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The relationship between local authority schools' funding levels and their provision of qualifications

Research Report

Tim Gill

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Author contact details:

Tim Gill
Assessment Research and Development,
Research Division
Cambridge Assessment
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA
UK

gill.tim@cambridgeassessment.org.uk

<http://www.cambridgeassessment.org.uk>

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Introduction

For the past few years there have been decreases in the average real per-pupil funding for secondary schools (Belfield, Farquharson and Sibieta, 2018). According to research from the Education Policy Institute think tank (Perera, Andrews & Sellen, 2017) further decreases are also likely when a new National Funding Formula (NFF) is introduced: their research estimated that all schools will see a real terms cut in funding between 2017 and 2020 due to the introduction of NFF. Furthermore, around half will have large reductions in real funds of between 6 and 11% over the same period.

One possible impact of these cuts is a reduction in the number of different subjects or qualifications offered by schools. There have already been reports of schools dropping subjects because of funding pressures. For example, the Association of School and College Leaders (ASCL, 2017) reported the results of a survey of their members which found that 72% of respondents whose schools teach Key Stage 4 said that their school had removed either GCSE or vocational courses in the past 12 months due to funding pressures. The National Education Union also surveyed its members (NEU, 2018) about the impact of funding reductions on their school. They found that 50% of secondary school respondents reported a reduction in the range of non-Ebacc subjects in the last 12 months, and a similar percentage reported a fall in vocational options available.

The main aim of this research was to investigate whether there was empirical evidence of a relationship between falls in per-pupil funding and schools reducing their subject offer. More specifically, the aim was to investigate whether those schools that had suffered the most severe reductions in funding were more likely to stop offering subjects than others and, if so, to discover which subjects were most likely to be dropped.

Data and methods

There were two main sources of data used in this research. Data on per-pupil funding for each local authority (LA) maintained secondary school was downloaded from a government website (<https://www.compare-school-performance.service.gov.uk/download-data>) for the years 2010/11 to 2015/16. Data on academy schools and independent schools was not analysed because the financial data for these schools was not available. Data on the qualifications and subjects offered by LA maintained schools was taken from the Key Stage 4 (KS4) extract of the National Pupil Database (NPD) for the years 2011/12 to 2016/17. The NPD is a database of results for all students in all subjects in schools and colleges in England, maintained by the Department for Education.

The two sets of data did not entirely align in terms of years because we expected a lag between changes in funding and changes in provision¹. However, it was not clear how much of a time lag there was likely to be between these two factors. In other words, how long would it take for schools to react to a reduction in funding by, for example, dropping a

¹ The definition of provision used in this report was as follows: A school was deemed to have provided a subject in a particular year if at least one student in the school took an assessment in that subject in that year.

subject? Additionally, it was necessary to take into account the fact that the data on provision was only available at the end of the course, because the NPD only records results at the end of KS4. For example, it may be that a school stopped offering a particular subject to students starting KS4 courses in 2013/14. However, this information would only reveal itself in the 2014/15 NPD when it would be clear that there were no students with a result in the qualification subject in question.

To account for different possible time lags, the percentage change in per-pupil funding was calculated for each school for three different time periods: three years (2010/11 to 2013/14), four years (2010/11 to 2014/15) and five years (2010/11 to 2015/16). Then changes in provision were calculated for three different time periods: three years (2013/14 to 2016/17), four years (2012/13 to 2016/17) and five years (2011/12 to 2016/17) This meant it was possible to assess changes to provision between the start year and 2016/17 based on changes to funding, whilst accounting for time lags of one, two and three years. The data was then restricted to those schools with funding data in each year (2010/11 to 2015/16). This meant any schools that closed or converted to an academy, or any new schools which opened during the period in question were excluded.

Some caution is required when interpreting the funding data, because it is self-reported by schools (DfE, 2017a) and therefore may be subject to errors. The funding data is reported annually by schools and includes both funding from central government and any other revenue generated by the schools themselves. Due to the possibility of errors in self-reporting, some schools with 'extreme' values were excluded. These were schools where the reported per-pupil funding (for the first year or the last year of each analysis) was more than three standard deviations above or below the mean value across all schools. Furthermore, after calculating the percentage *change* in funding between the first and last years of each analysis, any schools with a change in funding which was more than three standard deviations above or below the mean value across all schools (i.e. schools with very large increases or reductions in funding) were also excluded. These exclusions reduced the data to 926 schools for the five year analysis, and 928 schools for both the four year and three year analyses. We controlled for inflation so that all funding data was in 2010 prices².

A further shortcoming with the funding data is that some LAs centrally retain the funds for school support services, such as finance, HR and IT (DfE, 2016), meaning that schools in these LAs will have reported funding levels which appear lower than they actually are. It is not known which schools are in LAs which do this, or whether any LAs changed their policy on this during the time period investigated.

A number of other factors were likely to influence provision (or changes in provision) of a particular qualification subject. It was important to take account of as many of these factors as possible so the effect of funding changes could be evaluated in isolation. These were:

- Number of students taking the subject in the first year of the analysis (e.g. 2011/12 for the five year provision change analysis). Subjects with lower levels of uptake were probably more likely to be dropped.

² Using the Bank of England inflation calculator (<https://www.bankofengland.co.uk/monetary-policy/inflation/inflation-calculator>) it was possible to generate a multiplier for each year so that the value of school funding could be converted to 2010 prices. The multipliers used were as follows: 2011/12 = 0.951; 2012/13 = 0.921; 2013/14 = 0.894; 2014/15 = 0.873; 2015/16 = 0.865;

- Average of the number of students in the school at the end of KS4, across the time period in question (e.g. 2010/11 to 2013/14 for the three year funding change analysis). Having more students in total might mean that subjects were less likely to be dropped.
- Change in the number of students at the end of KS4 over the time period. A big fall in the number of students in a school might mean subjects were more likely to be dropped.
- Total number of different subjects offered by the school in the first year of the analysis. Schools with a larger subject offer might have been more likely to drop a subject.
- Mean prior attainment of students at the end of KS4 in the school, over the time period. Prior attainment was measured as the average fine level for English and Maths at KS2. The student make-up of a school (see also the percentages of free school meal students and special educational needs students, below) may have had an impact on which subjects were dropped. For example, some qualifications may be more suitable for pupils of lower ability and therefore schools with high proportions of these pupils were less likely to drop them even when funding pressures increased.
- Mean percentage of students (at the end of KS4) who had claimed for free school meals (FSM) in any of the previous six years, over the time period.
- Mean percentage of students (at the end of KS4) who were classified as having special educational needs (SEN), over the time period.
- School type – Comprehensive, Selective or Secondary Modern.

For the analysis of provision, we grouped similar qualifications together. This was because schools may swap between these qualifications (in the same subject), but this should not count as dropping a subject. For example, International GCSEs can be considered equivalent to GCSEs in the same subject. However, qualifications can also be categorised by their GCSE equivalent ‘size’ and by their level of difficulty (entry level, level 1 or level 2). Qualifications of different size or level were not considered equivalent, even if in the same subject. Table 1 details the different qualification groups used in the analyses.

Table 1: Qualification groupings

Qualification group	Qualifications included
GCSEs	All GCSE / International GCSEs
GCSE Short Courses	All GCSE Short Courses
Other General Qualifications (GQs)	Other GQ, Level 1/2 Certificates
Vocational qualifications (VQs)	BTECs, Cambridge Nationals, Vocationally Related Qualifications (VRQs)
Skills qualifications	Functional Skills, Key Skills, Basic Skills
Entry Level Qualifications (ELQs)	All ELQs

Two separate analyses were undertaken of the impact of changes to funding on the subjects offered by schools. First, we looked at the relationship between changes to funding and changes to the total number of subjects offered in a school, over the time periods of three, four and five years. In other words, was there a general trend for schools to reduce their

subject offer if their funding was reduced? Additional analyses were undertaken for the numbers of different types of qualification offered (general qualifications, vocational qualifications and other qualifications).

This was followed by a more detailed investigation of individual subjects, to see if there was a relationship between changes to funding and the likelihood of dropping the subject. For this analysis, only centres offering the subject in the first year were included.

Regression analyses

For both these investigations, an initial descriptive analysis was followed by fitting a number of regression models, to infer which factors were most important in determining whether or not subjects were dropped by schools. For the first analysis, a series of linear regression models were fitted, with the dependent variable being the percentage change in the number of subjects offered by schools. A number of independent variables were included in these models, taken from the list on pages 2-3; however, given the central aim of the research, the results section in this report focusses on the effect of the change in per-pupil funding variable only.

Multilevel models (MLMs) were used, to account for the clustering of schools within LAs. This clustering means that schools within a LA were likely to have more similar outcomes than schools in different LAs. Had this type of model not been used the standard errors of the regression coefficients would have been underestimated, leading to spuriously high levels of statistical significance. For a more detailed description of multilevel logistic regressions see Goldstein (2011). The use of MLMs should also partially account for the fact that LAs have different approaches for the allocation of funding for school support services (see above).

