An analysis of the effect of taking the EPQ on performance in other Level 3 qualifications

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Introduction

The Extended Project Qualification (EPQ) is a stand-alone qualification taken by students in Year 12 or Year 13, usually alongside General Certificate of Education (GCE) Advanced levels (A levels). It is equivalent in size to half an A level and involves undertaking a substantial project in an area of personal interest, where the outcome can range from writing a dissertation or report to creating a piece of art or organising an event. Its aims are summed up by the following quote from the Department for Education and Skills (DfES) White Paper which proposed the qualification:

> *This will be a single piece of work, requiring a high degree of planning, preparation, research and autonomous working. The projects …. will require persistence over time and research skills to explore a subject independently in real depth.*
>
> (DfES, 2005, p.63)

One of the perceived benefits of taking the EPQ is that the skills that are learnt by students whilst undertaking their project (e.g., planning, researching, critical thinking, etc.) may be useful for them in their future studies. In the evaluation of the EPQ pilot (Centre for Education and Industry [CEI], 2008), interviews and surveys were used to collect the views of teachers and students in centres offering the qualification, and of representatives from Higher Education (HE). A majority of teachers and HE representatives agreed that the EPQ taught students the skills and competencies that are required for university study and these skills were not assessed in other qualifications. Other research used quantitative analyses of assessment data to show that EPQ grades are good predictors of degree outcomes (Gill & Vidal Rodeiro, 2014) and that students taking the EPQ alongside A levels are more likely to achieve a good degree than those taking A levels only (Gill, 2016a).

It is also of interest to consider whether the skills learnt whilst undertaking the EPQ might be transferable to other qualifications taken at the same time, and might therefore improve performance in those qualifications. In the CEI 2008 study, a majority of teachers surveyed agreed that the EPQ helped their students (at least 'to some extent') with other qualifications taken at the same time. This was due to the new skills the students learnt, and also due to an increase in self-confidence and motivation that came from working independently. On the quantitative side, research by Jones (2015) using data from the AQA exam board found that taking the EPQ alongside A levels increased the odds of achieving a high grade (A* to B) at A level by 29 percent.

The potential for such improvement can also be inferred from research which found positive effects of other qualifications or programmes which explicitly teach or assess skills rather than knowledge. Black and Gill (2011) found that taking an Advanced Subsidiary (AS) level in Critical Thinking (and achieving at least a grade B) had a positive effect on overall performance at A level that was worth one quarter of a grade on average. Jones, Gaskell, Prendergast and Bavage (2016) found that teaching a pre-university skills course to Year 12 students in order to prepare them better for university study had the (unintended) effect of improving performance in A levels. Finally, a report by Stock Jones, Annable, Billingham and MacDonald (2016) investigated the impact of a programme designed to encourage Science, Technology, Engineering and Mathematics (STEM) participation. The British Science Association's Silver CREST Award gets General Certificate of Secondary Education (GCSE) level students to undertake their own STEM-related projects. Stock Jones et al. (2016) found that students undertaking a CREST project achieved better Science GCSE results by half a grade compared to a control group of statistically matched students who did not do a project.

The main aim of the research reported in this article was to investigate whether students taking the EPQ performed better, on average, in other qualifications compared with their counterparts who did not take the EPQ. This is similar to the analysis undertaken by Jones (2015), but extends it to include data from all exam boards in England and looks at the overall effect by student, rather than by A level entry. It also includes an investigation of the effect of the EPQ at centre level, alongside the student level analysis.

Student level analysis

Data and methods

The data used in the analysis was taken from the National Pupil Database (NPD). This database is managed by the Department for Education (DfE), and consists of all examination results for all pupils in schools and colleges in England, as well as pupil and school background characteristics (e.g., gender, ethnicity, deprivation). For this research, the Key Stage 5 (KS5) datasets for two different years were used. These include all results for students who were aged between 16 and 18 at the end of the academic year, and had taken at least one qualification in the current year equal in size to one A level. They include the results of qualifications taken by these students in previous years, such as AS levels (or the EPQ) taken in Year 12 by students currently in Year 13.

Data from the NPD for 2013/14 and for 2014/15 was used and separate analyses were undertaken for the two different academic years. As most students taking the EPQ combined it with A levels and AS levels or with A levels only (and usually this was a minimum of three A levels), it seemed sensible to make comparisons within this group of students only. Therefore, for the student level analysis,

a subset of NPD data was created, consisting of all students taking at least three A levels combined with at least one AS level or EPQ (or both) and no other qualifications. Qualifications that were retaken were counted only once and the best grade kept.

