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Sources of differential participation rates in school science: the impact of curriculum reform

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Abstract

Science participation has widely varying participation rates across a range of student characteristics. One of the stated aims of the 2006 Key Stage 4 science curriculum reforms in England was to improve social mobility and inclusion. To encourage students to study more science, this reform was followed by the introduction in 2008 of an entitlement to study the three separate sciences at Key Stage 4 for the more highly attaining students.

This paper uses longitudinal national data over a five year period to investigate the extent and change of participation across science courses at KS4, focussing on student gender and socio-economic status. It finds that whilst there is some evidence of a move towards a more equitable gender balance for some courses, there is as yet little evidence of substantial change in differential participation rates by socio-economic status.

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Introduction

Policy background

In 2006, secondary science education in England experienced a significant reform with the introduction of a new set of GCSE specifications and criteria, and a new Key Stage 4 (KS4) Programme of Study (Qualifications and Curriculum Authority 2005). With a greater emphasis on scientific literacy (Millar 2006), these reforms were also intended to provide greater flexibility to students in terms of additional 'applied' science specifications (i.e. science courses with a focus on work-related learning) , and to improve social mobility and inclusion (Ryder & Banner 2010). This latter paper examines in detail the multiple aims ascribed to the reform, and discusses the social, political and economic motivation for the implementation of the changes.

In 2008, a change of a different character was introduced into the KS4 science curriculum in England, through the establishment of the entitlement to study the three separate sciences (biology, chemistry and physics GCSE – commonly known as 'Triple Award') for students achieving at or above level 6 at Key Stage 3 science at age 14. The main motivation for the encouragement of students to study Triple Award was to get more students to do more science, with the long term aim of increasing the supply of scientists, engineers and technologists in the workforce (HM Treasury et al. 2009; Fairbrother & Dillon 2009).

Using national data, this paper assesses the longitudinal impact of these policy changes (together and from now on termed collectively as 'the reforms') on patterns of participation across KS4 science courses nationally, and the extent to which differential participation rates (or 'stratification' as a shorthand) by gender and socio-economic status (SES) have been impacted as the reforms work their way through the KS4 school science system.

No particular framework or model for educational change is advanced in this article. Curriculum reform is clearly a part of the process of educational change (Goodson 2003) but in the current article the focus is on the *outcomes* of curriculum policy change using national quantitative data, rather than on, say, the qualitative experiences of teachers as they negotiate such change.

Stratification of school science participation by gender

It is well known that gender plays an important role in participation in school science, with girls having lower participation rates generally where studying physical science is not compulsory (The Royal Society 2008; Gorard & See 2009). Biological sciences are sometimes an exception to this, with girls often over-represented on such courses (i.e. post-16 in England). At KS4, however, the study of science is a statutory requirement and so all students must cover the science programme of study. The issue then is the extent of differential participation rates between girls and boys across the range of science courses available. For example, there has long been a gender imbalance in Triple Award, with boys over-represented, despite the fact that at KS3 girls and boys attainment in science is broadly similar[2].

Differential participation rates in science courses are sometimes accounted for by varying attitudes to science by gender. In some UK-based studies, girls are found to

[2] See for example, the 2007 KS3 National statistics first release at http://www.dcsf.gov.uk/rsgateway/DB/SFR/s000749/SchSep07DCSFweb.pdf (accessed 27/04/11)

view the subject more instrumentally, whereas boys are more likely to study the subject for intrinsic reasons (Osborne et al. 2003; Institute of Physics 2006). This research also finds that girls and boys tend to have different views on the relevance of science to them, whilst other studies find that girls are less likely to state that they really want to study science (NFER 2006), or do not necessarily see themselves as ‘scientists’ (Archer et al. 2010). Internationally, data from PISA in 2006 (OECD 2007) show that gender differences in attitudes to science in the UK are large in comparison with many other countries. However, alongside the UK, PISA results indicate that there are other countries where gender plays an important role in attitudes to science, particularly with regard to students’ self-concept of science, and these include Germany and Japan.

The ‘gap’ in participation between girls and boys, particularly in Triple Award, is important beyond the issue of gender equity alone. Triple Award is the KS4 course with the greatest emphasis on traditional scientific content, and in many schools it is the preferred route into post-16 science study. A potential first step towards increasing the number of students studying science post-16 (one key aim of the reforms) would be to increase the number of girls studying suitable science courses subject at KS4 (Institute of Physics 2006). Therefore, this paper considers the extent to which any gender ‘gap’ in participation in science courses has changed in the first years following the reforms, especially for Triple Award.

Stratification of school science participation by socio-economic status

In England and the UK more widely, there has long been a general concern about the degree and extent of the relatively low attainment of students from lower socio-economic groups across all subjects in the school curriculum (Gorard & See 2009; Equalities Review 2007). As Gorard and See (2009) point out, the lower attainment for these groups is evidenced from early on in their education - see also Chowdry et al. (2011). For school science, the choice made at age 14 of which KS4 science course to follow is often dependent upon assessment results at KS3, and so there is a propensity for stratification of these course by SES. Additionally, there is evidence that parental education level, admittedly a crude indicator of student SES, also impacts on options taken at 14, with students of parents without degrees less likely to take Triple Award compared to students whose parents do have degrees (Sullivan et al. 2010).

Since the reforms are intended in part to promote inclusion as well as improving social mobility, this paper considers how stratification of science courses by SES has changed over the time of the reform, and the extent to which any stratification by SES can be accounted for by prior attainment.

