CAMBRIDGE ASSESSMENT

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

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Abstract

The Extended Project Qualification (EPQ) is a stand-alone qualification taken by sixth form students. It involves undertaking a substantial project in an area of personal interest, where the outcome can range from writing a dissertation or report to putting on a performance or organising an event. In recent years the EPQ has seen substantial increases in entries, perhaps partly because it is seen as good preparation for university study and is now included in offers by some higher education institutions.

This research uses data from the National Pupil Database (NPD) to investigate the students taking EPQ and the schools or colleges offering the qualification. First, descriptive data on levels of uptake and results in the EPQ over time and for different groups are presented. As entries have proliferated, it is of interest to consider which groups of students are taking EPQ and how they perform. The second, and main, part of the research was to undertake statistical modelling to investigate whether taking the EPQ had any significant effect on performance in other qualifications. It is hypothesised that some of the transferable skills learnt by students whilst undertaking their project (e.g. independent research, planning, analysis, problem-solving etc.) could help them in their other qualifications taken at the same time.

Two separate investigations were undertaken on the impact of taking EPQ. Firstly, the performance of individual students was analysed, using a multilevel regression model to compare EPQ and non-EPQ students, after accounting for prior attainment and other background characteristics. The results showed that there was a small, but statistically significant effect, with those taking EPQ achieving better results on average in their A levels than those not doing so. This result was consistent across two different academic years and when using different performance measures.

The second investigation analysed performance at school level, using a regression to model the effect on overall performance of increasing the percentage of students in a school taking EPQ, again after accounting for contextual variables such as the average prior attainment of students in the school. The results showed a significant and positive effect of increasing the percentage of students taking EPQ. However, the effect was very small.

Introduction

The Extended Project Qualification (EPQ) is a level 3 stand-alone qualification taken by sixth form students. It involves undertaking a substantial project in an area of personal interest, where the outcome can range from writing a dissertation or report to putting on a performance or organising an event. It is thought 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. Previous research has shown that EPQ grades are good predictors of degree outcomes (Gill & Vidal Rodeiro, 2014) and that students taking EPQ alongside A levels are more likely to achieve a good degree than those taking A levels only (Gill, 2016a).

It is therefore also of interest to consider whether EPQ might be beneficial to students in their other qualifications taken at the same time. The hypothesis is that the skills learnt whilst undertaking EPQ (research, analysis, independent learning) might be transferable to other qualifications. The main aim of this research was to investigate whether students taking EPQ performed better, on average, in other qualifications than their counterparts who did not take EPQ. Two separate analyses of the effect of EPQ were undertaken, one at student level and one at centre level.

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 several 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 equal in size to one A level in the current year. They include the results of qualifications taken by these students in previous years, such as AS levels (or 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 3 A levels combined with at least one AS level or EPQ (or both) and no other qualifications. Qualifications that were re-sat were counted only once and the best grade kept. Tables 1 and 2 present the number of students taking each combination in each year.

Table 1: Number of students combining at least 3 A levels with AS levels and/or EPQ (2013/14)

		A levels		
AS levels	**EPQ**	**3**	**4**	**5+**
0	1	1,704	985	246
1	0	67,334	14,874	703
1	1	11,746	2,916	244
2	0	20,175	2,428	116
2	1	4,087	604	56
3+	0	4,133	416	23
3+	1	718	83	9

Table 2: Number of students combining at least 3 A levels with AS levels and/or EPQ (2014/15)

		A levels		
AS levels	**EPQ**	**3**	**4**	**5+**
0	1	1,900	959	183
1	0	78,451	12,180	480
1	1	13,609	2,380	198
2	0	18,582	1,758	80
2	1	4,024	435	36
3+	0	3,842	345	14
3+	1	710	70	7

Thus, the majority of students took 3 A levels and 1 AS level, either with EPQ (11,746 in 2013/14 and 13,609 in 2014/15) or without EPQ (67,334 and 78,451 respectively).