A multilevel regression model was undertaken for each year, with the outcome variable being the mean University and College Admissions Service (UCAS) points score (excluding the EPQ result, where taken). The effect of candidate ability was accounted for by including a measure of prior attainment in the models (Key Stage 4 [KS4] mean points score, centred on its mean). A further variable was included for the total size of the qualifications taken by a student (including the EPQ, where taken). This was measured in terms of A level equivalents (e.g., A level =1, AS level = 0.5, EPQ = 0.5). This was an attempt to account for two possible, though opposing, effects: first, a motivation effect whereby students choosing to take more qualifications may be more motivated, leading to them performing better on average; secondly, students taking a large number of qualifications may be over-worked, leading to them performing less well on average. To make interpretation of this variable easier, the minimum size (in this cohort of students) of three and a half (equal to three A levels + one AS level or EPQ) was subtracted from each value. This meant that the baseline for the variable was taking the equivalent of three and a half A levels and the parameter estimate represented the change in the outcome variable associated with taking one more A level (or equivalent).

Two background characteristics were also included: gender and school type. Students were also classified by whether or not they took the EPQ and this was included in the models. A statistically significant parameter estimate for this variable would indicate that taking the EPQ was associated with better (or worse) overall performance in KS5 qualifications. Finally some interaction terms between the EPQ variable and other contextual variables (KS4 mean points score, gender, school type and qualification size) were included to explore whether the effect of taking the EPQ was different for different groups of students.

The hierarchical nature of the data meant that it was appropriate to use multilevel regression models. These take account of the fact that data at one level (students) was 'nested' within another level (schools). Outcomes tend to be more similar within schools than between schools and so to ignore this structure would potentially lead to incorrect results. For a more detailed description of multilevel logistic regressions see Goldstein (2011).

The models presented in this analysis took the following general form:

$$Y_{ij} = \beta_0 + \beta_1 IV1_{ij} + \beta_2 IV2_{ij} + \cdots \beta_k IVk_{ij} + u_j + e_{ij}$$

where Y_{ij} is the mean UCAS points score for student i in school j, $IV1$ to IVk were the independent variables (including the contextual variables and whether or not the student took the EPQ), β_0 to β_k were the regression coefficients, u_j was a random variable at school level and e_{ij} was an individual level residual.

Results

Descriptive

Tables 1 to 3 present descriptive data on the students taking EPQ, compared with those not taking the qualification (i.e., taking A levels only, or A levels combined with AS levels). This shows that EPQ students were more likely than non-EPQ students to be female (61.3% in 2013/14 and 63.4% in 2014/15) and to attend sixth form colleges or grammar schools, and were less likely to attend comprehensive or independent schools or Further Education (FE) or Tertiary colleges.

Table 1: Percentage of EPQ and non-EPQ students in different groups

	2013/14		*2014/15*	
	EPQ	*Non-EPQ*	*EPQ*	*Non-EPQ*
No. of students	23,396	110,203	24,510	115,731
All	17.5	82.5	17.5	82.5
Female	61.3	55.8	63.4	56.5
Male	38.7	44.2	36.6	43.5
Academy	27.5	28.6	30.9	31.2
Comprehensive	19.0	22.7	19.9	20.8
FE/Tertiary	5.3	7.0	3.8	6.6
Independent	11.4	16.1	11.6	15.4
Other	0.8	0.8	1.6	0.8
Grammar	6.9	4.2	7.6	4.0
Sixth Form	29.2	20.6	24.5	21.2

Table 2: Comparison of EPQ and non-EPQ students, 2013/14

	EPQ		*Non-EPQ*	
	Mean	*SD*	*Mean*	*SD*
KS4 mean points score	50.1	4.6	48.5	4.5
Qualification size	4.3	0.6	3.8	0.5
Mean UCAS points	96.5	22.7	87.7	23.0

Table 3: Comparison of EPQ and non-EPQ students, 2014/15

	EPQ		*Non-EPQ*	
	Mean	*SD*	*Mean*	*SD*
KS4 mean points score	49.9	4.6	48.3	4.5
Qualification size	4.3	0.5	3.8	0.4
Mean UCAS points	96.4	22.7	87.7	22.8

In terms of their prior attainment, EPQ students had a higher average KS4 points score (50.1 compared with 48.5 in 2013/14; 49.9 compared with 48.3 in 2014/15). EPQ students also performed better on average in terms of average UCAS points and tended to have taken more qualifications.