The general form of the models was as follows:

$$y_{ij} = \beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2ij} + \dots + \beta_k x_{kij} + \mu_j + \varepsilon_{ij}$$

Where y_{ij} is the change in the total number of subjects offered by school i in local authority j , x_{1ij} to x_{kij} are the independent variables, β_1 to β_k are the regression coefficients, μ_j is a local authority effect (technically known as the level 2 “random” effect) and ε_{ij} is the residual difference between a school’s predicted and actual change in number of subjects offered.

For the second analysis, a series of logistic regression models were required, one for each subject with the dependent variable being whether or not schools dropped the subject over the time period investigated. Again, there were a number of independent variables which were included in the models, but we were only interested in the change in per-pupil funding variable. As before, MLMs were used to account for the clustering of schools with local authorities. The general form of the models was as follows:

$$\log\left(\frac{p_{ij}}{1 - p_{ij}}\right) = \beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2ij} + \dots + \beta_k x_{kij} + u_j$$

where p_{ij} is the probability of school i from local authority j dropping the subject, x_{1ij} to x_{kij} are the independent variables, β_0 to β_k are the regression coefficients and u_j is a random effect at local authority level.

Selecting subjects

For the analysis of dropping of individual subjects, there were a number of considerations when deciding which subjects to look at. First, there were some subjects, such as English and Mathematics, which were compulsory and therefore should not be dropped by any schools. There were also a number of subjects (e.g. Core Science, Additional Science, History and Geography) where the 'dropping' percentage was very low. For these it seemed unlikely that funding levels would be relevant. In contrast, there were some subjects with a very high rate of dropping. These tended to be subjects which were about to be removed from league tables or were no longer available (e.g. English Language and Literature GCSE). Again it seems unlikely that funding levels would be relevant to the decision about whether to drop these subjects. Once these subjects were excluded, the remaining subjects were ordered by qualification type and by the total number of schools offering the subject in the initial year of analysis (2011/12). The ten most popular GCSE subjects were selected, along with the subjects in each of the other qualification categories where at least 100 centres offered the qualification in the original year (up to a maximum of five subjects). Table 2 details the number of subjects in each of the categories.

Table 2: Number of individual subjects in each qualification group included in analysis

Qualification group	No of individual subjects included
GCSEs	10
GCSE Short Courses	1
Other General Qualifications (GQs)	2
Vocational qualifications (VQs)	5
Skills qualifications	4
Entry Level Qualifications (ELQs)	1

Results

Descriptive analyses

Changes to funding

Figure 1 presents the distribution of per-pupil funding changes in schools in the three different time periods which were investigated (2010/11 to 2013/14, 2010/11 to 2014/15 and 2010/11 to 2015/16). This shows that most schools had a fall in funding over each of the time periods analysed. The average percentage changes were -4.4% for 2010-11 to 2013/14, -7.1% for 2010-11 to 2014/15 and -7.0 for 2010-11 to 2015/16. However, not all schools had a fall, with 23.4%, 15.5% and 16.5% respectively showing an increase in funding.

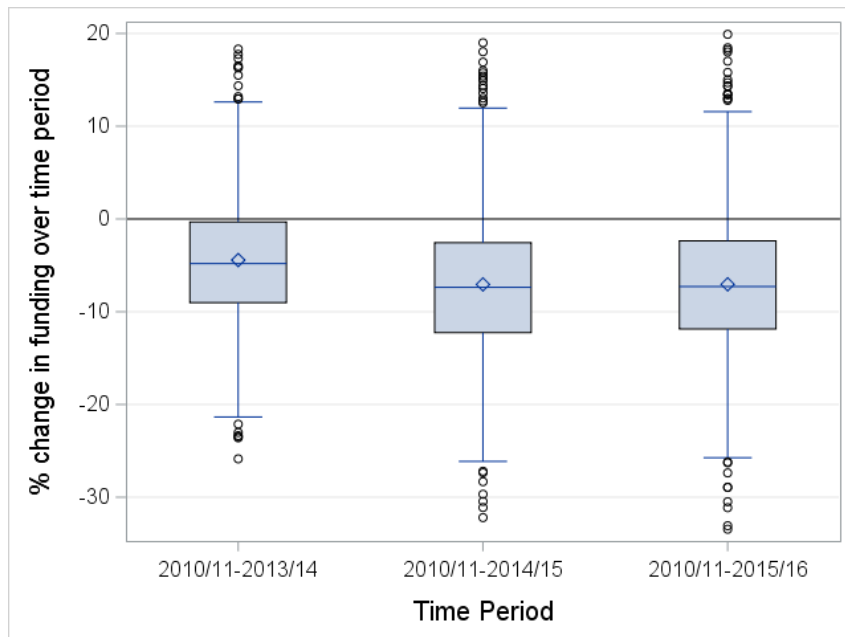


Figure 1: Distribution of percentage change to funding in schools over three different time periods

Changes to subject offer

Figure 2 presents the distribution of the percentage change in the total number of subjects offered by schools, during the three time periods.

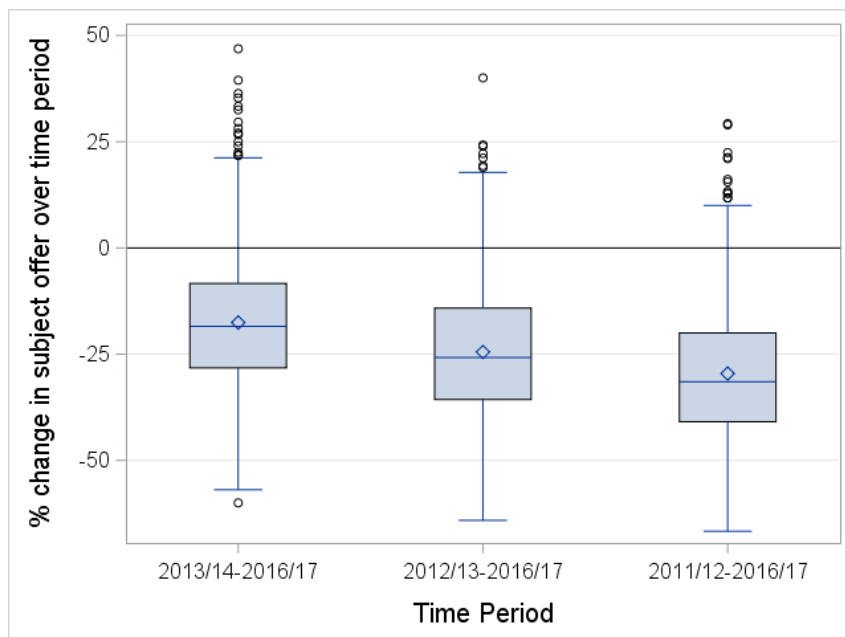


Figure 2: Distribution of percentage change to subject offer in schools over three different time periods

This shows that most schools reduced their subject offer over the time period. The average percentage reductions were 17.5%, 24.5% and 29.5% for each of the time periods respectively. To look at this another way, the mean number of subjects offered in 2011/12 was 56.2 but by 2016/17 it had fallen to 38.4. It was not necessarily the case that these reductions were due to falls in funding, as there were many other possible reasons why

schools might have reduced their subject offer. For example, the removal of eligibility for inclusion in accountability measures for a large number of subjects, following the Wolf review of vocational qualifications (Wolf, 2013).

Dropping individual subjects

Figures 3 to 8 give an indication of the number of schools dropping particular subjects over the four year time period (2012/13-2016/17), for each different qualification group. Results for three years and five years were very similar so are not shown here. These figures show the results for the most common subjects only (30 for GCSE, 20 for vocational, 10 for ELQs, all GCSE Short Courses, Other GQ and Skills qualifications). They also exclude any subjects where there were no schools dropping the subject, or where more than 90% of schools dropped the subject.

