.1
GCSE Biology: Human	2.0	2.6	1.1
GCSE Environmental Science	4.2	3.7	1.2
GCSE Geology	1.8	1.0	0.1
OCR National Applied Science	2.1	3.2	5.0
BTEC First Applied Science	7.6	12.9	20.9

### Characteristics of candidates taking level 2 Science qualifications

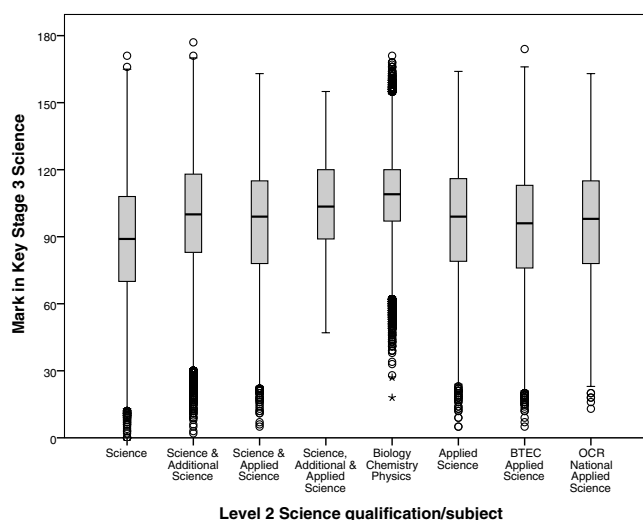
In this section of the article the characteristics of the candidates taking Science qualifications at level 2 are investigated. For this purpose, students taking Science qualifications at level 2 were classified as pursuing the following routes:

- GCSE Science
- GCSE Science & GCSE Additional Science
- GCSE Science & GCSE Additional Applied Science
- GCSE Science & GCSE Additional Science & GCSE Additional Applied Science
- GCSE Biology & GCSE Chemistry & GCSE Physics
- Applied Science GCSE
- BTEC First Applied Science
- OCR National Applied Science

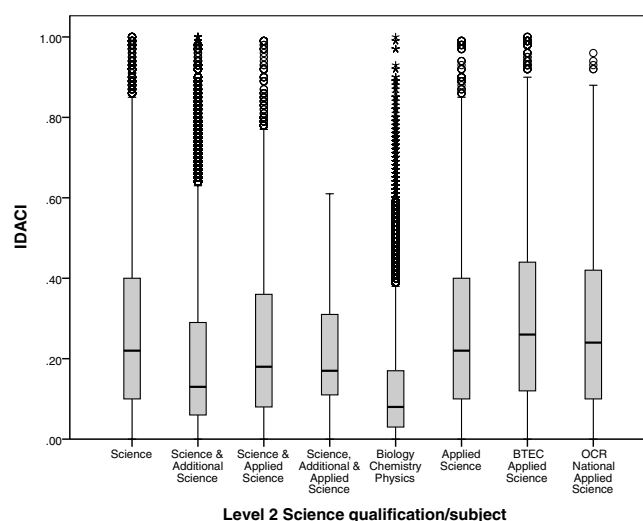
#### Prior attainment

Figure 1 shows the mark distribution in the Key Stage 3 Science tests for candidates taking different Science qualifications at level 2 and reveals that there were differences in the Science prior attainment among the different level 2 Science routes, with the highest average prior attainment corresponding to those students taking the separate Sciences (Biology, Chemistry, Physics) and the lowest prior attainment to those taking Science only or the BTEC and OCR National routes. An analysis of variance showed that the differences between the prior attainment of candidates following the different Science routes were statistically significant. Figure 1 also shows that the variation in the Key Stage 3 scores was smaller among the students taking the separate Sciences than among the students following any other route.

These results therefore suggest that prior attainment in Science may have an effect on the type of Science qualification pursued at level 2.