Modelling (2013/14)

The results of the modelling using 2013/14 data are presented in Table 4. The model building proceeded as follows: Model 1 included no predictors, just an intercept, to assess the amount of variance in achievement between schools. From the error variance part of the table we can calculate that around 20.5 percent of the variance was accounted for by schools[1]. This is a substantial proportion of the variance and suggests that the use of a multilevel model was justified.

1. As calculated by the intraclass correlation coefficient (ICC). ICC = school variance/(school variance + error variance) = 114.060/ (114.060 + 440.160) = 0.205.

Table 4: Model parameter estimates for student level analysis, 2013/14

(standard errors in brackets)

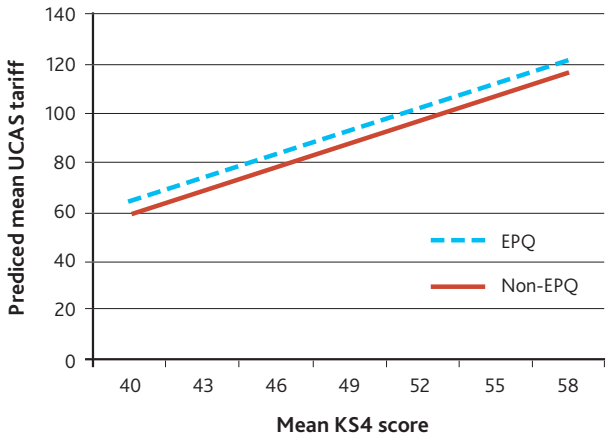
Fixed effects		*Model 1*	*Model 2*	*Model 3*	*Model 4*
Intercept		**87.028 (0.234)**	**87.403 (0.146)**	**86.681 (0.214)**	**86.623 (0.219)**
KS4 points score			**3.182 (0.012)**	**3.156 (0.012)**	**3.120 (0.013)**
Gender	Male				
	Female		**1.107 (0.102)**	**1.139 (0.101)**	**1.587 (0.110)**
Qualification size			**-1.121 (0.123)**	**-1.050 (0.123)**	**-1.335 (0.134)**
EPQ	No				
	Yes		**5.309 (0.151)**	**5.239 (0.150)**	**5.360 (0.361)**
School type	Academy				
	Comprehensive			-0.374 (0.287)	-0.352 (0.293)
	FE/Tertiary			**-2.875 (0.523)**	**-3.354 (0.531)**
	Independent			**5.494 (0.330)**	**5.585 (0.336)**
	Other			-2.100 (1.142)	**-2.603 (1.151)**
	Grammar			0.156 (0.636)	-0.177 (0.653)
	Sixth Form			-0.349 (0.486)	-0.640 (0.488)
KS4 points score*EPQ					**0.184 (0.030)**
Gender*EPQ	Male				
	Female				**-2.632 (0.256)**
School type*EPQ	Academy				
	Comprehensive				-0.225 (0.404)
	FE/Tertiary				**3.072 (0.660)**
	Independent				-0.790 (0.480)
	Other				**4.259 (1.639)**
	Grammar				**1.444 (0.637)**
	Sixth Form				**1.600 (0.374)**
Qualification size*EPQ					**1.127 (0.257)**
Error variance					
Level 1		440.160 (1.720)	277.980 (1.099)	278.060 (1.099)	227.620 (1.097)
Level 2 – intercept		114.060 (3.899)	27.264 (1.153)	20.970 (0.943)	20.743 (0.934)
Model fit					
AIC		1197428	1109291	1108896	1108689

AIC = Akaike Information Criterion

Model 2 then includes the Level 1 predictors (prior attainment, gender, qualification size and whether EPQ was taken). Model 3 adds in the Level 2 predictor (school type) and finally Model 4 adds in interaction terms between the EPQ indicator and each of the other predictor variables. In these, and all subsequent models, statistically significant effects are signified by bold type.