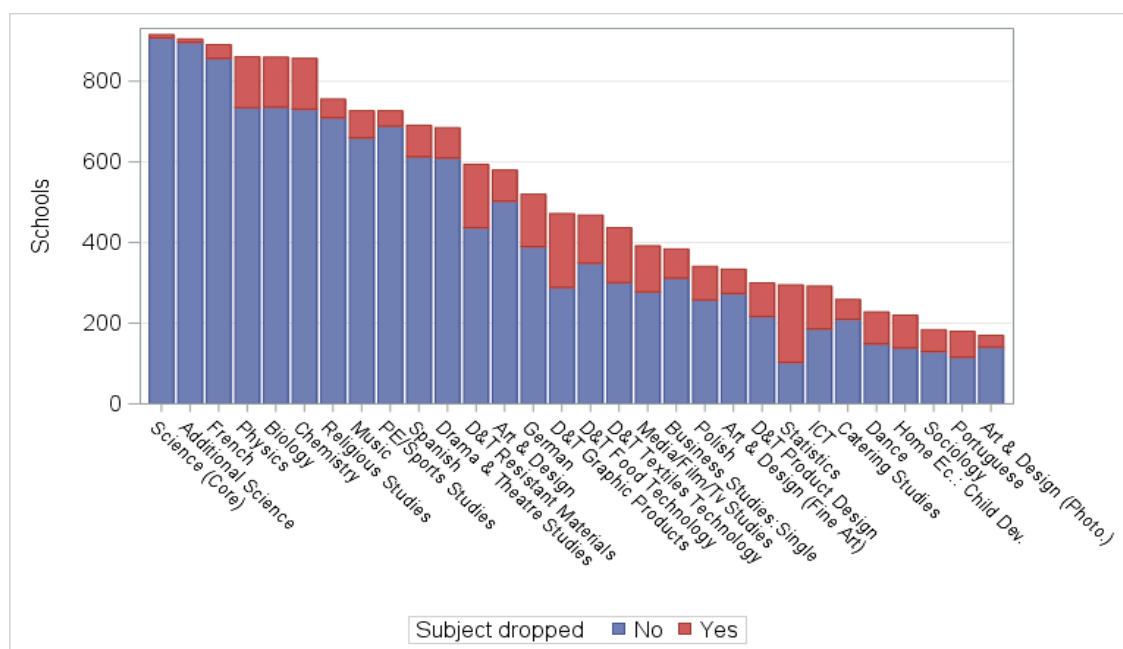


Figure 3: Number of schools dropping (or not) each subject (GCSEs, 4 year time period)

Figure 3 demonstrates relatively low percentages of schools dropping most of the GCSE subjects, particularly the most common ones. Amongst the subjects displayed here, Statistics was the subject with the highest number of dropping schools (192, 65.1% of schools offering it in the initial year), followed by three of the D & T subjects, German and the separate sciences (Biology, Chemistry and Physics).

In contrast, for the other qualification groups subjects tended to be dropped by more than half of the schools. This may be partly due to the outcomes of the Wolf review (2013), which led to many non-academic subjects being removed from eligibility for league tables.

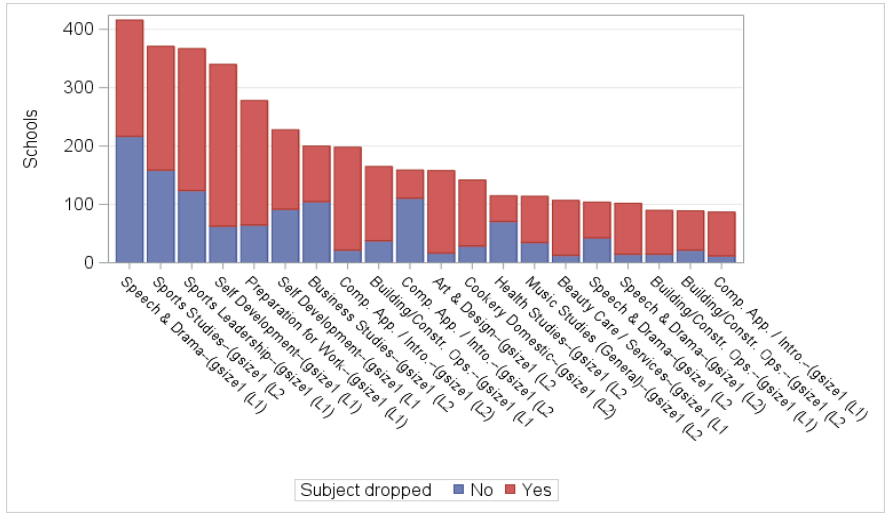


Figure 4: Number of schools dropping (or not) each subject (vocational qualifications, 4 year time period)

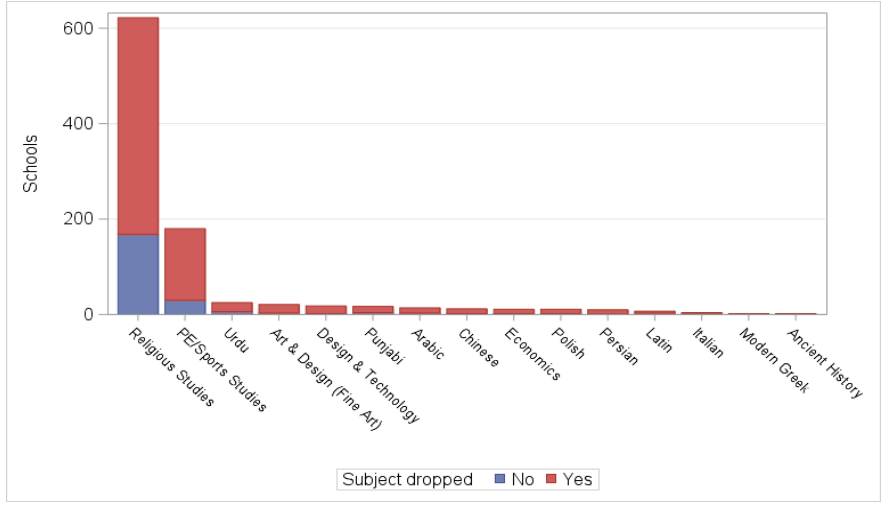


Figure 5: Number of schools dropping (or not) each subject (GCSE Short Courses, 4 year time period)

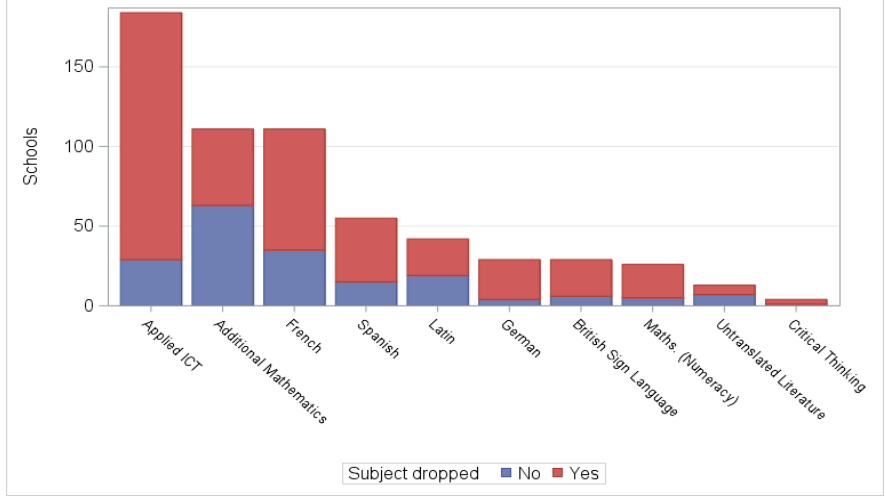


Figure 6: Number of schools dropping (or not) each subject (Other GQs, 4 year time period)

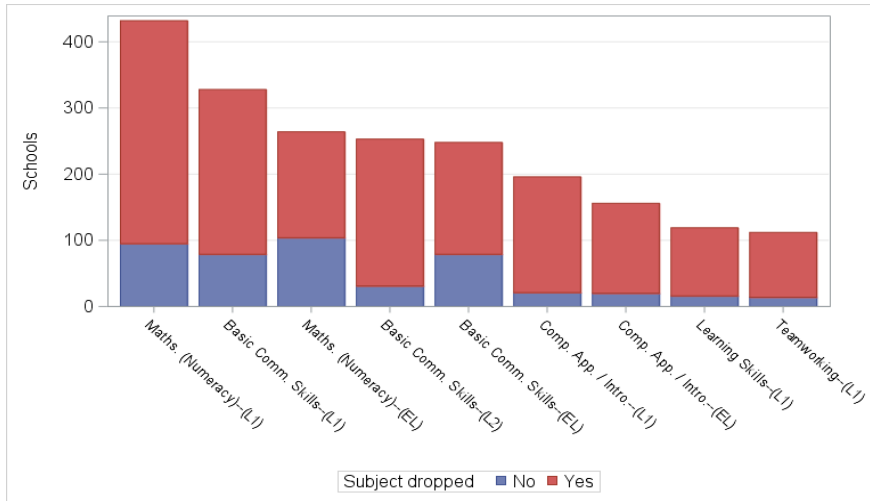


Figure 7: Number of schools dropping (or not) each subject (Skills qualifications, 4 year time period)

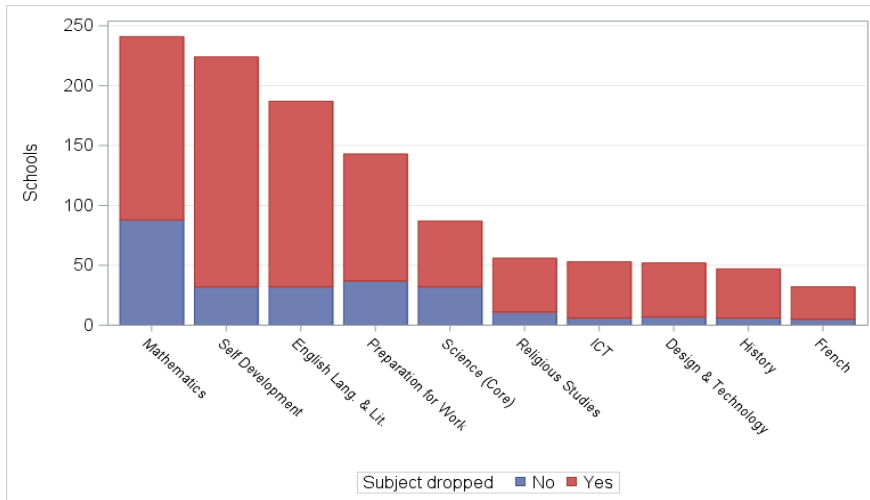


Figure 8: Number of schools dropping (or not) each subject (ELQs, 4 year time period)

Relationship between funding changes and changes to subject offer

The analysis provided so far has shown that during the time period investigated schools lost per-pupil funding on average and also reduced their subject offer on average. However, this does not mean that the two were linked. Figure 9 plots, for the three time periods, the change in funding against the change in the number of subjects offered by each school.