The aims of this paper

As evidenced above and to summarise, science participation at KS4 is known to be stratified by both gender and SES. The central questions to be addressed in this paper are:

- How has the overall pattern of participation at KS4 by science course changed over the period before and after the reforms?

- Is there evidence that patterns of participation are more equitable following the reforms in terms of gender and SES, or has the existing stratification shown little change or even increased?
- To what extent are differential gender and SES participation rates at KS4 due to differential prior attainment between the relevant sub-groups at KS3?
- How can national data be used to assess and monitor the overall impact of nationally set policies intended to promote the uptake of science and greater social inclusion?

The article does not enter into the debate concerning the academic parity or otherwise of types of courses/qualifications, and the related issue of whether stratification by student characteristics is desirable or otherwise (Oates 2010; Wolf 2011).

Methods

Datasets and KS4 science course options

The National Pupil Database (NPD)[3] is a longitudinal database containing student-level personal and attainment data for all students in maintained schools in England, including those schools with academy status. In particular as relevant to this study, it includes all KS3 and KS4 assessment results as well as student gender and indicators that can be used as proxies for student SES. This combination of both attainment and social data allows the longitudinal investigation into participation rates between different courses, and how these rates might differ by gender and

[3] See http://nationalpupildatabase.wikispaces.com/ (accessed 27/07/11).

SES, and how any stratification changes over time. Students studying science in private (i.e. independent) schools form approximately 8% of the 14-16 age group in England (DFE 2011), and cannot form part of the analysis. Whilst examination results from private schools are present in the NPD, there are no matched student characteristics available for students in these schools. Further, private schools are not required to follow the national curriculum and so reforms thereof do not have a direct impact on them in the way that they do for state funded schools.

The analysis in this paper concerns **five** successive cohorts of students:

i. The **two** cohorts immediately preceding the 2006 reform (beginning KS4 in Year 10 in 2004 and 2005; examinations and assessments in 2006 and 2007 respectively). These provide a baseline for subsequent analyses.

ii. The first **three** post-2006 reform cohorts of students (beginning KS4 in Year 10 in 2006, 2007, and 2008; examinations and assessments in summer 2008, 2009, and 2010 respectively).

For each cohort, students are grouped into one of six categories of science 'course' based on the KS4 qualifications they achieved, and this breakdown is shown in Table 1. Some of these 'courses' are composite (i.e. made up of multiple qualifications). The approximate number of students in each cohort is 600,000 and the precise proportion taking each of these courses and how this changes over time will be detailed later (Figure 1).

There is a seventh category in Table 1 for those students in each cohort who, whilst present in the Pupil Annual Level Census (PLASC) data, did not have any qualification records in the NPD corresponding to any of the preceding science courses listed in Table 1. Since the studying of science is a statutory requirement at KS4, it is likely that the majority of students in this last group did follow a science course throughout KS4 but were not entered for any examination/assessments in the relevant year.

TABLE 1 HERE

The courses in Table 1 might be interpreted as arranged broadly in descending order of the emphasis on traditional scientific knowledge. For example, Triple Award Science and Double/Dual Award Science provide the standard routes into the study of the separate sciences post-16 (i.e. biology, chemistry and physics A-levels).

Applied sciences courses have a stronger focus on the use of science knowledge within vocational contexts such as healthcare and forensic science. Entry Level Qualifications are targeted at students working at below grade G at GCSE level, whereas the other courses cover the full range of GCSE (or equivalent) grades.

The longitudinal analysis of participation rates will focus on the first four of the courses listed in Table 1 (shaded). As will be seen (Figure 1), approximately 80% of the cohort does one of these four courses.

Indicators of socio-economic status

Two separate measures are available in the NPD as proxies for socio-economic status (SES):

- Free School Meal (FSM) eligibility – this is a dichotomous variable, indicating whether or not a student is eligible for and in receipt of free school meals. At any one time approximately 14% of the KS4 student population is FSM-eligible.
- The Income Deprivation Affecting Children Index (IDACI) indicates the proportion of children under age 16 in the local area where the student lives who are living in low income households. It is measured on a scale from 0.00 to 1.00, so that higher values correspond to greater deprivation in the local area. This measure has a highly positively skewed distribution, so that most of the distribution is below the mean value, implying that the median is a better measure of 'typical' value. The median IDACI value in the KS4 student population in England is approximately 0.16 implying that the 'typical' student lives in an area where 16% of children come from low income households.

Children are classified as 'eligible' for FSM only if they are both eligible for and claiming FSM. Partly for this reason, FSM-eligibility as recorded in the NPD has been criticised as a crude, and sometimes poor measure of SES (Hobbs & Vignoles 2010), but is it has the advantage of being simple to understand, and is a direct measure of the student. The IDACI, on the other hand, concerns the area the student lives in rather than that student themselves but is a more refined measure compared to the dichotomous FSM variable. Since each of these indicators brings advantages and disadvantages as proxies for SES, they are both employed as such in this paper.

Measures of stratification

Over the five years under study, the following summary statistics are reported in graphical and tabular form:

- the percentage of students in the cohort doing each course listed in Table 1
- the percentage of female students within each course
- the percentage of FSM-eligible students and the median IDACI within each course

The longitudinal patterns of participation are analysed, and the findings for the two measures of SES are compared.

Accounting for prior attainment

The students taking courses towards the top of Table 1 generally have higher prior attainment compared to students doing courses lower down (Homer et al. 2011). An analysis of changing participation rates (as proposed above) does not account for the possibility of differential changes in patterns of attainment at KS3 (i.e. by gender or FSM-eligibility) that might then influence the pattern of uptake of KS4 courses.