**Figure 1: Prior attainment (Key Stage 3 Science) – by Science route at level 2**



**Figure 2: Level of deprivation (IDACI) – by Science route at level 2**

#### Level of deprivation

Figure 2 shows the level of deprivation (IDACI) for candidates taking different Science qualifications at level 2 and reveals that there were differences in the level of deprivation among the different level 2 Science routes, with the lowest level of deprivation corresponding to those students taking the separate Sciences and the highest level of deprivation to those taking the BTEC and OCR National routes. An analysis of variance showed that the differences between the level of deprivation of candidates following the different Science routes at level 2 were statistically significant. As above, it is worth noting that the variation in the deprivation scores was lower among the students taking the separate Sciences than among those following any other route.

#### Type of school

Table 4 shows the type of school where the level 2 Science qualification was obtained (the table shows column percentages). For example, in independent schools, 35% of the candidates had pursued the triple Science route. This contrasts with only 11% in comprehensive schools. Similarly, only 1% of candidates in independent schools obtained a BTEC in Applied Science, whilst 6% of the candidates in comprehensive schools and 7% of the candidates in academies did so.

**Table 4: Type of school where the level 2 Science route was pursued (column %)**

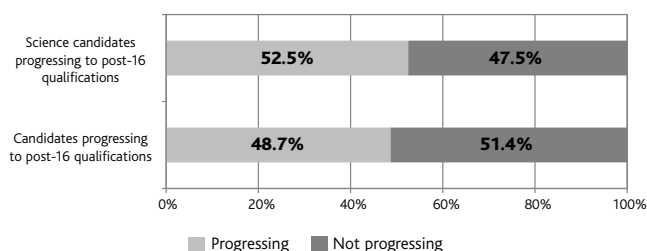
Science route at level 2	Comprehensive	Academy	Independent	Selective	Secondary Modern	Other
Science	12.8	12.2	7.0	1.7	19.9	64.1
Science & Additional Science	51.6	45.2	40.3	36.7	43.9	12.9
Science & Additional Applied Science	8.3	5.8	1.3	0.5	7.9	1.2
Science, Additional & Additional Applied Science	0.0	0.0	0.0	0.1	0.0	0.3
Biology & Chemistry & Physics	10.5	15.0	34.7	50.7	4.3	7.6
Applied Science GCSE	3.5	3.3	0.3	0.0	3.4	1.5
BTEC First Applied Science	5.7	7.4	1.2	0.0	5.8	1.4
OCR National Applied Science	0.8	1.3	0.2	0.0	0.3	0.7

### Progression to post-16 qualifications in Science

#### Uptake of level 3 qualifications and level 3 Science qualifications

This section of the article investigates the progression from candidates with at least one Science qualification at level 2, obtained in June 2009, to level 3 qualifications certificated in June 2011.

Figure 3 shows that 49% of candidates at the end of Key Stage 4<sup>10</sup> in 2009 obtained a level 3 qualification at the end of June 2011. This percentage was slightly higher, 53%, among candidates with at least one Science qualification at level 2.



**Figure 3: Progression from level 2 to post-16 (level 3) qualifications**

Table 5 shows the percentages of candidates progressing to any level 3 qualification by the Science route at level 2 and Table 6 the percentages progressing to level 3 Science qualifications. These tables highlight that the route with higher progression rates to level 3 was the triple Science route (Biology, Chemistry and Physics), with 80% of the candidates who pursued it progressing to level 3 and 46% of the candidates progressing to a Science qualification at level 3. Table 6 highlights that around 26% of the candidates taking Science and Additional Science GCSEs progressed

**Table 5: Candidates progressing to level 3 qualifications (any subject) – by Science route at level 2**

Science route at level 2	Progressing to level 3 (any subject)	
	Number	%
Science	17255	22.5
Science & Additional Science	167507	58.7
Science & Additional Applied Science	14795	35.3
Science, Additional & Additional Applied Science	85	50.3
Biology & Chemistry & Physics	63637	80.0
Applied Science GCSE	6843	36.9
BTEC First Applied Science	11251	33.6
OCR National Applied Science	1832	38.1

**Table 6: Candidates progressing to Science qualifications at level 3 – by Science route at level 2**

Science route at level 2	Progressing to level 3 (Science)	
	Number	%
Science	775	1.0
Science & Additional Science	37287	13.1
Science & Additional Applied Science	959	2.3
Science, Additional & Additional Applied Science	22	13.0
Biology & Chemistry & Physics	36467	45.8
Applied Science GCSE	747	4.0
BTEC First Applied Science	1107	3.3
OCR National Applied Science	169	3.5

to level 3 Science qualifications and that fewer than 5% of the candidates following an applied route at level 2 (Applied Science GCSE, Science and Additional Applied Science, BTEC First or OCR National) progressed to Science at level 3.