These show that a reduction in the number of subjects offered was evident across the range of changes in reported funding and, in fact, those schools receiving an increase in funding were more likely to drop subjects than those with a decrease. This is the opposite of what we expected.

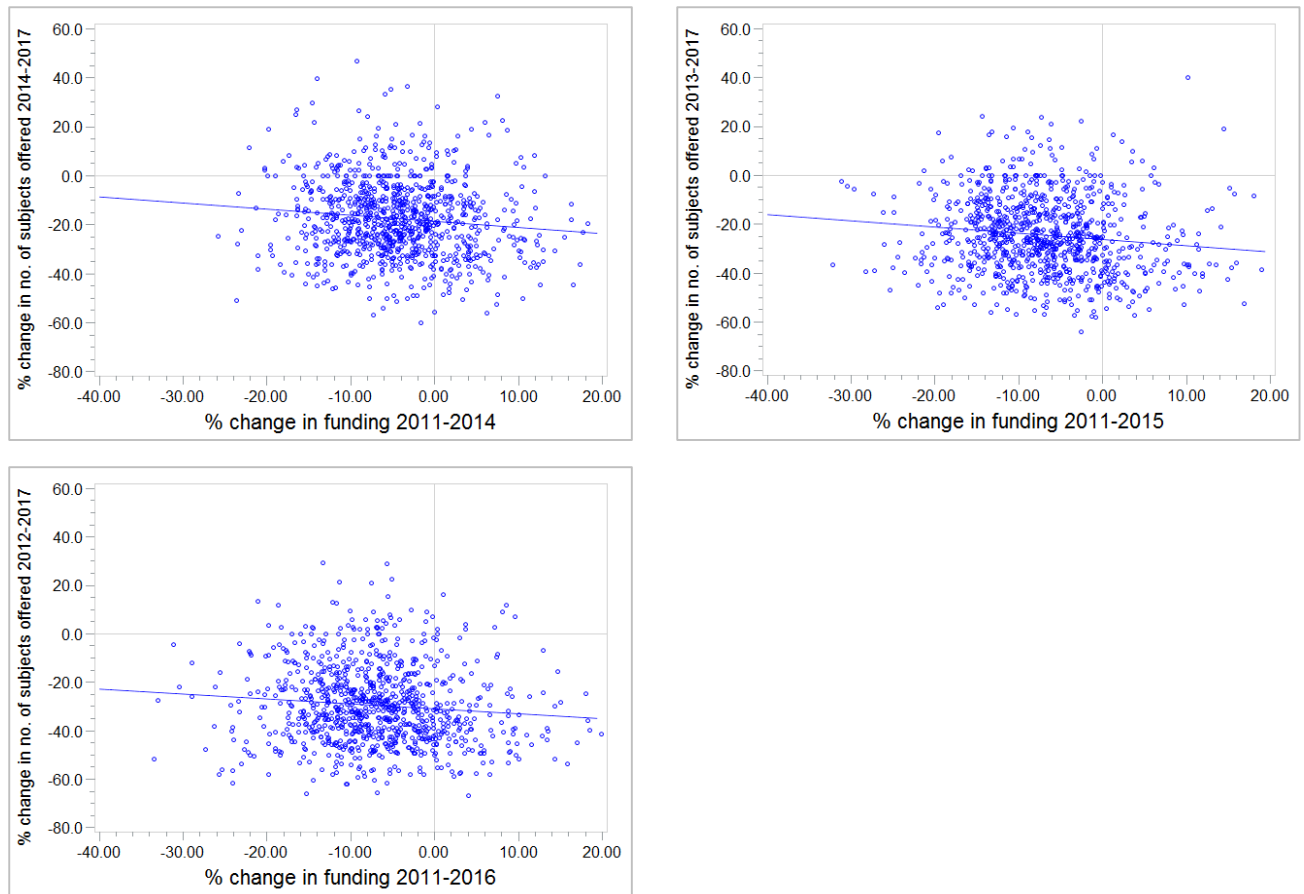


Figure 9: Relationship between changes to funding and changes to subjects offered

Relationship between funding changes and likelihood of dropping specific subjects

For the analysis of individual subjects, we first made simple comparisons of the changes to funding between schools which dropped the subject in question and schools which did not drop it. Table 3 shows, for each subject investigated over the 4 year period, the mean percentage change in funding for schools dropping the subject and for those not dropping it. The table also shows the total number of schools offering the subject in the initial year and the percentage of those schools who dropped it. Results for the 3 year and 5 year time periods were very similar, so are not shown here. The distributions of percentage changes in funding for schools in each category of dropping and for each subject are shown in Appendix A.

The table shows that for a majority of subjects (14 out of 23) the mean reduction in funding was greater for the schools not dropping the subject than for those dropping it. In other words there was no evidence of an association between reduced funding and dropping any of these subjects. There were some exceptions, where the mean percentage fall in funding was much greater for schools who dropped the subject. For example, GCSE French (mean = -7.0% for not dropping schools and -8.6% for dropping schools); Other GQ French (mean = -6.3% for not dropping schools and -8.9% for dropping schools).

Table 3: Comparison of changes to funding for schools dropping and not dropping each subject (4 year period)

Qualification	Subject	Schools in 2012/13 (n)	% dropped	Mean % funding change (subject not dropped)	Mean % funding change (subject dropped)
GCSE	French	891	3.8	-7.0	-8.6
	Religious Studies	756	6.1	-7.3	-4.4
	PE	727	5.2	-6.9	-4.6
	Music	727	9.2	-7.1	-5.6
	Physics	861	14.6	-7.1	-7.1
	Drama	685	10.9	-7.3	-6.3
	Spanish	691	11.3	-7.0	-6.7
	Art	580	13.3	-6.9	-6.5
	D & T (resistant mat.)	594	26.4	-7.0	-5.6
	German	520	25.0	-7.5	-6.1
Vocational	Speech & Drama (<1, L1)	416	47.8	-6.4	-6.1
	Sports leadership (<1, L1)	367	66.2	-6.4	-7.4
	Self-development (1, L1)	228	59.6	-7.8	-7.1
	Sports studies (1, L2)	371	57.1	-7.1	-7.1
	Business Studies (1, L2)	200	47.5	-7.3	-7.0
Skills	Numeracy (L1)	432	78.0	-7.5	-6.7
	Numeracy (EL)	264	60.6	-6.0	-7.0
	Communication skills (L1)	328	75.9	-6.2	-6.9
	Communication skills (EL)	248	68.1	-6.3	-6.9
Entry Level	Mathematics	241	63.5	-6.9	-6.9
Other GQ	French	111	68.5	-6.3	-8.9
	Additional Maths	111	43.2	-9.2	-6.9
Short course	Religious studies	622	73.0	-7.5	-6.7

This descriptive analysis provided no evidence of a causal relationship between reduced funding and schools dropping subjects (either overall, or for specific subjects). However, there are many other factors which will have had an effect on the subject offer and these needed to be accounted for. This was done using the regression model described in the methods section.

Regression analyses

Changes to subject offer

Separate models were fitted for each of the three time periods. The dependent variable for the first model was the percentage change in the total number of subjects offered. This was then followed by three further models for each time period, where the dependent variable in each case was the percentage change in the number of subjects offered from one of the following qualification groups: general qualifications (GCSE or Other GQ); vocational qualifications; other qualifications (GCSE Short Course, Skills qualifications, ELQs) . These models were assessing whether there was any association between changes to funding and changes to the subject offer for each qualification group. It may be that schools were more

likely to drop subjects which were less valued, such as vocational or other qualifications, than the more 'academic' qualifications, such as GCSEs.

Table 4 presents the regression coefficients and standard errors for the percentage change in funding variable, for each of the models. Regression coefficients for the other variables in the models are not presented here as they were not relevant to the investigation but, for completeness, are recorded in Appendix B.