To control for the effect of prior attainment, the results of two separate logistic regression analyses are presented (termed Models 1 and 2). For each of the five cohorts, these models compare the likelihood of participation in Triple Award versus that in Double/Dual Award, and each includes two predictors:

- Model 1: KS3 science level and gender
- Model 2: KS3 science level and FSM eligibility.

Model 1 produces a measure (an odds ratio) that indicates the likelihood of participation in Triple Award versus Double/Dual Award for boys (against girls) *having controlled for prior attainment in KS3 science*. Odds ratios are difficult to interpret (Bland & Altman 2000) but can be converted to probabilities which are generally more intuitive. Comparing the odds ratios (or the associated probabilities) for different cohorts shows how the influence of gender on uptake of Triple or Double/Dual Award changes over time. The results from Model 2 give corresponding measures of the influence of FSM-eligibility.

These more complex analyses are focused on a comparison between Triple Award and Double/Dual Award for two central reasons:

1. In terms of student numbers these are the two most popular science courses as KS4 (as of 2010). Further, Double/Dual Award science is the modal course at KS4 across all five cohorts.
2. These two courses provide the standard routes into post-16 science study (e.g. A-levels), with many schools preferring students to study Triple Award over Double/Dual Award in this regard.

Methodological limitations

National data are not the result of a controlled experiment, and therefore any causality has to be inferred on the basis of a 'best fit' explanation of findings rather than being directly demonstrable (Levin 1999). In a complex and evolving school system, there are many external influences on what happens at KS4 that do not form part of our data. For example, the school inspection regime together with school accountability measures based on student performance (including school league tables), play an important role in the shaping of school and student responses in terms of course options and choices (Banner et al. 2011; Perryman et al. 2011) but cannot form part of our analysis. It is always possible that changes in patterns of participation might be partly due to other (unmeasured or unknown) influences rather than as a direct result of the reforms.

In addition, it is generally recognised that educational reforms can take a long time to have a major impact (Kahle 2007), and a second weakness in this study is that the data cover only the first three post-reform years.

Nevertheless, it is hoped that the analysis do provide real insight into how the early phases of the reform are playing out nationally. It is likely, however, that future reforms will further cloud the issue (see conclusion), making it ever more difficult to investigate the singular impact of the earlier reforms as time progresses.

Results

Overall participation

Figure 1 shows how overall participation across the range of science courses at KS4 has changed, with an increased 'diversification' of awards (i.e. more students doing more types of course).

FIGURE 1 HERE

The major longitudinal changes over the five years are that the percentage doing Triple Award has shown significant growth (from 5.6% to 16.1% of the cohort), Double/Dual Award has declined (from 68.6% to 46.0%), and the percentage doing applied courses has grown (from 6.3% to 21.5%, combining the two 'applied' options).

Over the period of the study, the first four of the courses detailed in Figure 1 (Triple Award, Double/Dual Award, Dual Award Applied, and Other Applied) account for between 77.5 and 83.7% of the cohort. These courses will be the focus of the remainder of the analysis and discussion in this paper.

Course participation by gender

Figure 2 shows the longitudinal change in the within-course percentage of girls participating in the first four courses listed in Table 1. The full details across all courses are given in Table A1 in the appendix.

The overall percentage of girls in the cohort is quite stable over the five years at 48.8 or 48.9%. For courses where the percentage of girls is above this level they are over-represented compared to the cohort as a whole, whilst for courses with the percentage of girls below this they are under-represented.

FIGURE 2 HERE

There is evidence in Figure 2 that in equity terms girls have generally 'benefitted' from these reforms, since, for example, the percentage of girls taking Triple Award has increased (from 41.8% to 44.8%, so that the gender 'gap' between the overall percentage female and that within Triple Award has declined from 7.0% to 4.1%). It should be noted, however, that as of 2010 girls remain under-represented on this course. There has been little change to the slight over-representation of girls on Double/Dual Award. However, patterns of change in participation in Dual Award Applied Science tell a different story with girls becoming more over-represented. In Other applied science courses there has been a move towards greater gender equity, but girls remain over-represented in these courses too.

This analysis is a zero-sum game in the sense that over-representation somewhere must correspond to under-representation elsewhere. Looking across all available KS4 science courses, the data in Table A1 show boys are more over-represented than they were before the reforms in Entry Level Qualifications (ELQ) and amongst those students not awarded any qualification in science at KS4.

Course participation by SES

Figure 3 shows the longitudinal change in the within-course percentage of FSM-eligible students participating in select courses for select courses listed in Table 1. Again, the full details across all courses are given in the appendix (Table A2). The appendix also includes Table A3 detailing the median IDACI within course.

The overall percentage of FSM-eligible students has declined slightly from 15.2% to 14.0% whilst the median IDACI for the whole cohort shows a small increase from 0.158 to 0.165.

FIGURE 3 HERE

In contrast to the changes in patterns of participation by gender, particularly for Triple Award, there is only tentative evidence of the reforms having any significant impact on the existing stratification by student SES. Overall patterns of participation within all KS4 science courses remain broadly as they were across different socio-economic groups, with FSM-eligibility or IDACI telling much the same story (Table A3). There has, for example, been a small increase in the percentage of Triple Award students eligible for FSM (from 4.4% to 5.3% so that the FSM ‘gap’ between the overall percentage FSM and that within Triple Award has declined from 10.8% to 8.6%), but these students remain grossly under-represented on this course. Participation in Dual Award Applied shows a move towards SES equity, but Other Applied courses show a divergence in this regard.