Looking at Model 3 first of all, we can see that there is evidence that taking the EPQ was beneficial to overall performance at KS5. Although the difference of around five points is equivalent to only about a quarter of a grade on average (i.e., one grade in one qualification if taking four A levels), this could still be an important difference in practice. For example, it could mean the difference between meeting and not meeting a university offer. The other variables in this model were all significant, with females being more likely to do well than males, and students taking more qualifications less likely to do well. Compared to academy schools, students at FE/Tertiary colleges were less likely to do well, whilst those at independent schools were more likely to do well.

To illustrate the magnitude of the EPQ effect, Figure 1 uses the results of Model 3 to compare (at different levels of prior attainment) the predicted UCAS tariff for students taking the EPQ, with the predicted UCAS tariff for those not taking the EPQ. These predictions were for a male student at an academy school, taking qualifications equal to four A levels – either three A levels and two AS levels, or three A levels, one AS level and the EPQ.



Prior attainment	*Predicted UCAS tariff (Non-EPQ)*	*Predicted UCAS tariff (EPQ)*
40	59.3	64.5
43	68.7	74.0
46	78.2	83.4
49	87.7	92.9
52	97.1	102.4
55	106.6	111.8
58	116.1	121.3

Figure 1: Predicted UCAS tariff by prior attainment level, EPQ and non-EPQ students, 2013/14, (Model 3)

Table 5: Model parameter estimates for student level analysis, 2014/15

(standard errors in brackets)

Fixed effects		*Model 1*	*Model 2*	*Model 3*	*Model 4*
Intercept		**86.720 (0.231)**	**87.421 (0.141)**	**87.221 (0.201)**	**87.267 (0.205)**
KS4 points score			**3.143 (0.012)**	**3.121 (0.012)**	**3.098 (0.013)**
Gender	Male				
	Female		**0.796 (0.099)**	**0.832 (0.099)**	**1.137 (0.107)**
Qualification size			**-2.365 (0.125)**	**-2.322 (0.125)**	**-2.734 (0.137)**
EPQ	No				
	Yes		**5.741 (0.148)**	**5.746 (0.148)**	**5.072 (0.345)**
School type	Academy				
	Comprehensive			**-1.012 (0.282)**	**-1.112 (0.289)**
	FE/Tertiary			**-3.816 (0.537)**	**-4.203 (0.543)**
	Independent			**4.220 (0.323)**	**4.207 (0.323)**
	Other			**-5.603 (1.149)**	**-5.844 (1.162)**
	Grammar			-0.423 (0.642)	-0.547 (0.661)
	Sixth Form			-0.220 (0.485)	-0.434 (0.487)
KS4 points score*EPQ					**0.108 (0.029)**
Gender*EPQ	Male				
	Female				**-1.845 (0.252)**
School type*EPQ	Academy				
	Comprehensive				0.567 (0.404)
	FE/Tertiary				**2.839 (0.660)**
	Independent				0.007 (0.480)
	Other				1.868 (1.639)
	Grammar				0.402 (0.637)
	Sixth Form				**1.114 (0.374)**
Qualification size*EPQ					**1.781 (0.269)**
Error variance					
Level 1		433.750(1.653)	277.470 (1.070)	277.500 (1.070)	227.250 (1.069)
Level 2 – intercept		114.570 (3.831)	25.971 (1.100)	21.141 (0.934)	20.925 (0.927)
Model fit					
AIC		1255345	1164179	1163857	1163733
BIC		1255363	1164220	1163933	1163862

AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion

Thus, a male student with a prior attainment of 52 points (equivalent to all grade As) and not taking the EPQ was predicted a mean UCAS tariff of just over 97 points (equivalent to A level grades of BBB and AS levels grades of B and C). If he did take the EPQ the prediction is 102.4 points (equivalent to grades ABB in the A levels and a grade C in the AS level).

Returning to the analysis presented in Table 4, we can see that if we include the interaction terms (Model 4), the effect of the EPQ was again around five UCAS points. However, because of the interaction effects, this EPQ effect only refers to students in the baseline category for all other variables (male students, taking the equivalent of three and a half A levels, attending an academy school, and with a KS4 points score equal to the mean). The interactions between EPQ and KS4 points score, gender, school type and qualification size mean that the effect of the EPQ was found to be different for different levels of each variable. Thus, as KS4 points score increased, the effect of the EPQ became significantly larger, but for female students it was significantly smaller (compared to males). The effect of taking the EPQ was also significantly larger for students in FE/Tertiary colleges, 'Other' schools, grammar schools and sixth form colleges, and for those taking more qualifications.