Table 4: Regression coefficients for change in funding variable (changes to number of subjects model)

Model	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
All subjects	0.022	0.065	0.042	0.056	0.058	0.053
General qualifications	-0.118	0.087	-0.040	0.079	-0.042	0.074
Vocational qualifications	-0.028	0.187	-0.062	0.170	0.066	0.157
Other qualifications	-0.096	0.269	-0.063	0.242	<-0.001	0.225

This table shows that the percentage change in funding was not significant in any of the models. In other words there was no evidence that changes in funding levels were associated with changes to the number of subjects offered.

Dropping Individual subjects

Separate models were fitted for each of the subjects selected for analysis. The dependent variable for each model was whether or not the school dropped the subject between the start and end of the time period. The independent variable of interest was the percentage change in per-pupil funding in the relevant time period. Other variables were included in the model if they had a significant association with the dependent variable, but as they are not of interest for this investigation they are not included in the results here. However, for completeness they are included in Appendix B.

The regression coefficients and standard errors for the percentage change in funding variable for each model are presented in Table 5. There was only one model (highlighted in bold in the table) where the funding change variable was significant: Other GQ in French (three year time period). This qualification was a level 1 Foundation Certificate of Secondary Education (FCSE) in French, offered by the AQA exam board. The size of this effect was -0.101.

The coefficients for logistic regression models are hard to interpret as they represent the change in the log of the odds of, in this case, dropping the subject, for a one unit increase in the predictor variable. To help with the interpretation they can be converted to probabilities, as is shown in Figure 10. This shows the probability (according to the model) of dropping the Other GQ in French for different levels of the change in funding variable. The shaded area displays the 95% confidence interval around the predicted probabilities. The negative slope of the line implies a larger fall in funding was associated with an increased probability of dropping the subject. Thus, for a school with no change in funding the probability of dropping the subject was around 0.45; with a drop in funding of 10%, the probability increased to around 0.70. However, as shown by the shaded area, there was a great deal of uncertainty in the model including the possibility, consistent with other subjects, that a change in funding was barely associated with any difference in the chance of this subject being dropped. This

can be seen by the fact that it would be possible to draw an almost horizontal line completely within the shaded area.

Table 5: Regression coefficients for change in funding variable (dropping specific subjects model)

Qualification	Subject	3 year period		4 year period		5 year period	
		Coefficient	SE	Coefficient	SE	Coefficient	SE
GCSE	French	0.016	0.032	-0.032	0.023	-0.003	0.026
	Religious Studies	0.008	0.028	0.041	0.024	0.027	0.023
	PE	0.021	0.029	0.026	0.030	0.034	0.028
	Music	0.017	0.026	<0.001	0.024	-0.009	0.023
	Physics	-0.019	0.026	-0.017	0.020	-0.010	0.020
	Drama	0.022	0.025	0.015	0.023	0.011	0.024
	Spanish	0.009	0.024	0.008	0.022	0.004	0.022
	Art	-0.019	0.026	0.009	0.023	-0.004	0.022
	D & T (resistant mat.)	0.040	0.023	0.028	0.020	0.008	0.020
	German	0.001	0.024	0.012	0.021	0.011	0.022
Vocational	Speech & Drama (<1, L1)	0.018	0.023	0.011	0.021	0.033	0.022
	Sports leadership (<1, L1)	-0.009	0.026	-0.013	0.023	-0.009	0.021
	Self-development (1, L1)	-0.020	0.034	0.011	0.029	-0.002	0.025
	Sports studies (1, L2)	0.016	0.027	0.002	0.022	-0.017	0.020
	Business Studies (1, L2)	0.022	0.031	0.004	0.027	-0.005	0.028
Skills	Numeracy (L1)	-0.018	0.026	0.017	0.024	0.015	0.021
	Numeracy (EL)	0.008	0.028	-0.005	0.024	0.005	0.024
	Communication skills (L1)	0.009	0.028	-0.013	0.025	0.025	0.024
	Communication skills (EL)	-0.007	0.030	-0.001	0.024	0.002	0.029
Entry Level	Mathematics	-0.003	0.030	0.010	0.026	0.006	0.026
Other GQ	French	-0.101	0.045	-0.055	0.038	-0.031	0.031
	Additional Maths	-0.022	0.030	0.047	0.042	n/a	n/a
Short course	Religious studies	-0.011	0.024	0.011	0.020	0.005	0.019

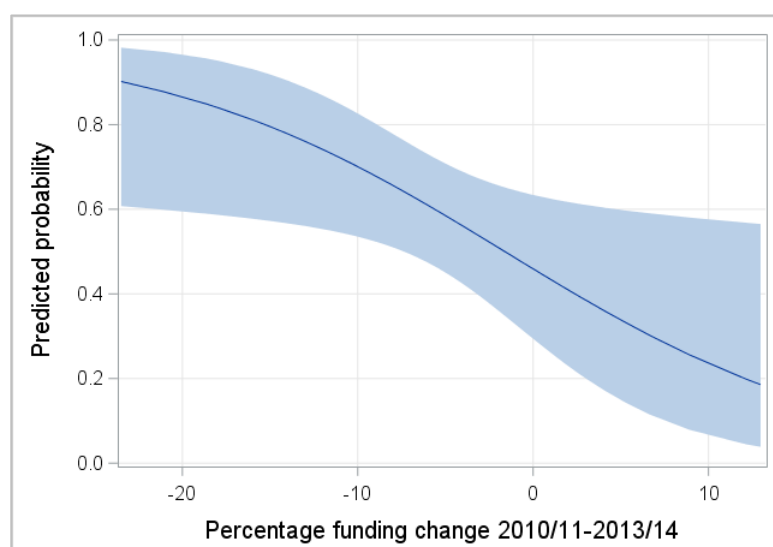


Figure 10: Predicted probability of schools dropping Other GQ French, for different levels of funding change (3 year period).

Furthermore, even with this single significant result we need to be cautious in interpreting this as significant, due to the issue of multiple testing of hypotheses. When many hypotheses are tested simultaneously (in this case, 23), it greatly increases the probability of detecting what appears to be a significant result by chance. For a single hypothesis test with a significance level of 0.05, the probability of finding a (non-genuine) significant effect by chance is 0.05. However, with 23 simultaneous tests, the probability of finding a significant effect purely by chance is much higher:

$$\begin{aligned} P(\text{at least one significant result}) &= 1 - P(\text{no significant results}) \\ &= 1 - (1 - 0.05)^{23} \\ &= 0.69 \end{aligned}$$

Conclusion

The results presented in this report provide no evidence that schools reacted to reductions in funding by reducing their subject offer, or that they were more likely to drop specific subjects. This is despite reports which suggested that a high proportion of schools were doing exactly that (e.g. ASCL, 2017; NEU, 2018). However, it is possible that respondents to these surveys were more likely to be those schools who did make changes to provision based on changes to funding, and were therefore not representative of all schools. It is worth noting that the results here do not directly contradict those of ASCL and NEU. Most schools have experienced funding reductions (see Figure 1) and so it is quite plausible that many of them have responded by dropping subjects. However, the analysis in this report has shown that schools that have *not* experienced falls in funding are at least as likely to have dropped subjects nonetheless. This indicates that there are strong influences on school's decisions with regard to provision beyond funding. For example, as shown by Gill (2018), changes to accountability measures appear to be a major factor in schools' decisions in this area.

There are a number of possible reasons why this analysis did not find any evidence for the expected association between funding and subject provision. First, it may be that the longest time lag included in this report (three years) was not long enough. Schools may wait longer than this period to see if funding continues to fall before making decisions about cutting subjects. Thus, one area of further research would be to re-run the analysis with a longer time gap, or look only at schools which had consistent falls in funding over several years.

Similarly, schools may have decided that running up a deficit for a few years is a better option than dropping subjects. Data retrieved from reports by the DfE (2014; 2017b) revealed that the percentage of maintained secondary schools running a deficit increased from 5.6% in 2013/14 to 9.1% in 2016/17. Furthermore, the average deficit amongst schools with a deficit increased from £248,000 to £416,000³ over the same time period. With the possibility of further reductions in funding in the future, it would be interesting to re-visit this analysis in a few years' time.