Course participation controlling for prior attainment

As stated earlier, prior attainment at KS3 is an important factor in course choice at KS4, and this is in part due to the differences across the KS4 courses in their emphasis on traditional scientific content.

For model 1, Figure 4 shows the probability of boys participating in Triple Award (compared to Double/Dual Award) in each cohort. The comparison is with that of a group of girls with the same prior attainment, half of whom participate in Triple Award and half in Double award (so that in each cohort an individual girl has a probability of participation in Triple Award of 0.5). Hence, Figure 4 gives a measure of how much more likely (than girls) boys are to participate in Triple Award compared to Double Award and how this changes over time.

For model 2, Figure 4 shows a similar set of probabilities comparing FSM-eligible students to non-eligible students (with the latter again assumed to have a 50:50 probability of participating in Triple Award).

FIGURE 4 HERE

A summary of the model statistics for these analyses is shown in Table A4 in the appendix. The models do not show particularly 'good fit' in terms of variance explained (and cases correctly classified) and so should be treated as indicative rather than definitive.[4]

[4] Other more complex models using ordinal and multinomial regression to compare gender/SES effects across all courses whilst controlling for prior attainment were also relatively poor. Following the principle of parsimony, it was decided to only include simple models that involve straightforward

Figure 4 shows that having controlled for prior attainment at KS3, the probability of participation in Triple Award (compared to Double/Dual Award) is greater for boys than for girls (consistently greater than 0.5 over the five cohorts), but there is a downward trend over time towards more equitable likelihood of participation (i.e. the horizontal line at value 0.5).

Over each of the five years of the study, FSM-eligible students remain less likely to take Triple Award (compared to Double/Dual Award) having controlled for prior attainment. This is an important finding demonstrating that even accounting for the much lower prior attainment in the FSM-eligible group there remains a residual 'bias' against these students in terms of participation in the most academically orientated courses.

However, Figure 4 also indicates tentative evidence that there has also been a recent move towards equitable participation in terms of FSM-eligibility. A third model, replacing in model 2 FSM-eligibility with IDACI (as a co-variate, results not presented here), corroborates this recent trend towards greater equity in terms of participation by SES. It also shows that the more deprived the area the student lives in the less likely he or she is to participate in Triple Award, even having accounted for prior attainment.

The key difference here in comparison with gender is that FSM-eligible students (and, more generally, students from poorer areas) continue to achieve significantly

comparison between two courses, and also to ignore the issue of pupils nested in schools (i.e. hierarchical clustering).

lower on average at KS3 than do their non-eligible peers (Gorard & See 2009). It is therefore easy to misinterpret the results of model 2 (Figure 4) as indicating that FSM-eligible students are, as of 2010, almost equally likely to participate in Triple Award as are their non-eligible peers. This is not the case as model 2 has taken account of the large difference in prior attainment between the two groups. The resulting ‘FSM effect’ on participation evidenced in model 2 is substantially weakened once prior attainment has been accounted for in the modelling since there is a strong association between FSM-eligibility and KS3 performance. The same is not true in the case of gender where KS3 attainment is broadly similar between boys and girls.

Discussion

There is good evidence that the introduction of the entitlement to Triple Award has been successful in driving up the total number of students taking this course, one of the aims of the its introduction. As of 2010, the increase in Triple Award student numbers shows no sign of tailing off (Figure 1). Preliminary evidence from qualitative data (not reported here) indicates that the entitlement has made Triple Award more and more the standard science route in schools for high achievers, replacing Double/Dual Award in this regard, and these high achieving students include roughly equal numbers of boys and girls. Through this reform, schools have been incentivised to move towards a more equitable gender balance in participation in Triple Award.

The analysis has also shown that participation across the full range of KS4 science courses remains stratified by both gender and SES (Figures 2 and 3 respectively), and that stratification remains even after accounting for prior attainment (Figure 4). This latter point is important – whilst prior attainment is a key driver of stratification in upper school science, especially in terms of SES, there are (apparently) other factors at play, perhaps including student identity, shaped in part by parent and school attitudes to participation in science (Archer et al. 2010), and the availability or otherwise of qualified science teachers in particular schools and the effect this might have on courses offered in schools, particularly Triple Award (Gorard & See 2009). Measures of these attitudinal and other differences between students, parents and schools are not present in our data.

Whilst the focus of this paper in terms of gender and participation has been on Triple Award, where there is evidence of disadvantage for girls (all be it decreasing over time), the patterns of participation in other courses tell a different story. Amongst the courses with less emphasis on academic content or where there is no KS4 science achievement at all, the simple analysis of participation rates shows that boys are becoming ever more over-represented. This supports the contention that reforms that introduce more course/choice options can lead to less equitable participation (van Langen et al. 2008). The role of prior attainment in influencing these changing participation patterns across courses other than Triple and Double/Dual Award has yet to be fully explored, and could form part of future work.

The role played by student SES in science participation at KS4 is different to that of gender. It is well known that students lower down the socio-economic scale generally achieve relatively poorly as a group at KS3 across a range of subjects including science (Gorard & See 2009). As these authors point out, ascribing casual explanations for lower levels of attainment for particular student sub-groups based on SES is very difficult, but they surmise that low prior attainment at any particular stage is predicated on low prior attainment at the previous stage, and that differences across sub-groups are evidenced from a very early age. However, even when prior attainment at KS3 is taken into account, Triple Award remains a less likely option at KS4 for FSM-eligible students compared to Double/Dual Award. This could in part be due to problems in some types of schools with the recruitment and retention of good quality science teachers (Ofsted 2011). Unfortunately, the reforms cannot directly impact either the teacher recruitment/retention problem, or more broadly on the systematic under-achievement at KS3 of FSM-eligible students as a whole. Hence, the increased flexibility and diversification of pathways on offer following the reforms (Banner et al. 2010) has made little change, with the highly stratified pattern of participation by SES generally untouched. It appears that the aim of the reforms relating to increasing social mobility (Ryder & Banner 2010) shows little sign of being realised, at least from the point of view of student socio-economic background.