Modelling (2014/15)

Table 5 presents the results using the 2014/15 data.

The results were very similar to the models using the 2013/14 data. This time schools accounted for 20.9 percent of the variation in the outcomes. The value of the EPQ parameter in Model 3 suggests that taking the EPQ was beneficial to overall performance at KS5, by around five points (equivalent to one grade in one subject if taking four A levels). Other variables were all significant, including females being more likely to do well than males, and students taking more qualifications less likely to do well. Compared to academy schools, students at comprehensive schools, FE/Tertiary colleges or 'Other' schools were less likely to do well, whilst those at independent schools were more likely to do well.

If we include the interaction terms (Model 4 in Table 5) we can see that the effect of the EPQ was again around five UCAS points. However, this effect was only for students in the base category for all variables. The interactions show that, as KS4 points score increased, the effect of the EPQ became larger, but for female students it was smaller (compared to males). The effect of taking the EPQ was also larger for students in FE/Tertiary colleges and sixth form colleges, and for those taking more qualifications.

The results of the modelling were very similar, whether using the 2013/14 or the 2014/15 data. They show that taking the EPQ did have a statistically significant and positive effect on student performance in terms of the UCAS points tariff. However, the effect was quite small, equivalent to around one grade in one A level if taking four A levels.

As a further check on the robustness of these results, two further models were run (using the 2014/15 data only) which only included students with the same volume of qualifications (so that the students being compared were more alike). The data for the first of these models was restricted to those taking qualifications equivalent to four A levels (three A levels and two AS levels, or three A levels, one AS level and the EPQ) and for the second model equivalent to three and a half A levels (three A levels and one AS level, or three A levels and the EPQ). The results of the models are presented in Appendix 1. They show mostly very similar results, with a small but significant EPQ effect.

Centre level analysis

Data and methods

The second part of this research investigated the effect at centre level of taking the EPQ. More specifically, looking at whether increasing the proportion of students taking the EPQ in a centre was associated with better overall performance (in all qualifications). To do this, data from the NPD in two different academic years (2009/10 and 2011/12) was used. This data was chosen because the increase in EPQ entries was particularly large between these two years, up from around 18,700 in 2009/10 to over 33,000 in 2011/12 (Gill, 2016b). A gap of two years was thought to be suitable because inspection of the data found that for many centres the uptake of the EPQ was quite low in the first year of offering the qualification and tended to be much higher in the second year. Furthermore, two years is a short enough period that there should not be too many changes within centres in terms of other factors that might affect attainment.

A difference-in-differences design was used to assess the impact of increasing EPQ uptake. This technique is appropriate for assessing the effect of a reform or the introduction of a new programme or policy (see, for example, Abramovsky, Battistin, Fitzsimons, Goodman, & Simpson, 2011; Belot & Vandenberghe, 2014). The outcome variable in such a model is the difference between some outcome measure before and after the reform or programme is introduced. Comparisons can then be made, in terms of this difference, between those exposed to the new reform/programme and those not exposed.

For this research the 'reform' was the introduction of the EPQ in some centres. The outcome variable was the difference in centre mean UCAS tariff between before (2009/10) and after (2011/12) introducing the EPQ. This variable was calculated by adding up the UCAS tariff for each grade achieved in Level 3 qualifications in the centre and dividing by the total size of qualifications taken. The EPQ and any qualifications worth less than half an A level were excluded from this calculation.

The centres included in the models were only those with zero, or very low (less than 5 percent) EPQ uptake in 2010, so that the effect of the introduction of the EPQ into centres which had not previously offered the qualification could be investigated. The inclusion of centres with very low uptake in 2009/10, as well as those with zero uptake, was necessary to boost the number of centres available for the modelling. Only centres whose mean UCAS tariff (in both 2009/10 and 2011/12) was based on at least 20 students were included. This meant that the final dataset for the models included 1,730 centres.

A standard difference-in-differences model would include a binary indicator of whether or not the centre had introduced the EPQ. However, further inspection of the data found that most of the centres introducing the EPQ only had a very low percentage of their students taking the qualification in 2011/12, which is unlikely to have a big effect on outcome measures. This is shown in Figure 2, which presents the distribution of EPQ uptake amongst centres.