A multilevel regression model was undertaken for each year, with the outcome variable being the mean UCAS points score (excluding EPQ result, where taken[1]). 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 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, opposing effects: first, a motivation effect whereby students taking 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 3.5 (equal to 3 A levels + 1 AS level or EPQ) was subtracted from each value. This meant that the default for the variable was taking the equivalent of 3.5 A levels and the parameter estimate represented the change in the outcome variable associated with taking one more A level (or equivalent).

[1] Although it would also have been reasonable to include the EPQ result in the mean UCAS points score. To check if this would have made any difference the models detailed below were re-run with the EPQ result included. The results were very similar.

Two further 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 (Key Stage 4 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 (e.g. students) can be 'nested' within another level (e.g. 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 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 3 to 5 present descriptive data (using the NPD subsets) 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 FE/Tertiary colleges.

Table 3: Percentage of EPQ and non-EPQ students in different groups

	2013/14		**2014/15**	
	EPQ	**No EPQ**	**EPQ**	**No 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
6th Form	29.2	20.6	24.5	21.2

Table 4: Comparison of EPQ and non-EPQ students (2013/14)

	EPQ		No 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 5: Comparison of EPQ and non-EPQ students (2014/15)

	EPQ		No 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 6. 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% of the variance was accounted for by schools[2]. This is a substantial proportion of the variance in achievement and suggests that the use of a multilevel model was justified. 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.

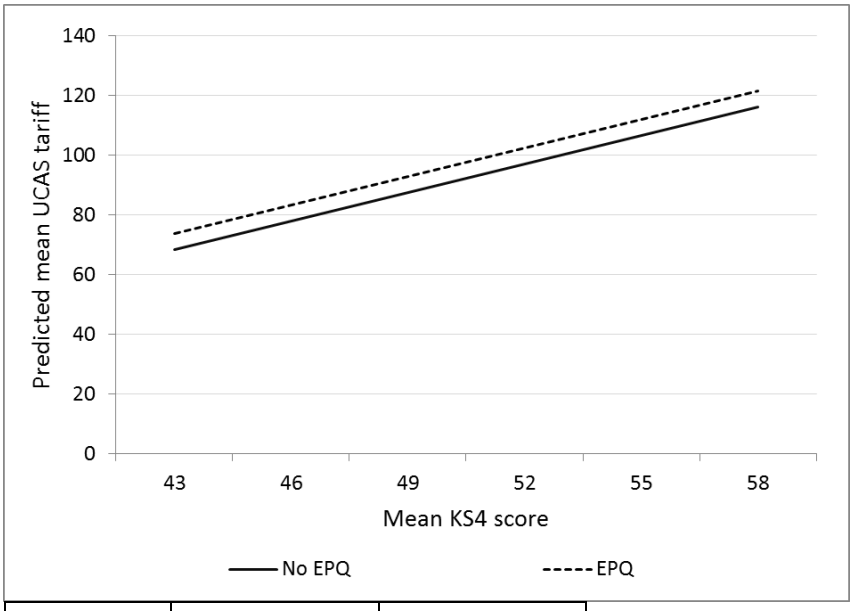
Looking at model 3 first of all, we can see that there is evidence that taking EPQ was beneficial to overall performance at KS5. Although the difference of around 5 points is equivalent to only about 1/4 of a grade on average (i.e. one grade in one qualification if taking 4 A levels), this could still be an important difference in practice. For example, it could mean the difference between meeting or 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.

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

Table 6: 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)**
Qual 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				
	Comp			-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)
	6th 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				
	Comp				-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)**
	6th Form				**1.600 (0.374)**
Qual 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

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 EPQ, with the predicted UCAS tariff for those not taking EPQ. These predictions were for a male student at an academy school, taking qualifications equal to 4 A levels – either 3 A levels and 2 AS, or 3 A levels, one AS and EPQ.