Methodologically, one point of interest is that the analysis has demonstrated that the two proxies for socio-economic status, FSM-eligibility and IDACI, generally agree in terms of broad findings related to gender and SES. This provides additional reassurance that the findings in this area are robust and that the two measures, whilst different in character, share considerable commonality.

Conclusion

Through the analysis of longitudinal national data, this paper shows that curriculum reform and the offer of entitlements for particular courses can and do impact on stratification, but only for certain sub-groups in certain specific circumstances. The example of girls and Triple Award shows that if there is a latent ability/achievement that, perhaps for socio-cultural reasons, was not previously reflected in course participation rates for particular sub-groups, then appropriate reform through course entitlements can have an important impact. If, however, the stratification across courses is largely based in a more straightforward way on prior attainment (as it is for FSM-eligible pupils), then the reform is likely to make little overall difference to patterns of participation for such disadvantaged sub-groups and is therefore unlikely to have much long term impact on social mobility or inclusion. These findings largely concur with those of Heath & Sullivan (2011) who across several countries report that in terms of socio-economic status curricula reforms (not necessarily in science education) make little impact in terms of equity, but that in terms of gender, wider societal pressures are more likely to have an effect.

With the change of government in the UK in 2010, new policies and further school curriculum reforms are expected (DFE 2010). These include simplifications to value-added measures in schools to no longer take account of the profile of pupils within the school, and the introduction of the English Baccalaureate (an additional performance indicator whose science component consists of two non-applied science GCSEs and excludes non-GCSE science qualifications). In addition, alongside all other subjects, the national science curriculum is under review. Ongoing work will be needed to monitor both the continuing impact of the earlier science education reforms central to this article, and also to assess how any new policies are affecting differential participation rates in upper school science.

Finally, the nature of any findings resulting from the analysis of national data, whilst often insightful, is necessarily limited (Homer et al. 2011). Additional in-depth work at the school level with students, teachers and others will always be necessary in order to complement the large-scale findings with individual and institutional experience of curriculum reform.

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[5] For more details see http://www.education.leeds.ac.uk/research/cssme/projects.php?project=99&page=1 (accessed 25/07/11)

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Appendix

Tables

Table 1

Course/qualification	Description
Triple Award Science	Students awarded all three of the separate GCSEs in biology, chemistry and physics
Double/Dual Award Science	Students awarded Double Award (prior to the reform), or awarded GCSE Science and GCSE Additional Science (post the reform).
Dual Award Applied Science	Students awarded GCSE Science and GCSE Additional Applied Science (available post the reform only)
Other Applied Science	Students awarded Dual Award Applied Science, BTEC First Diplomas or OCR Nationals in science.
GCSE Science Only	Students awarded GCSE Science only and no other science course/qualification.
Entry Level Science Qualification	Students awarded an Entry Level Qualification (pre-GCSE) in science.
None of the above science courses	Students with no record of a science course/qualification in the NPD at the relevant time.

Table A1

Course	KS4 cohort				
	04-06	**05-07**	**06-08**	**07-09**	**08-10**
Triple Award Science	41.8	40.9	43.0	44.1	44.8
Double/Dual Award Science	50.0	50.2	49.9	50.1	50.2
Dual Award Applied Science	NA	NA	52.9	53.8	54.3
Other Applied Science	53.3	53.4	54.2	53.0	52.6
GCSE Science Only	49.1	48.6	48.5	47.4	46.7
Entry Level Science Qualification	39.8	40.5	39.0	38.6	34.2
None of the above science courses	41.4	42.1	41.1	40.8	40.3
Overall	**48.8**	**48.9**	**48.9**	**48.9**	**48.9**

Table A2

Course	KS4 cohort				
	04-06	**05-07**	**06-08**	**07-09**	**08-10**
Triple Award Science	4.4	4.3	4.3	4.6	5.3
Double/Dual Award Science	11.9	11.2	10.5	10.5	10.4
Dual Award Applied Science	NA	NA	16.1	15.6	14.7
Other Applied Science	19.3	18	17.9	19.1	20.2
GCSE Science Only	23.3	22.3	21.7	22.2	22.3
Entry Level Science Qualification	31.7	31.1	30.9	31.5	33.9
None of the above science courses	34.1	31.9	30.2	31.4	32.7
Overall	**15.2**	**14.4**	**14.2**	**14.1**	**14.0**

Table A3

Course	KS4 cohort				
	04-06	**05-07**	**06-08**	**07-09**	**08-10**
Triple Award Science	0.086	0.087	0.086	0.099	0.104
Double/Dual Award Science	0.139	0.137	0.134	0.144	0.143
Dual Award Applied Science	NA	NA	0.186	0.185	0.169
Other Applied Science	0.226	0.227	0.233	0.254	0.250
GCSE Science Only	0.235	0.233	0.229	0.241	0.233
Entry Level Science Qualification	0.252	0.273	0.271	0.266	0.264
None of the above science courses	0.290	0.291	0.283	0.306	0.310
Overall	**0.158**	**0.158**	**0.158**	**0.168**	**0.165**