To take account of this, the variable indicating introduction of EPQ was split into four separate categories depending on what proportion of students took the EPQ in 2011/12. These categories indicated *zero uptake* (actually less than 5%), *low uptake* (5–10%), *moderate uptake* (10–30%) or *high uptake* (>30%) of the EPQ.

Several centre level contextual variables were included in the models. These were a measure of the average prior attainment of students at the school (KS4 mean points score), the mean size of the qualifications taken

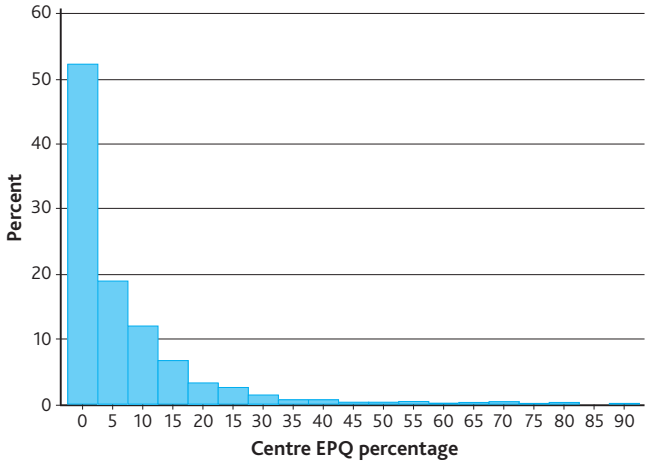


Figure 2: Distribution of centre EPQ uptake in 2011/12

by students, the percentage of white students, the percentage of students eligible for free school meals (FSM) and the school type. For the ethnicity and FSM variables, there was a relatively large amount of missing data, so the percentage of missing data was calculated for each centre and also included in the models.

Finally, to account for any changes within centres between 2009/10 and 2011/12, a difference variable was calculated for each of the contextual variables, equal to the 2011/12 value minus the 2009/10 value (e.g., FSM percentage in 2011/12 – FSM percentage in 2009/10).

Thus, the final models took the following form:

$$\Delta Y_j = (Y_{j2012} - Y_{j2010}) = \beta_0 + \beta_1 IV1_j + \beta_2 IV2_j + \cdots + \beta_k IVk_j + u_j$$

where ΔY_j is the change in the mean UCAS tariff for school j between 2010 and 2012, $IV1$ to IVk were the independent variables (including the EPQ category, contextual variables and the variables accounting for differences in contextual factors over time), β_0 to β_k were the regression coefficients and u_j was the residual.

Results

Descriptive

In total there were 1,730 centres included in the model. The distribution of centres by EPQ category was as follows:

Table 6: Distribution of centres by EPQ uptake category

EPQ category	*Uptake levels*	*No. of centres*
No uptake	<5%	1,096
Low uptake	5–10%	267
Moderate uptake	10–30%	306
High uptake	>30%	61

Table 7 presents descriptive data on the outcome variable for the models.

Thus, centres in 2012 performed slightly better on average on the measure of attainment. The biggest difference in a centre was about 40 points, equivalent to two A level grades.

Table 7: Descriptive data for difference in centre mean UCAS tariff between 2009/10 and 2011/12

Mean	*SD*	*Min*	*Max*
0.27	7.06	-38.87	44.04

Modelling

Linear regression models were used for this analysis. The only predictor in the first model was the EPQ category. The second model added in the contextual variables and the 'difference' variables. Only variables with statistically significant effects were included in these final models. The results of the models are presented in Table 8.

Model 1 included only the EPQ category as a predictor variable, and showed that centres that introduced the EPQ with at least 30 percent of students had a significantly larger improvement in their mean UCAS tariff between 2009/10 and 2011/12 than centres with no uptake. However, there was no such effect if the EPQ uptake was low or moderate in 2011/12.

The results after including the covariates that were statistically significant (Model 2) show that having low uptake did not make a significant difference, but having moderate or high uptake was associated with a larger increase in the mean UCAS tariff for a centre. The difference was small, just one UCAS point for moderate uptake and two UCAS points for high uptake. Two UCAS points is equivalent to 1/10th of an A level grade. In other words, the model predicts that introducing the EPQ into a centre (with 30 percent or more students taking the qualification) would increase a centre's attainment by one grade for every ten A levels taken, compared with centres not introducing the EPQ.