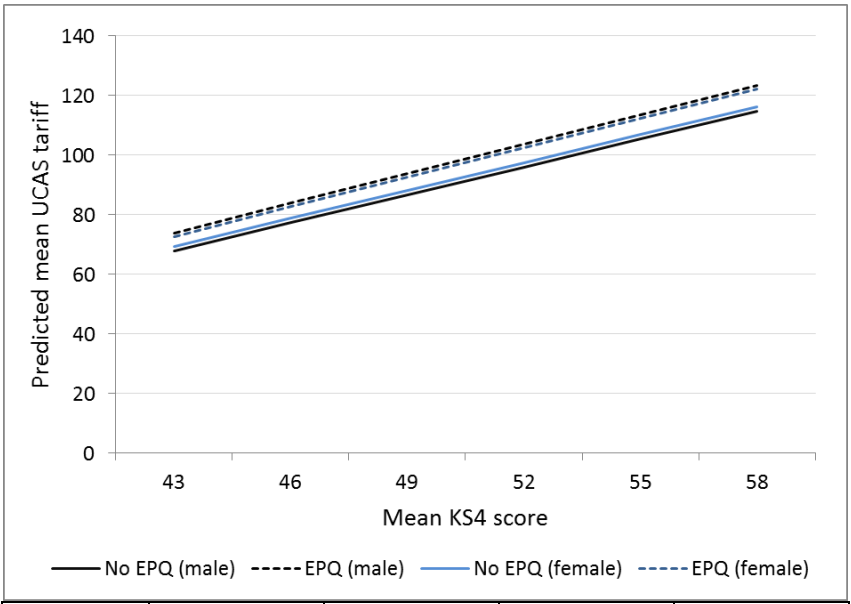


Prior attainment	Predicted UCAS tariff (no EPQ)	Predicted UCAS tariff (EPQ)
43	68.6	73.9
46	78.1	83.4
49	87.6	93.0
52	97.2	102.5
55	106.7	112.0
58	116.3	121.6

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

Thus, a male student with a prior attainment of 52 points (equivalent to all grade As) and not taking EPQ was predicted a mean UCAS tariff of just over 95 points (equivalent to A level grades of BBC and B grades in the AS levels). If he did take EPQ the prediction is just over 100 points (equivalent to all B grades in the A levels and AS level).

If we include the interaction terms (model 4) we can see that the effect of EPQ was again around 5 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 3.5 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 EPQ was found to be different for different levels of each variable. Thus, as KS4 points score increased the effect of EPQ became significantly larger, but for female students it was significantly smaller (compared to males). The effect of taking EPQ was also significantly larger for students in FE/Tertiary colleges, 'Other' schools, grammar schools and 6th form colleges and for those taking more qualifications. As an example of the how the interactions affect the predicted outcome, Figure 2 compares female and male students taking EPQ with female and male students not taking EPQ (again, for different levels of prior attainment).



Prior attainment	No EPQ (male)	EPQ (male)	No EPQ (female)	EPQ (female)
43	68.0	74.0	69.5	72.8
46	77.4	83.9	78.8	82.7
49	86.7	93.8	88.2	92.6
52	96.1	103.7	97.5	102.5
55	105.5	113.7	106.9	112.5
58	114.8	123.6	116.3	122.4

Figure 2: Predicted UCAS tariff by prior attainment level and gender, EPQ and non-EPQ students (2013/14, model 4)

Thus the effect of taking EPQ for a male student with prior attainment of 43 was to increase predicted UCAS tariff by 6 points (74.0 – 68.0), whilst the effect for female students was only 3.3 points (72.8 – 69.5). The effect for a male student with prior attainment of 55 was 8.2 points and for females was 5.6 points (i.e. a larger effect at higher prior attainment).