Table 7 shows the percentages of candidates<sup>11</sup>, by Science route at level 2, who progressed to specific qualifications at level 3. The key findings from this table are:

- very similar percentages of candidates progressed to A level and BTEC qualifications from GCSE Science;
- higher percentages of candidates from level 2 applied routes (including from Applied Science GCSEs, OCR Nationals and, particularly, from BTEC Firsts) progressed to level 3 BTEC qualifications than to any other qualification;
- much higher percentages of candidates from the triple Science (Biology, Chemistry, Physics) or the double Science (Science and Additional Science) routes progressed to A level than to any other qualification;

10. Key Stage 4 refers to the two years of schooling in England when pupils are aged 15 to 16.

11. Row percentages do not necessarily add up to 100% because candidates can progress to more than one qualification at level 3.

**Table 7: Candidates progressing to level 3 qualifications (in any subject area) – by Science route at level 2**

Science route at level 2	Level 3 qualifications															
	A level	AS level	Applied A level	Applied AS level	Applied AS/A level	Pre-U	EPQ	Diploma	IB	AQA Bacc	NVQ	VRQ	BTEC	OCR National	Key Skills	Other
Science	44.3	28.3	10.1	4.9	0.1	0.0	3.4	0.7	0.2	0.2	0.6	7.5	44.0	3.2	1.8	0.1
Science & Additional Science	69.5	39.4	8.6	3.6	0.1	0.1	5.0	0.5	0.5	0.7	0.3	4.4	24.2	1.7	1.9	0.0
Science & Additional Applied Science	43.7	27.9	13.3	6.4	0.1	0.0	3.3	0.7	0.1	0.1	0.3	7.9	45.3	3.2	2.1	0.1
Science, Additional & Additional Applied Science	64.7	37.6	17.6	2.4	0.0	0.0	3.5	1.2	0.0	1.2	0.0	1.2	35.3	0.0	1.2	0.0
Biology & Chemistry & Physics	88.1	51.8	3.7	1.6	0.0	0.5	7.1	0.1	1.5	1.7	0.1	1.7	7.0	0.6	1.6	0.0
Applied Science GCSE	44.6	27.6	16.4	6.7	0.1	0.0	4.6	0.6	0.1	0.1	0.4	7.4	45.7	4.9	1.5	0.0
BTEC First Applied Science	33.5	22.8	9.1	3.8	0.1	0.0	2.9	0.7	0.3	0.1	0.7	8.5	60.2	3.4	2.4	0.0
OCR National Applied Science	40.0	27.3	10.8	6.0	0.3	0.0	3.4	1.2	2.3	0.1	0.3	6.8	47.8	5.3	2.5	0.1

**Table 8: Candidates progressing to level 3 Science qualifications – by Science route at level 2 (as a percentage of the candidates taking the subject at level 2 and progressing to level 3)**