Table A4

<table>
<tr><th rowspan="2">Model</th><th rowspan="2" colspan="2">Model fit/odds ratios</th><th colspan="5">KS4 cohort</th></tr>
<tr><th>04-06</th><th>05-07</th><th>06-08</th><th>07-09</th><th>08-10</th></tr>
<tr><td rowspan="4">1. Gender</td><td colspan="2">Nagelkerke R Square</td><td>0.280</td><td>0.273</td><td>0.276</td><td>0.288</td><td>0.307</td></tr>
<tr><td colspan="2">KS3 science level (odds ratio)</td><td>5.168</td><td>5.171</td><td>4.936</td><td>4.599</td><td>4.486</td></tr>
<tr><td rowspan="2">Boys</td><td>odds ratio</td><td>1.435</td><td>1.356</td><td>1.324</td><td>1.336</td><td>1.220</td></tr>
<tr><td>Probability (girls=0.5)</td><td>0.589</td><td>0.576</td><td>0.570</td><td>0.572</td><td>0.550</td></tr>
<tr><td rowspan="4">2. FSM</td><td colspan="2">Nagelkerke R Square</td><td>0.276</td><td>0.270</td><td>0.274</td><td>0.285</td><td>0.306</td></tr>
<tr><td colspan="2">KS3 science level (odds ratio)</td><td>5.125</td><td>5.160</td><td>4.894</td><td>4.538</td><td>4.467</td></tr>
<tr><td rowspan="2">FSM-eligible</td><td>odds ratio</td><td>0.849</td><td>0.839</td><td>0.800</td><td>0.800</td><td>0.886</td></tr>
<tr><td>Probability (ineligible=0.5)</td><td>0.459</td><td>0.456</td><td>0.445</td><td>0.444</td><td>0.470</td></tr>
<tr><td colspan="8">Outcome variable=TA (compared to DA).

Predictors are KS3 Science level and 1. Gender, 2. FSM eligibility</td></tr>
</table>