Some further models were run that included a measure of the level of deprivation in the area where the student lives (known as the Income Deprivation Affecting Children Index, or IDACI). However, as this measure was missing for about 27,000 students it was thought better not to include it in the final model. The results of the models including IDACI were very similar to the final model, in terms of parameter estimates for the other variables.

Modelling (2014/15)

Table 7 presents the results using the 2014/15 data.

Table 7: 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)**
Qual 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				
	Comp			**-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)
	6th 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				
	Comp				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)
	6th Form				**1.114 (0.374)**
Qual 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

The results were very similar to the models using 2013/14 data. This time schools accounted for around 20.9% of the variation in the outcomes. The value of the EPQ parameter in model 3 suggests that taking EPQ is beneficial to overall performance at KS5, by around 5 points (equivalent to one grade in one subject if taking 4 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 7) we can see that the effect of EPQ was again around 5 UCAS points. However, this effect was only for students in the base category for all variables. The interactions showed that as KS4 points score increased the effect of EPQ became larger, but for female students it was smaller (compared to males). The effect of taking EPQ was also larger for students in FE/Tertiary colleges and 6th form colleges and for those taking more qualifications.

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

As a further check on the robustness of these results some more models were run which only included students with the same volume of qualifications (i.e. so that the students being compared were more alike). The data for these models was restricted to those taking qualifications equivalent to 4 A levels (3 A levels and 2 AS, or 3 A levels, 1 AS and EPQ) and equivalent to 3.5 A levels (3 A levels and 1 AS, or 3 A levels and 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 of EPQ at centre level. More specifically, looking at whether increasing the proportion of students taking EPQ in a centre was associated with better overall performance (in all qualifications). To do this data from the NPD in two different years (2009/10 and 2011/12) was used. This data was chosen because the increase in EPQ students 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 the best because inspection of the data found that for many centres the uptake of 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 et al. 2011, Belot and 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 new ‘reform’ was the introduction of the EPQ in some centres. The outcome variable was the difference in centre mean UCAS tariff (and separately, the difference in centre mean A level) between before (2009/10) and after (2011/12) introducing EPQ. These were calculated by adding up the UCAS tariff (or A level grade score) for each grade achieved in level 3 qualifications in the centre and dividing by the total size of

qualifications taken[3]. For the UCAS tariff calculation the EPQ grades and any qualifications worth less than half an A level were excluded.

The centres included in the models were those with zero, or very low (less than 5%), EPQ uptake in 2010, so that the effect of the introduction of EPQ into centres which had not previously offered the qualification could be investigated. Centres with very low uptake in 2009/10 were included as well as those with zero uptake to boost the number of centres available for the modelling. Only centres whose mean UCAS tariff or A level grade (in both 2009/10 and 2011/12) was based on at least 20 students were included. This meant that the final dataset for the mean UCAS tariff models included 1,730 centres, whilst for the A level mean models there were 1,680 centres.

A standard difference-in-differences model would include a binary indicator of whether or not the centre had introduced EPQ. However, further inspection of the data found that most of the centres introducing EPQ between 2009/10 and 2011/12 only had a very low percentage of their students taking the qualification, which is unlikely to have a big effect on outcome measures. This is demonstrated in Figure 3, which presents the distribution of EPQ uptake percentage.