**(a) Progression to AS/A level in Science subjects**

Science route at level 2	Level 3 Science qualifications											
	AS <sup>12</sup> level Biology	AS <sup>12</sup> level Chemistry	AS <sup>12</sup> level Physics	AS level Environmental Science	A level Biology	A level Chemistry	A level Physics	A level Environmental Science	AS level Applied Science	A level Applied Science		
Science	0.8	0.5	0.4	0.0	1.1	0.5	0.5	0.1	0.2	0.3		
Science & Additional Science	2.5	1.6	1.1	0.2	10.9	7.1	4.8	0.4	0.4	0.7		
Science & Additional Applied Science	0.6	0.3	0.1	0.1	0.9	0.3	0.2	0.1	0.9	2.3		
Science, Additional & Additional Applied Science	2.4	2.4	2.4	25.9	15.3	10.6	3.5	1.2	0.0	2.4		
Biology & Chemistry & Physics	4.2	3.8	2.9	0.2	31.5	27.9	18.6	0.5	0.2	0.3		
Applied Science GCSE	0.7	0.4	0.2	0.1	1.4	0.6	0.4	0.2	1.4	5.0		
BTEC Applied Science	0.8	0.4	0.2	0.0	0.7	0.5	0.3	0.0	0.4	0.8		
OCR National Applied Science	0.3	0.2	0.1	0.1	1.1	0.6	0.5	0.1	1.4	2.5		

**(b) Progression to other level 3 qualifications in Science**

Science route at level 2	Level 3 Science qualifications							
	Pre-U <sup>13</sup> Biology	Pre-U Chemistry	Pre-U Physics	IB Biology	IB Chemistry	IB Physics	BTEC Applied Science	
Science	0.0	0.0	0.0	0.1	0.0	0.0	0.8	
Science & Additional Science	0.0	0.0	0.0	0.3	0.2	0.1	1.0	
Science & Additional Applied Science	0.0	0.0	0.0	0.0	0.0	0.0	1.8	
Science, Additional & Additional Applied Science	0.0	0.0	0.0	0.0	0.0	0.0	3.5	
Biology & Chemistry & Physics	0.0	0.0	0.0	0.9	0.8	0.4	0.6	
Applied Science GCSE	0.0	0.0	0.0	0.1	0.0	0.0	2.0	
BTEC Applied Science	0.0	0.0	0.0	0.1	0.0	0.0	6.6	
OCR National Applied Science	0.0	0.0	0.0	1.2	0.3	0.1	2.8	

12. Candidates progressing to AS level and not continuing to A level.

13. Note that percentages have been rounded to 0.0 so there might be some candidates who progressed to Pre-U Science subjects, particularly from the triple Science route at level 2.

- higher percentages of candidates from the Applied Science routes than from the more traditional routes progressed to applied AS/A levels;
- higher percentages of candidates from the triple Science route than from almost any other route progressed to the International Baccalaureate (IB) Diploma (1.5% compared to fewer than 1%);
- higher percentages of candidates from the triple Science route progressed to the Extended Project Qualification (EPQ) than from any other route (around 7% compared to less than 5%);
- very small percentages of level 2 Science candidates progressed to level 3 OCR Nationals. Indeed, the highest percentage was around 5% and corresponded to the progression of those candidates who obtained an OCR National at level 2.

Table 8 shows the percentages of candidates, by Science route at level 2, who progressed to specific Science qualifications at level 3. The key findings from this table are:

- higher percentages of candidates from the triple Science or the double Science routes progressed to A level in Biology, Chemistry or Physics than to any other qualification;
- independently of the level 2 Science route, progression was generally higher to A level in Biology than to A level in Chemistry or Physics;
- there was hardly any progression to A levels in Biology, Chemistry or Physics from the level 2 applied routes;
- higher percentages of candidates from the Applied Science routes than from the more academic routes progressed to the level 3 BTEC in Applied Science.

### Performance in level 3 Science qualifications

This section of the article reports on the performance in Science at level 3 of candidates progressing from each of the level 2 Science routes.

Performance in each of the different Science routes at level 3 has been measured in a different scale. For example, A levels are graded A\* to E whilst BTECs are graded as pass, merit or distinction. Therefore, the figures presented in this section do not allow comparison across the level 3 qualifications and comparisons should only be made within qualifications.