Table captions

Table 1: KS4 science courses

Table A1: Percentage of female participation within course

Table A2: Percentage of FSM-eligibility within course

Table A3: Median IDACI within course

Table A4: Logistic regression model fit, odds ratios and probabilities

Figures

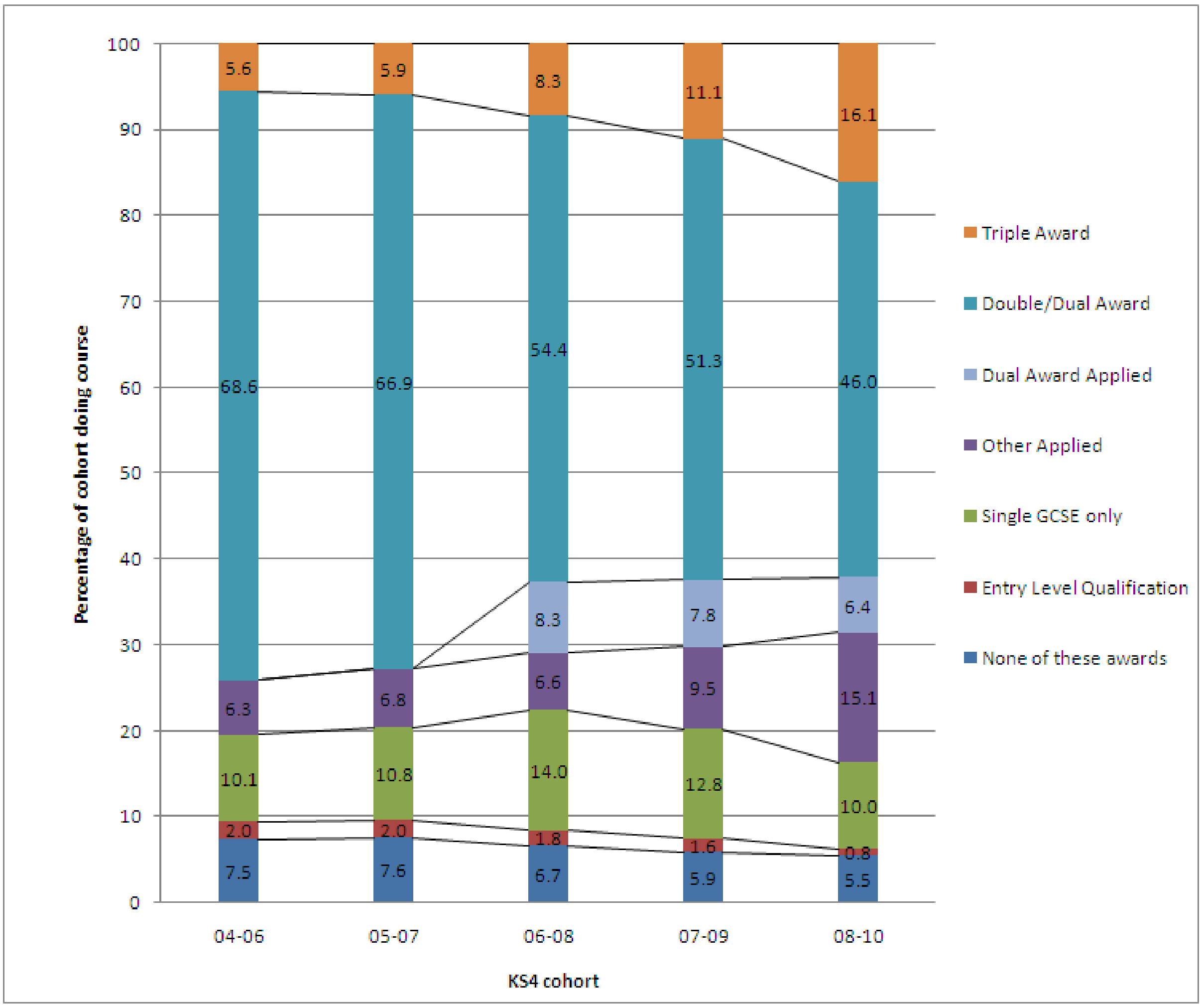

Figure 1: KS4 participation in science courses across cohorts