³ Figures not inflation adjusted

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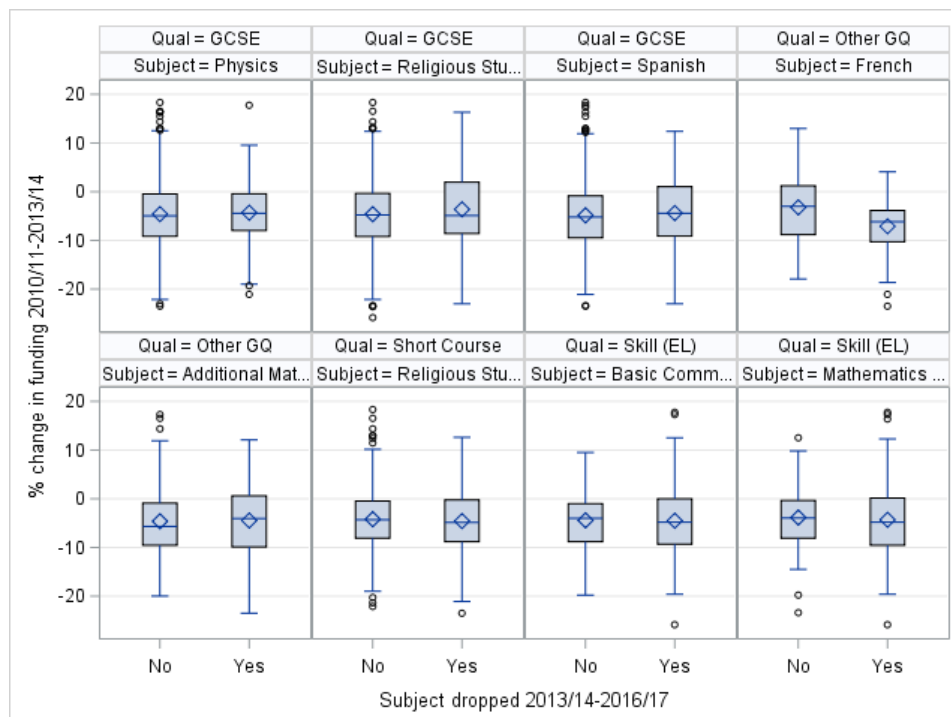
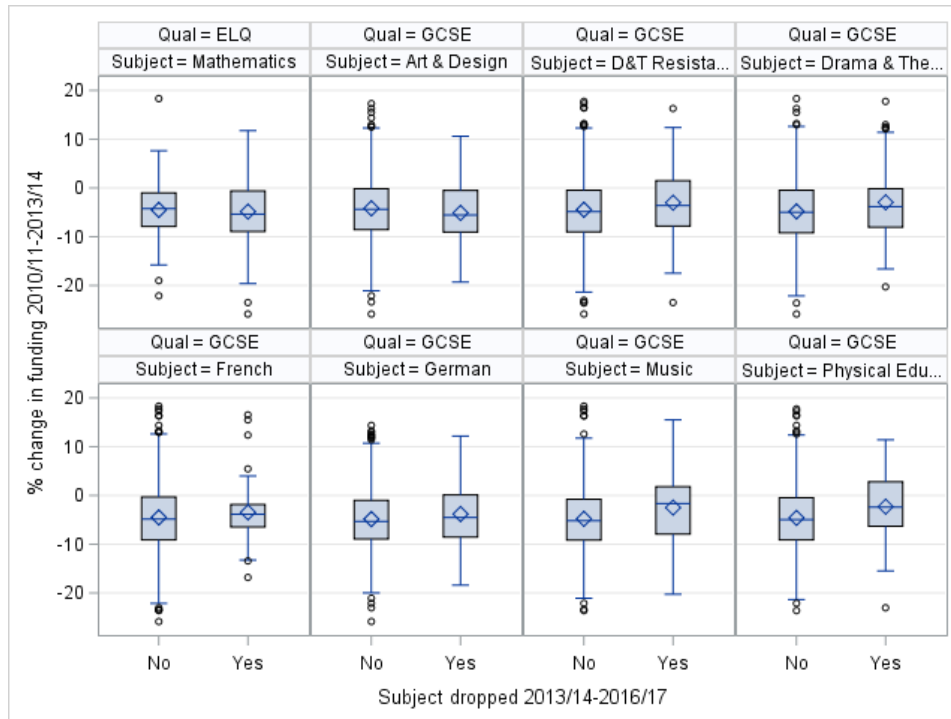
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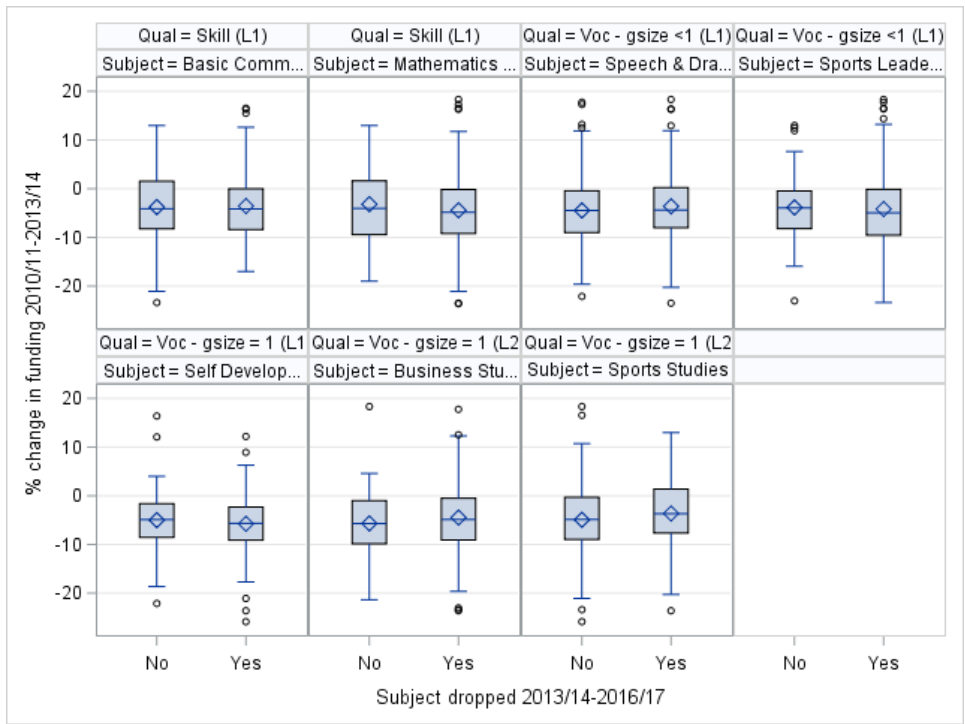
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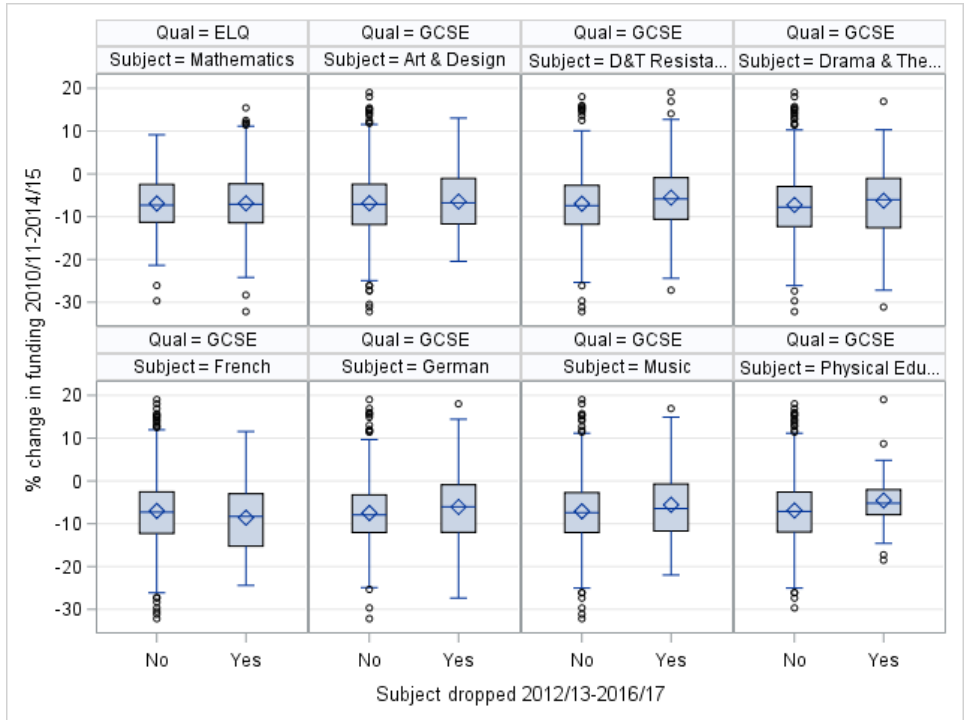
Appendix A: Distribution of % change to funding (schools dropping v not dropping subject)