Although not the main focus of this research, it is interesting to note the effects of the contextual and 'difference' variables included in the model. The only contextual variable that was statistically significant in Model 2 was the percentage of FSM students in the centre[2]. This was negative, indicating that having a higher proportion of FSM students was associated with lower attainment in 2011/12 compared with 2009/10. There were three other statistically significant variables, which indicated the effect of changes within centres between the two years (KS4 mean points score, mean qualification size, and the percentage of female students in the centre). All of these were positive. The positive effect of the change in the mean KS4 points score makes sense intuitively, in that

Table 8: Model parameter estimates for centre level analysis
(standard errors in brackets)

Fixed effects		*Model 1*	*Model 2*
Intercept		-0.101 (0.213)	**-0.774 (0.275)**
EPQ category	None		
	Low	0.268 (0.481)	0.284 (0.438)
	Moderate	0.344 (0.456)	**0.920 (0.416)**
	High	**2.003 (0.928)**	**1.949 (0.844)**
FSM %			**-0.069 (0.022)**
FSM % missing			-0.004 (0.005)
Mean KS4 points score difference			**2.001 (0.117)**
Mean qualification size difference			**2.233 (0.443)**
% of female students difference			**0.037 (0.018)**
Model fit			
Adjusted R Square		0.003	0.179

2. The percentage of missing FSM was also included in the models despite not being statistically significant because this varied considerably between centres and so could potentially impact on the FSM percentage variable.

if a centre attracts more able students, it is likely to improve its overall performance. Increasing mean qualification size, or the percentage of female students were both associated with larger improvements in attainment in 2011/12 compared with 2009/10.

It is interesting to note the low value for the adjusted R square in Model 2 (0.179), meaning that only around 18 percent of the variability in the outcome variable was explained by the predictor variables. In other words, most of the variability was explained by other factors, which were not included in the model.

Discussion

There is evidence from prior research about the benefits of taking the EPQ, in terms of teaching students the thinking skills and independent learning that may help them prepare for university study (see for example, CEI, 2008; Gill & Vidal Rodeiro, 2014; Gill, 2016a). Undertaking a project based qualification is also associated with improved performance in concurrent GCSE/A level studies in particular circumstances (CEI, 2008; Stock Jones et al, 2016; Jones, 2015).
The purpose of the research presented here was to investigate whether taking the EPQ could be advantageous for students in qualifications taken at the same time. This article extends beyond prior work by including data from all (rather than one) exam boards, and conducting student and centre level analysis. It is worth noting that the type of work that the EPQ prepares students for (e.g., research, independent thinking, etc.) is present to a lesser degree in A levels than it is at undergraduate level. However, this is not to say that some of these skills are not useful at A level as well.

The main conclusion from this research is that there was some evidence that taking the EPQ may be beneficial in terms of performance on other qualifications, both at the student level and at the centre level. However, in both cases the effect was relatively small. At the student level, taking the EPQ was associated with an improvement in mean UCAS tariff of around five to six points (in both 2013/14 and 2014/15). This is equivalent to an improvement of one grade in one A level for a student taking four A levels. At the centre level, increasing the EPQ uptake from less than 5% of sixth formers to over 30% between 2010 and 2012 was associated with an increase in the overall performance in a centre. This increase amounted to one tenth of an A level grade (in other words, one grade improvement in every tenth A level taken at the centre).

Although neither of these effects could be considered large, they are still important in practice, when considering that they could be the difference between meeting and failing to meet a university offer.

At the student level there were also some interesting (although small) interaction effects between taking the EPQ and other contextual variables. First, the effect of taking the EPQ was higher for those with higher prior attainment, suggesting that the EPQ may benefit the brightest students most. The effect of the EPQ was also greater for male students than for female students, which contrasts with the overall effect of gender on performance according to the models, which favoured females. Indeed the gender interaction effect was larger than the main gender effect, which means that although the the non-EPQ females were predicted a higher mean UCAS than the non-EPQ males, the EPQ females were predicted a lower mean UCAS than the EPQ males. Finally, students attending FE/Tertiary colleges had the biggest improvement in performance from taking the EPQ, compared with not taking it.

In terms of the overall effect at the student level we should be somewhat cautious in the interpretation, because we cannot say for certain that there is a causal relationship. For instance, it may be that students taking the EPQ are more motivated to do well academically than those not doing so and it is this, rather than taking the EPQ per se, that enables them to do better in their A levels.