Figures 4 to 6 display the average performance in the more popular level 3 Science qualifications by Science route at level 2. Figure 4 highlights that in each level 3 academic qualification (A levels in Biology, Chemistry and Physics) those progressing from triple Science at level 2 did better than anybody else. However, when interpreting these results, it should be taken into account that candidates from different level 2 routes might have different levels of academic ability, measured in this work by the Key Stage 3 tests results. For example, candidates taking the triple Science route might be more academically able than those taking the single Science route and therefore, their performance at level 3 is likely to be better. This issue has been taken into account in Vidal Rodeiro (2012a) where uptake and performance of level 3 Science qualifications were investigated for different groups of students.

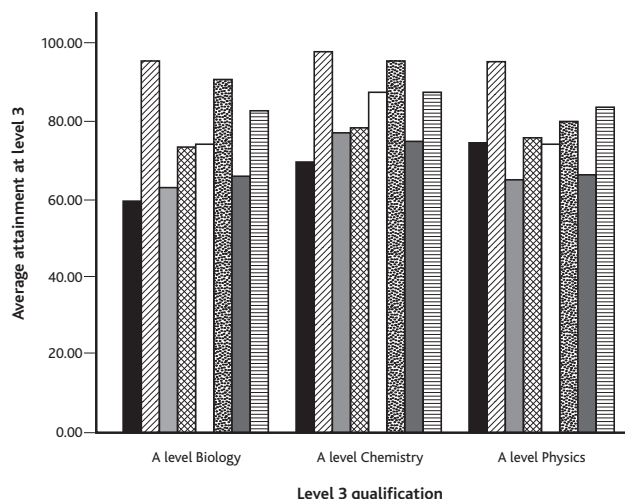


Figure 4: Average performance in A level Biology, Chemistry and Physics<sup>14</sup>

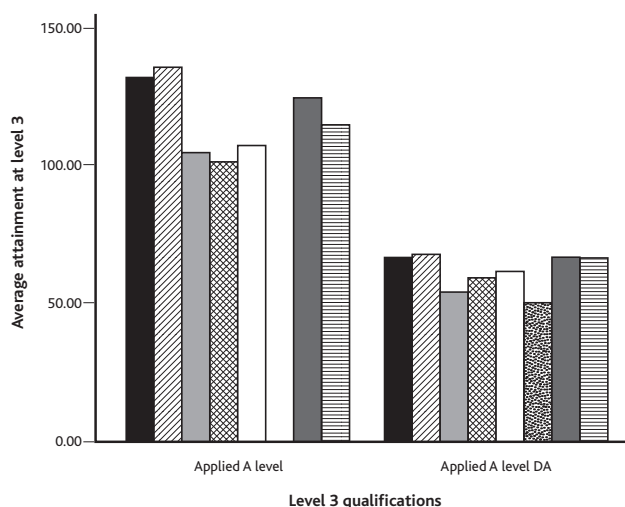


Figure 5: Average performance in applied A level and applied A level double awards in Science<sup>14</sup>

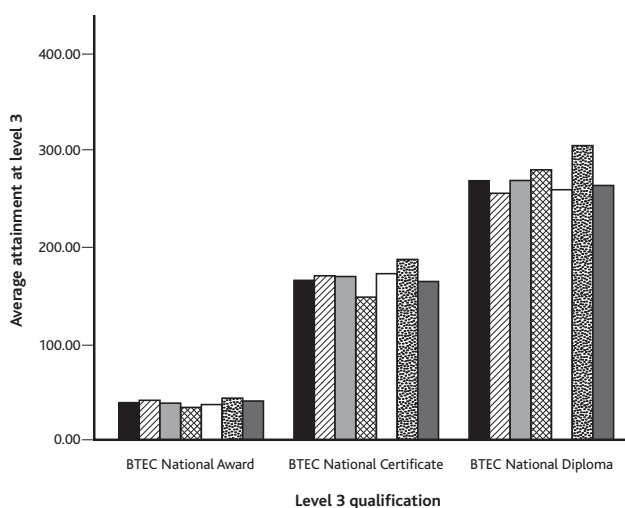


Figure 6: Average performance in BTEC qualifications in Applied Science<sup>14</sup>