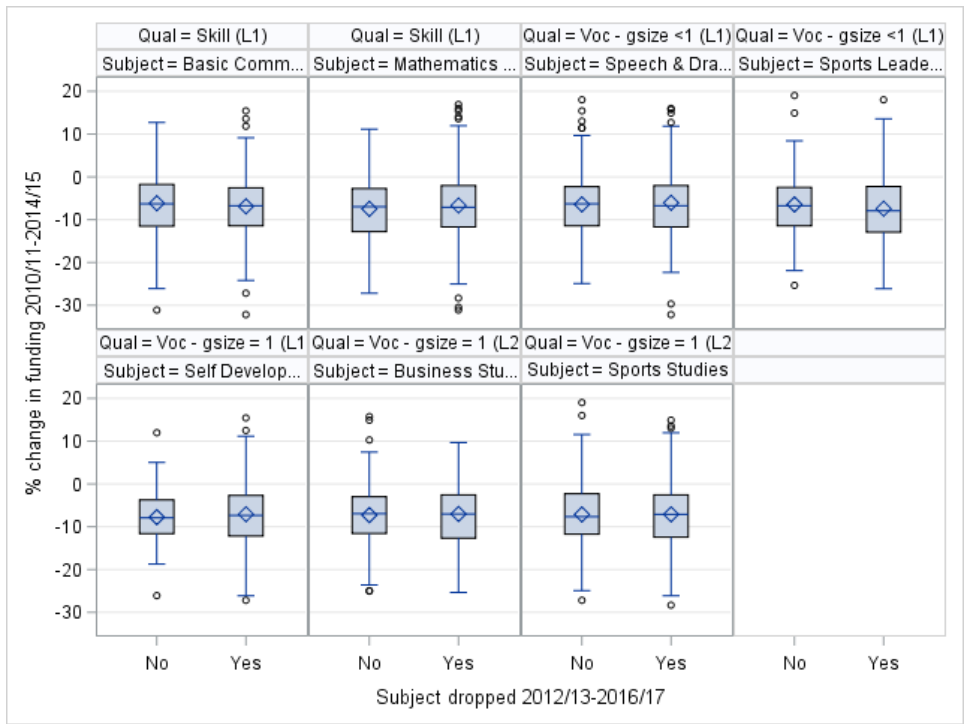
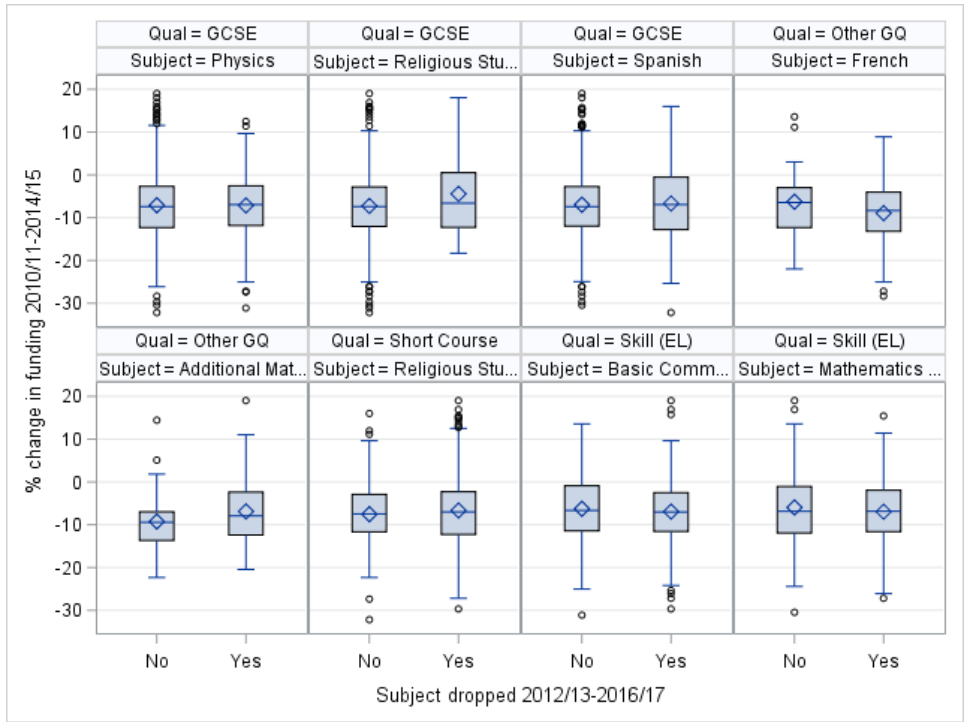
3 years



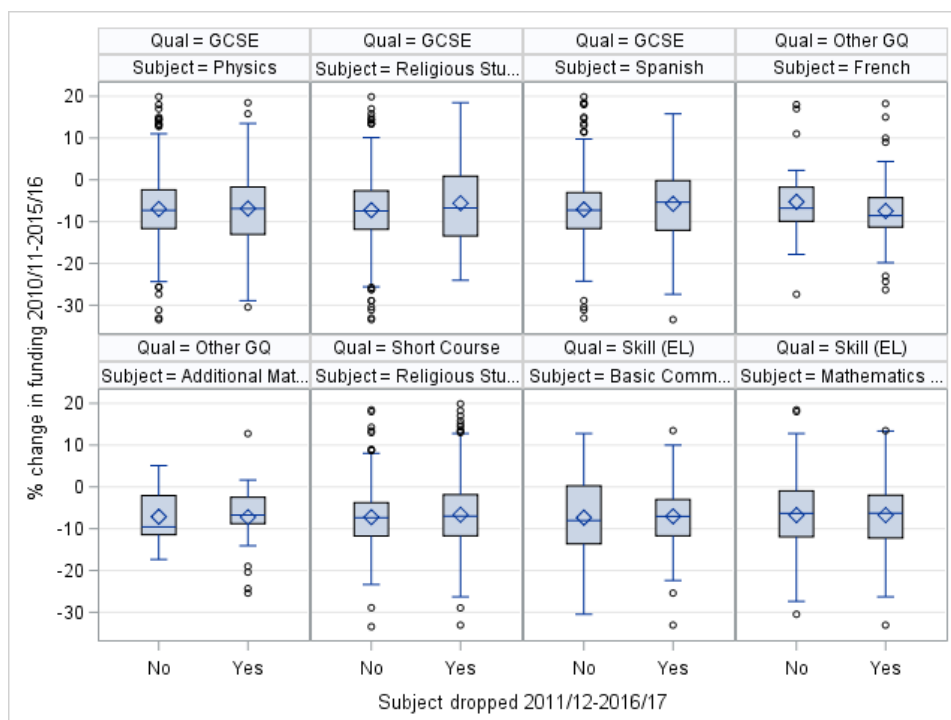
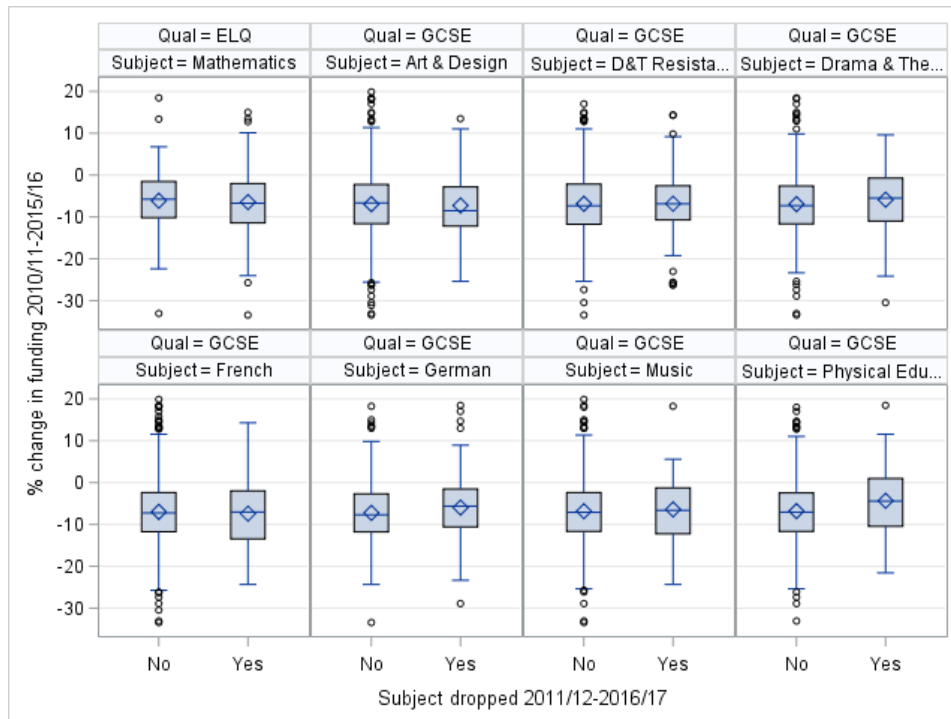