In the centre level model, the outcome variable was the difference in performance over a period of two years. However, it may be that any positive impact of introducing the EPQ into a centre is less in the first few years, as teachers become familiar with teaching the qualification. This hypothesis is borne out by the evaluation of the EPQ pilot (CEI, 2008) which found that teachers reported that it took time for them to get used to the requirements of the new qualification. Therefore the effect found in the results presented in this article may be an underestimate of the longer term effect. One way of assessing whether the effect increases as centres become more experienced would be to re-run the student level models and include a variable indicating, for each student, how long their centre had been teaching the EPQ.

One factor that has not been explored in this research is the effect of the grade received in the EPQ by students. Black and Gill (2011) found that the overall positive effect of taking AS level Critical Thinking was greater for those who achieved a higher grade in the qualification. It would be interesting to see whether the students who achieved best in their EPQ were those who also did well at A level (after accounting for ability). A further centre level analysis could be undertaken to investigate this, by including the centre level EPQ performance in the models. This might indicate that centres where students do particularly well at the EPQ might be able to improve their overall performance more than centres that do less well in the EPQ (i.e., the EPQ is beneficial, but only if it is taught well).

Another area that might be interesting to explore is whether the EPQ is more beneficial for some A level subjects than for others. Jones (2015) found the positive effect of taking the EPQ on A level performance was present (and very similar in terms of size) for all subject groups apart from Mathematics and Languages, for which there was no significant effect. Research by Gill (2016b) found that correlations between the EPQ grade and A level grades differed depending on the A level subject, with the best correlations (amongst the top 10 most common A levels taken by EPQ students) for English Literature (0.47) and History (0.47), and the worst for Mathematics (0.37) and Sociology (0.38). This suggests that the skills learned in the EPQ may be more applicable to some subjects than to others.

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Appendix

This analysis checks the results of the student level modelling by running the same models on a subset of students (for 2014/15 only) with the same volume of qualifications; students taking three A levels and two AS levels, or three A levels, one AS level and the EPQ, and then three A levels and one AS level or three A levels and the EPQ.

Table A1 presents the numbers of students in each group. Table A2 presents the results of the model with UCAS tariff as the outcome variable.

The results are very similar to the model with the full data, with the EPQ effect being slightly higher for the two AS levels model than for the one AS level model. Interestingly, for both models the EPQ effect decreased as KS4 increased, which is the opposite of the effect in the original model.

Table A1: Number of students taking each combination of qualifications

Combination (A level + AS level + the EPQ)	*Number of students*
3 + 2 + 0	18,582
3 + 1 + 1	13,609
3 + 1 + 0	78,451
3 + 0 + 1	1,900

Table A2: Model parameter estimates for student level analysis on subsets of students, 2014/15

(standard errors in brackets)

Fixed effects		*3+2+0 v 3+1+1*	*3+1+0 v 3+0+1*
Intercept		**85.912 (0.353)**	**85.481 (0.224)**
KS4 points score		**3.201 (0.030)**	**2.945 (0.016)**
Gender	Male		
	Female	**0.938 (0.260)**	**1.392 (0.131)**
EPQ	No		
	Yes	**6.610 (0.487)**	**3.028 (0.474)**
School type	Academy		
	Comp	**-2.438 (0.504)**	**-0.691 (0.313)**
	FE/Tertiary	**-3.796 (0.871)**	**-3.110 (0.574)**
	Independent	**3.566 (0.633)**	**4.826 (0.352)**
	Other	-3.648 (1.974)	**-3.938 (1.282)**
	Grammar	-1.117 (0.970)	0.322 (0.799)
	Sixth Form	-0.317 (0.664)	-0.159 (0.506)
KS4 points score*EPQ		**-0.112 (0.047)**	**-0.686 (0.093)**
Gender*EPQ	Male		
	Female	**-0.987 (0.402)**	n.s.
School type*EPQ	Academy		
	Comp	**1.697 (0.665)**	n.s.
	FE/Tertiary	**3.026 (1.073)**	n.s.
	Independent	1.121 (0.815)	n.s.
	Other	-1.852 (2.434)	n.s.
	Grammar	0.725 (1.211)	n.s.
	Sixth Form	0.555 (0.641)	n.s.