Common key to Figures 4, 5 and 6

- Applied Science GCSE
- ▨ Biology – Chemistry – Physics
- BTEC Applied Science
- ▩ OCR National Applied Science
- Science
- ▩ Science, Additional & Additional Applied Science
- Science & Additional Applied Science
- ▨ Science & Additional Science

14. Grades were converted into points using the UCAS tariff. Available online at: ([http://www.ucas.com/students/ucas\\_tariff/tariffables/](http://www.ucas.com/students/ucas_tariff/tariffables/))

Figures 5 and 6 present the performance in some of the applied level 3 Science qualifications. In particular, Figure 5 highlights that performance in the applied A levels was better among those students progressing from the triple Science, but followed closely by the performance of those progressing from the Applied Science and the Science and Additional Applied Science routes at GCSE. Figure 6 shows that performance on BTEC qualifications at level 3 was a little better among students progressing from the Science and Additional Applied Science GCSE than among students progressing from any other level 2 route.

The above results show that the Additional Applied Science, which has a strong focus on work-related learning, was associated with better results in applied level 3 options than other qualifications at level 2.

## Conclusions and discussion

This research aimed to gather detailed information about pupils taking level 2 Science qualifications and their progression to level 3 on completion of specific Science routes. Its main driver came from national concerns about the relatively small numbers of young people choosing to study Science subjects beyond compulsory schooling.

The outcomes of this research showed that the different level 2 Science qualifications enabled learners to progress to level 3 in a variety of ways.

The key conclusions of the analyses presented in this article are summarised and discussed briefly below.

### Provision of level 2 Science qualifications

Although Science is compulsory at Key Stage 4, there were alternative routes available at level 2 in schools and colleges in England to fulfil the Science curriculum requirements.

The provision figures provided in this article showed that the majority of the secondary schools in England offered Science and Additional Science GCSEs. However, there has been a shift in recent years towards separate GCSEs in Biology, Chemistry and Physics (see, for example, Vidal Rodeiro (2012b) for an account of the provision in Science qualifications at level 2 from 2009 to 2011). This shift might have been due to the Government's commitment in February 2009 to increase access to triple Science in order to ensure that all pupils in maintained schools had access to triple Science GCSEs by 2014 and that the percentage of state school pupils taking the three Science subjects reached 17% by 2014.

There were also other alternative level 2 Science qualifications, such as the Applied Science GCSE (double award) or the BTEC First and OCR National in Applied Science which were offered in a small percentage of secondary schools in England.

This research showed that schools with certain characteristics were associated with a higher provision of particular Science options at level 2. In particular, provision of GCSEs in Biology, Chemistry or Physics was higher in selective schools or in schools with favourable economic factors (e.g. their students had low IDACI scores, indicating low levels of deprivation). Furthermore, provision of Applied Science qualifications, such as the Applied Science GCSE, the OCR National in Applied Science or the BTEC First in Applied Science, was greater in comprehensive schools and academies and in schools where pupil deprivation was high.

It should be noted that the fact that not all Science qualifications (or subjects) were on offer in the majority of schools may restrict students' options. For example, high ability students who live or attend a

school in a deprived area would have to tailor their choices to what the school is offering. Furthermore, it should be borne in mind that there is no information about how the selection of students into the different Science routes takes place within the schools. It might be that there is no actual choice made by the students and it is possible that, particularly at level 2, schools determine which students are suitable for each route.

### Characteristics of candidates taking level 2 Science qualifications

This research showed clear differences in the background of the students taking the different Science routes at level 2.

First, the outcomes of this research revealed that prior attainment in Science (at Key Stage 3) might have had an effect on the type of Science qualification pursued at level 2. In particular, the research showed that the highest prior attainment corresponded to students taking separate GCSEs in Biology, Chemistry and Physics and the lowest prior attainment to students taking GCSE Science, BTEC First in Applied Science or OCR National in Applied Science.

Secondly, there were differences in the level of deprivation between level 2 Science routes, with the lowest level of deprivation corresponding to students taking GCSEs in Biology, Chemistry and Physics and the highest level of deprivation corresponding to those taking a BTEC First or an OCR National in Applied Science.