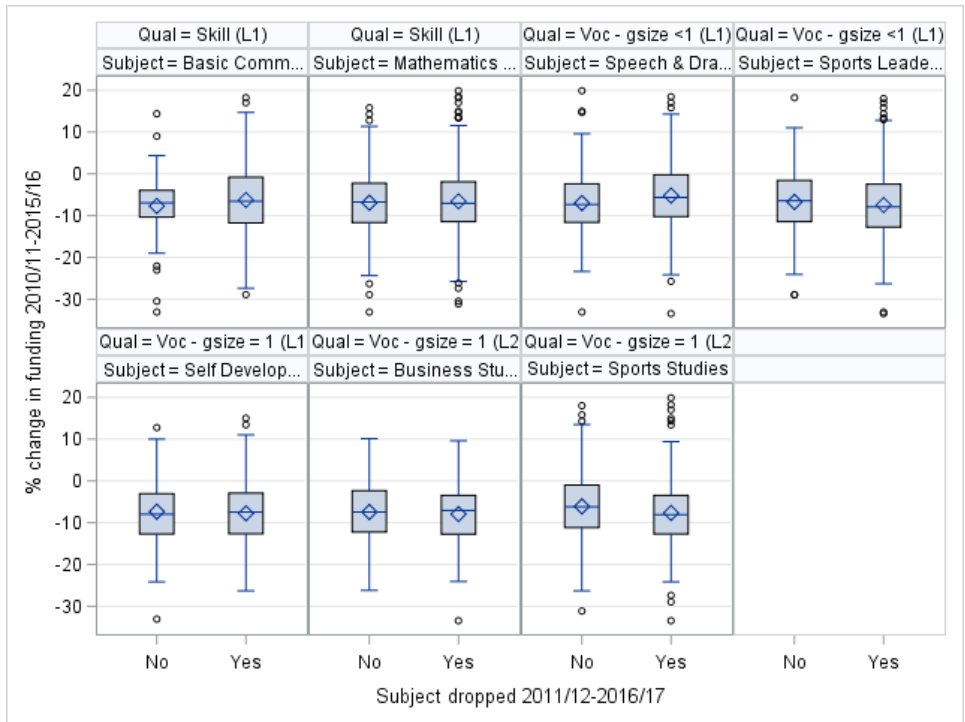
4 years





5 years





Appendix B: All significant regression coefficients from models

A stepwise regression method was used for all models, whereby each variable was added into the model separately and then removed if found to be not statistically significant. Then the change in funding variable was added at the end of this process. In the following tables 'n.s.' indicates that for the time period in question this variable was not significant.

Change in number of subjects offered

All subjects

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-17.247	0.504	-24.057	0.493	-28.937	0.550
Change in the cohort size over the time period	0.311	0.031	0.283	0.028	0.277	0.025
Mean prior attainment	n.s.	n.s.	6.577	2.217	6.323	2.116
Number of subjects offered at start	-0.642	0.041	-0.593	0.037	-0.582	0.034

General qualifications

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-0.295	0.576	-0.143	0.576	-0.134	0.566
Change in the cohort size over the time period	0.196	0.042	0.254	0.040	0.259	0.036
Mean prior attainment	-8.314	2.898	-10.919	2.940	-13.884	2.928
Number of subjects offered at start	n.s.	n.s.	n.s.	n.s.	-0.181	0.046

Vocational qualifications

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-48.176	6.780	-49.773	6.693	-43.960	1.367
Change in the cohort size over the time period	0.193	0.090	0.197	0.0855	0.258	0.075
Mean prior attainment	23.865	7.840	16.889	8.119	24.372	6.496
Number of subjects offered at start	n.s.	n.s.	-0.310	0.113	-0.691	0.100
School type						
Sec Mod					n.s.	n.s.
Comprehensive	3.832	6.906	5.855	6.822	n.s.	n.s.
Grammar	35.082	13.225	35.133	13.199	n.s.	n.s.

Other qualifications

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-56.730	2.025	-56.357	2.002	-55.924	1.973
Change in the cohort size over the time period	0.649	0.129	0.607	0.121	0.365	0.109
Mean prior attainment	28.523	8.920	18.655	9.424	n.s.	n.s.
Number of subjects offered at start	n.s.	n.s.	-0.399	0.157	-1.059	0.135

Probability of dropping individual subjects

GCSE French

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-3.888	0.369	-4.628	0.424	-3.762	0.371
No. of students taking subject	-0.032	0.011	-0.067	0.013	-0.043	0.013
Mean % of FSM students	0.039	0.016	0.031	0.011	n.s.	n.s.

GCSE Religious Studies

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-3.291	0.323	-2.989	0.275	-2.936	0.275
No. of students taking subject	-0.017	0.004	-0.012	0.004	-0.013	0.004

GCSE PE

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-3.289	0.307	-3.554	0.342	-3.663	0.368
No. of students taking subject	-0.044	0.015	n.s.	n.s.	n.s.	n.s.
Mean prior attainment	-3.536	1.347	n.s.	n.s.	-4.132	1.577
Mean no of students (end of KS4)	n.s.	n.s.	-0.015	0.005	-0.017	0.006
Mean % of FSM students	n.s.	n.s.	0.041	0.016	n.s.	n.s.

GCSE Music

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-2.705	0.262	-2.597	0.256	-2.591	0.256
No. of students taking subject	-0.076	0.026	-0.050	0.024	-0.061	0.025
Change in the cohort size over the time period	n.s.	n.s.	-0.025	0.011	-0.024	0.011
Mean prior attainment	-5.451	1.223	-4.465	1.311	-4.884	1.267

GCSE Physics

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-2.765	0.257	-1.889	0.203	-1.808	0.204
No. of students taking subject	-0.032	0.009	n.s.	n.s.	n.s.	n.s.
Number of subjects offered at start	0.036	0.017	n.s.	n.s.	n.s.	n.s.
Mean % of FSM students	n.s.	n.s.	0.029	0.011	0.033	0.011

GCSE Drama

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-2.451	0.246	-2.459	0.251	-2.255	0.234
No. of students taking subject	-0.055	0.017	-0.060	0.017	-0.030	0.014
Mean prior attainment	n.s.	n.s.	n.s.	n.s.	-2.538	1.102

GCSE Spanish

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-2.462	0.262	-2.576	0.275	-2.358	0.260
No. of students taking subject	-0.044	0.010	-0.051	0.011	-0.045	0.013
Change in the cohort size over the time period	n.s.	n.s.	n.s.	n.s.	-0.022	0.011

GCSE Art

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-1.998	0.219	-1.840	0.220	-1.784	0.217
No. of students taking subject	n.s.	n.s.	-0.021	0.009	n.s.	n.s.

GCSE D & T (resistant mat.)

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-1.174	0.199	-0.893	0.187	-0.716	0.185
No. of students taking subject	-0.032	0.012	n.s.	n.s.	-0.018	0.009

GCSE German

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-1.374	0.217	-1.335	0.218	-0.986	0.202
No. of students taking subject	-0.035	0.009	-0.039	0.009	-0.031	0.008
Mean % of FSM students	n.s.	n.s.	0.028	0.013	n.s.	n.s.

Vocational Speech & Drama (<1, L1)

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-0.162	0.198	0.031	0.202	0.012	0.208
Average cohort size, across time period	-0.007	0.003	-0.006	0.003	n.s.	n.s.

Vocational Sports leadership (<1, L1)

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	0.781	0.221	0.875	0.218	1.049	0.210
No. of students taking subject	-0.013	0.004	n.s.	n.s.	n.s.	n.s.

Vocational Self-development (1, L1)

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-0.054	0.241	0.462	0.228	0.586	0.218
Average cohort size, across time period	n.s.	n.s.	n.s.	n.s.	-0.009	0.004

Vocational Sports studies (1, L2)

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	0.182	0.213	0.272	0.197	0.145	0.198

Vocational Business Studies (1, L2)

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-0.264	0.252	-0.169	0.230	0.044	0.230

Skills Numeracy (L1)

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	0.905	0.234	1.303	0.222	1.468	0.211
Average cohort size, across time period	n.s.	n.s.	n.s.	n.s.	-0.007	0.003

Skills Numeracy (EL)

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	0.269	0.228	0.358	0.228	0.752	0.241
Average cohort size, across time period	n.s.	n.s.	n.s.	n.s.	-0.011	0.004
Mean prior attainment	n.s.	n.s.	n.s.	n.s.	3.243	1.327
Mean % of FSM students	-0.034	0.015	n.s.	n.s.	n.s.	n.s.

Skills Communication skills (L1)

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	0.878	0.224	1.231	0.225	1.300	0.216
Average cohort size, across time period	n.s.	n.s.	-0.008	0.003	-0.008	0.003

Skills Communication skills (EL)

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	0.619	0.224	0.800	0.229	1.238	0.257
Number of subjects offered at start	n.s.	n.s.	-0.035	0.017	n.s.	n.s.
Mean prior attainment	n.s.	n.s.	n.s.	n.s.	4.052	1.476

ELQ Mathematics

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	0.442	0.222	0.660	0.230	0.665	0.224
Average cohort size, across time period	-0.008	0.003	-0.009	0.004	-0.008	0.004

Other GQ French

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	0.399	0.266	0.751	0.278	0.785	0.280

Other GQ Additional Maths

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	-0.278	0.226	-0.423	0.308	n/a	n/a
Mean prior attainment	-3.663	1.347	-9.197	2.510	n/a	n/a
Mean % of SEN students	n.s.	n.s.	-0.174	0.060	n/a	n/a

GCSE Short Course Religious studies

Variable	3 year period		4 year period		5 year period	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	0.547	0.190	0.917	0.188	0.953	0.187
Mean prior attainment	-1.826	0.840	-2.221	0.845	-1.984	0.806