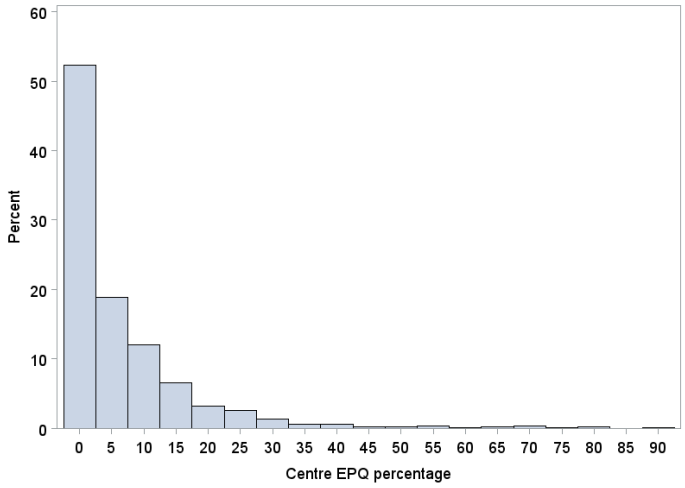


Figure 3: Distribution of centre EPQ percentage in 2011/12

To take account of this, the variable indicating introduction of EPQ was split into four separate categories depending on what proportion of students took EPQ in 2011/12. These categories indicated zero uptake, low uptake (5-10%), moderate uptake (10-30%) or high uptake (>30%) of 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 by students, the percentage of white students, the percentage of students eligible for free school meals (FSM) and the school type. There was a relatively large amount of missing ethnicity and free school meals data, so the percentage of missing was calculated for each centre and also included in the models.

[3] As opposed to just taking the mean of the student level mean UCAS tariff (or A level grade)

Finally, to account for any changes within a centre between 2009/10 and 2011/12 a difference variable was calculated for each of the contextual variables (e.g. KS4 mean points score), equal to the 2012 value minus the 2010 value.

Thus, the final models took the following form:

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

where ΔY_j is the change in the centre level performance (either mean UCAS tariff or mean A level) 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 with mean UCAS tariff difference as the outcome variable and 1,680 centres when the outcome variable was the mean A level difference. The distribution of centres by EPQ category was as follows:

Table 8: Distribution of centres by EPQ uptake category

EPQ category	Uptake levels	No. of centres (UCAS tariff)	No. of centres (A levels)
No uptake	<5%	1,096	1,067
Low uptake	5-10%	267	262
Moderate uptake	10-30%	306	292
High uptake	>30%	61	59

Table 9 presents descriptive data on the outcome variables for the models.

Table 9: Descriptive data for outcome variables (centre level analysis)

	Mean	SD	Min	Max
Mean UCAS points difference	0.27	7.06	-38.87	44.04
Mean A level points difference	0.07	0.29	-1.36	1.98

Thus, centres in 2012 performed slightly better on average on the measures of attainment. The biggest difference in a centre in terms of mean UCAS tariff was about 40 points, equivalent to two A level grades. Similarly the biggest difference in mean A level points was around two grades.

Modelling

Linear regression models were used for this analysis. For each outcome variable (difference in mean UCAS points and difference in mean A level in the centre) 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 with change in mean UCAS tariff as the outcome are presented in Table 10.

Table 10: Model parameter estimates for centre level analysis, difference in mean UCAS tariff as outcome variable (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

Model 1 included only the EPQ category as a predictor variable, and showed that centres that introduced EPQ with at least 30% 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 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 EPQ into a centre (with 30% or more of students taking the qualification) would increase a centre's attainment by one grade for every ten A levels taken, compared with centres not introducing 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[4]. 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 if a centre attracts more able students it is likely to improve its overall performance. Increasing mean qualification size or

[4] 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

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% 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.

The results of the models with mean A level grade as the outcome are presented in Table 11.

Table 11: Model parameter estimates for centre level analysis, difference in mean A level as outcome variable (standard errors in brackets)

Fixed effects		*Model 1*	*Model 2*
Intercept		**0.062 (0.009)**	0.020 (0.011)
EPQ Category	None		
	Low	-0.008 (0.020)	-0.010 (0.018)
	Moderate	0.009 (0.019)	0.021 (0.017)
	High	**0.122 (0.038)**	**0.110 (0.036)**
School type	Comprehensive		
	Academy		0.009 (0.019)
	FE/Tertiary College		**-0.098 (0.030)**
	Grammar		0.042 (0.034)
	Independent		**-0.044 (0.017)**
	Other		-0.091 (0.061)
	Sixth Form College		-0.029 (0.034)
Mean KS4 points score difference			**0.081 (0.005)**
FSM % difference			**0.004 (0.001)**
FSM missing % difference			**0.004 (0.001)**
Model fit			
Adjusted R Square		0.006	0.161

The results of model 1 showed that centres with high uptake of EPQ in 2011/12 had a significantly larger improvement in their mean A level grade between 2009/10 and 2011/12 than centres with no uptake.