Finally, given the numbers of schools of each type in England, and their provision of Science qualifications/subjects, it is not surprising that the overwhelming majority of the candidates obtained level 2 Science qualifications in comprehensive schools. However, the research revealed differences in the proportions of candidates in each type of school who followed each level 2 Science route. For example, in independent schools over a third of the candidates pursued the triple Science route (GCSEs in Biology, Chemistry and Physics); this contrasts with only 10% of the candidates in comprehensive schools and 50% in selective schools. Similarly, only 1% of candidates in independent schools pursued a BTEC First in Applied Science, whilst 6% of the candidates in comprehensive schools did so.

### Progression to post-16 qualifications in Science

One of the main aims of this research was to investigate the progression from candidates with at least one Science qualification at level 2 (obtained in June 2009) to level 3 qualifications, certificating in June 2011. Through analysis of national data this research showed that the level 2 Science route with the highest progression rates to level 3 was the triple Science route, with around 46% of the candidates progressing to a Science qualification at level 3. Only around 26% of the candidates from the double Science route progressed to level 3 Science qualifications and fewer than 5% of the candidates following an applied route (applied GCSE, Science and Additional Applied Science, BTEC First in Applied Science or OCR National in Applied Science) progressed to Science at level 3.

Performance in Science subjects at level 3 was better for pupils progressing from separate GCSEs in Biology, Chemistry and Physics than for pupils progressing from any other level 2 Science qualification. It should be noted though that pupils progressing from the triple Science route were more able (in terms of their Key Stage 3 Science results) than those progressing from other routes.

The above statements might suggest that choices at level 2 determine post-16 trajectories and therefore further study or employment options.



In particular, applied routes in Science did not show much progression to level 3 'academic' qualification/subjects and therefore progression to higher education could be restricted for candidates following those routes.

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# Early entry GCSE candidates: Do they perform to their potential?

Tim Gill Research Division

## Introduction

There has been concern recently that a large and increasing number of candidates are certificating for GCSEs at a younger age than scheduled. Although there has been a trend of increasing early entry<sup>1</sup> over recent years (Gill, 2010), there has been a particularly large increase in the last two years (Department for Education, 2011). It is thought that the driver for this increase is the scrapping of the Key Stage 3 (KS3) tests (the final tests were taken in 2008). These were taken in year 9, and their absence means schools can now start teaching some GCSE subjects in this year, and subsequently enter candidates at the end of year 10, or in the winter sessions of year 11. One possible reason for early certification is that candidates can 'bank' a grade in the subject (in particular a grade C would contribute towards achieving the league table target of 5 A\* to C grades as well as other important school accountability measures) allowing more time in year 11 to concentrate on other subjects. The concern is that many of these candidates are not reaching their potential in the subject because they certificate before they are ready. For example, Vidal Rodeiro & Nadas (2012) found evidence that candidates taking a (modular) English GCSE early were less likely to achieve a high grade than those certificating at the normal time.

A further issue relates to participation and performance in the subject at A level. Candidates who certificate early (particularly if they do so in June of year 10 or earlier) usually then have a break in studying the subject, meaning that they may lose interest or feel less confident that they are prepared for further study. Those students who do go on to take the A level in the subject may struggle because of this break.

This research first explores the extent of early certification in GCSEs. Two different years of data are used, to see whether there have been any changes in early certification patterns over time. Concerns about candidates not achieving their potential are then investigated by looking at GCSE performance based on certification session, as well as participation and performance in the same (or similar) subject at A level. Specifically, the research questions were:

- RQ1** What are the patterns of early certification in GCSE subjects in recent years?
- RQ2** How do candidates who certificate in a GCSE prior to June of year 11 perform relative to candidates taking the GCSE in June of year 11, after accounting for prior attainment?
- RQ3** What effect does certificating in a GCSE early have on uptake and performance in the same (or a related) subject at A level, after accounting for prior attainment?

1. This article refers both to 'early entry' and 'early certification'. However, they both mean the same thing – namely certificating for a GCSE before the summer of year 11.