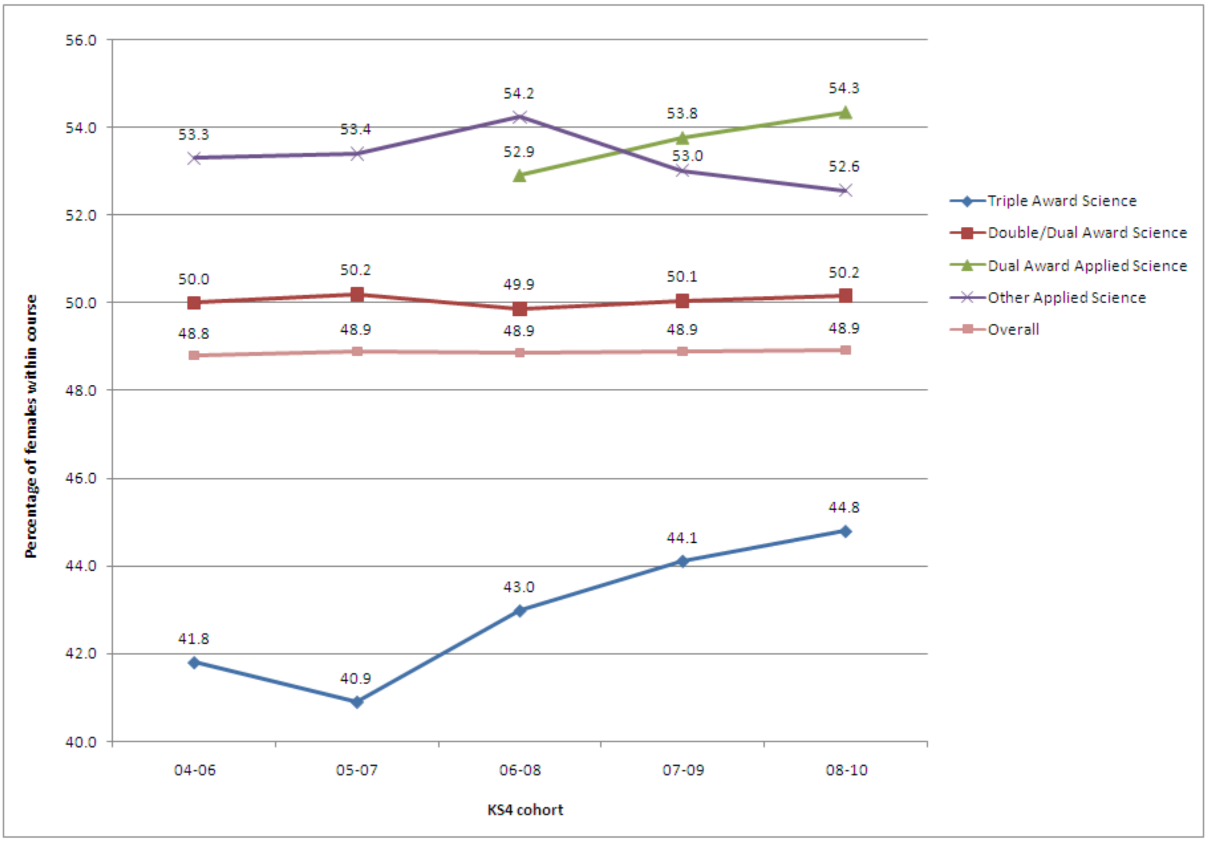

Figure 2: Percentage of female participation within select KS4 courses

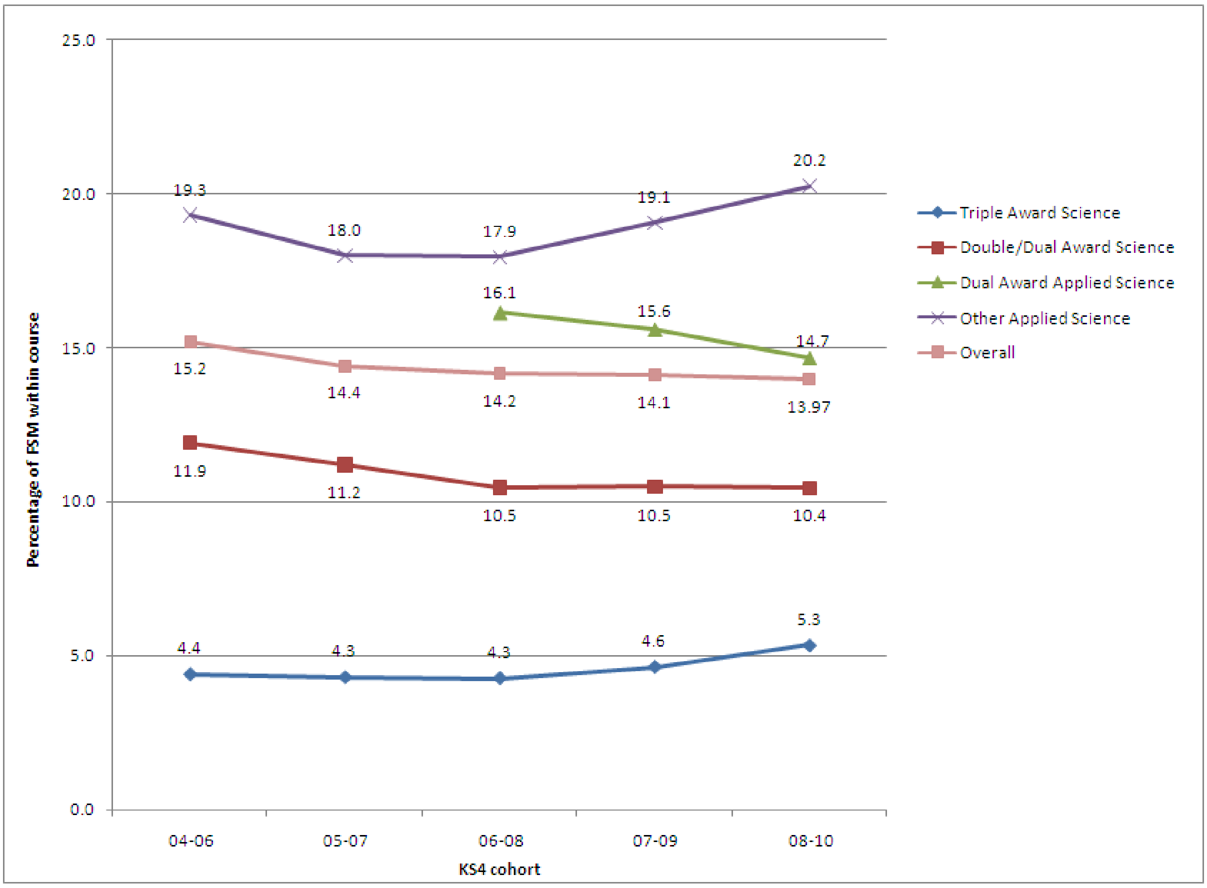

Figure 3: Percentage of FSM-eligible students within select KS4 courses

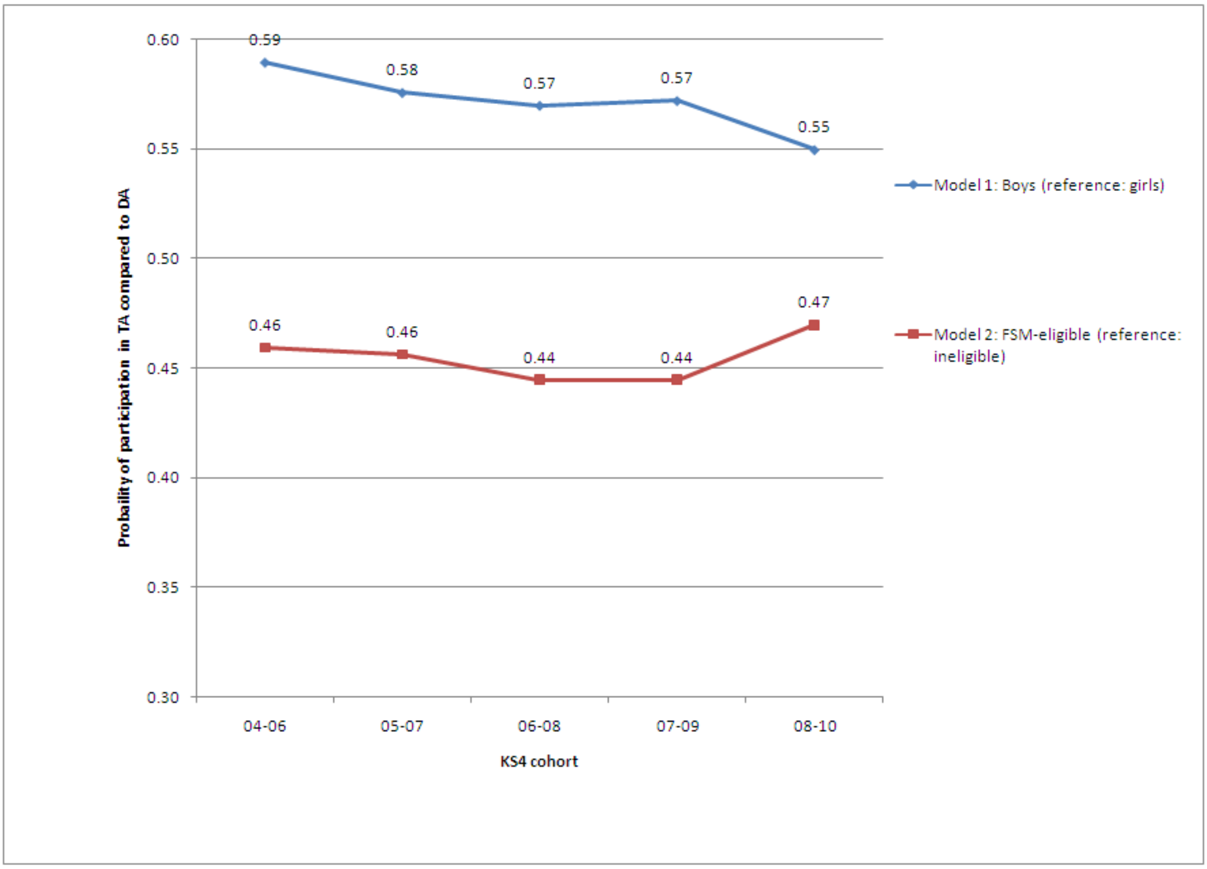

Figure 4: Probabilities of participation in TA compared to DA – boys and FSM-eligible students