In model 2, there was still only one significant difference with high uptake associated with higher predicted change in mean A level compared with zero uptake. The difference of 0.110 was again equivalent to about one grade in every 10 A levels taken. This time the significant contextual variables were the school type (which was assumed to be invariant over time), the difference in KS4 mean points score, the difference in the percentage of FSM students and the difference in the percentage of FSM missing students.

Regarding the contextual variables in the model, FE colleges and independent schools had a significantly lower predicted improvement in A level mean between 2009/10 and 2011/12

compared to comprehensive schools. As expected, a bigger increase in KS4 mean points score was associated with a higher predicted improvement in mean A level. A higher percentage of FSM students and a higher percentage of FSM missing students were also both associated with a higher predicted improvement in mean A level. Again, the adjusted R square value was quite low (0.161).

Discussion

Claims have been made 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, http://www.ocr.org.uk/qualifications/projects-extended-project-h856/; http://www.aqa.org.uk/subjects/projects/aqa-certificate/EPQ-7993). Research has shown some evidence that students taking EPQ were more likely to achieve a good degree (Gill & Vidal Rodeiro, 2014; Gill, 2016a). The purpose of the current research was to investigate whether taking EPQ could be advantageous for students in qualifications taken at the same time. It is worth noting that the type of work that EPQ prepares students for (e.g. research, independent thinking) 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 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 EPQ was associated with an improvement in mean UCAS tariff of around 5 to 6 points (in both 2013/14 and 2014/15). This is equivalent to an improvement for a student taking four A levels of one grade in one A level. At the centre level, increasing 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 you consider that they could be the difference between meeting or failing to meet a university offer.

At the student level there were also some interesting (although small) interaction effects between taking EPQ and other contextual variables. Firstly, the effect of taking EPQ was higher for those with higher prior attainment, suggesting that EPQ may benefit the brightest students most. The effect of 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 non-EPQ females were predicted a higher mean UCAS than non-EPQ males, EPQ females were predicted a lower mean UCAS than EPQ males. Finally, students attending FE or tertiary colleges had the biggest improvement in performance from taking EPQ, compared with not taking it.

For the centre level analysis the outcome was the difference in performance over a period of two years. However, it may be that any positive impact of introducing EPQ into a centre is less in the first few years, as teachers get used to teaching the qualification. Therefore the effect found in these results 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 EPQ.

One factor that has not been explored in this research is the effect of the grade received in the EPQ by students. It would be interesting to see whether the students who achieved best in their EPQ were those that 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 EPQ might be able to improve their overall performance more than centres that do less well in EPQ (i.e. EPQ is beneficial, but only if it is taught well).

Another area that might be interesting to explore is whether EPQ is more beneficial for some A level subjects than for others. Research by Gill (2016b) found that correlations between 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 Maths (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.

Appendix 1

This analysis checks the results of the student level modelling by running the same models on a sub-set of students (for 2014/15 only) with the same volume of qualifications; students taking 3 A levels and 2 AS or 3 A levels, 1 AS and EPQ and then 3 A levels and 1 AS or 3 A levels and 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.

Table A1: Number of students taking each combination of qualifications

Combination (A level + AS + 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 sub-sets 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)
	6th 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.
	6th Form	0.555 (0.641)	n.s.

The results are very similar to the model with the full data, with the EPQ effect being slightly higher for the 2 AS model than for the 1 AS model. Interestingly, for both models the EPQ effect decreased as KS4 increased, which is the opposite of the effect in the original model.

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