# How have students and schools performed on the Progress 8 performance measure?

*Conference Paper*

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Presented at the annual conference of the British Educational Research Association,
Northumbria University, Newcastle, UK,
September 2018

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## How to cite this publication:

Gill, T. (2018, September). *How have students and schools performed on the Progress 8 performance measure?* Paper presented at the annual conference of the British Educational Research Association, Northumbria University, Newcastle, UK.

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## 1. Introduction

In October 2013, the Department for Education announced that new ‘headline’ performance measures for schools would be introduced to replace the previous measure of the percentage of students achieving five or more grades A* to C at GCSE (including English and Maths). The new measures (known as Attainment 8 and Progress 8) are based on performance in a student’s best eight subjects at GCSE (or equivalent), but with some restrictions; students are required to take EBacc[1] qualifications in English and Maths as well as at least three other EBacc qualifications. The remaining three slots can be filled either by other EBacc qualifications or by other approved, non-EBacc qualifications.

One of the reasons for the introduction of the new measures was concern that the previous measures penalised schools with a low-attaining intake. As Progress 8 is a value-added measure, it already accounts for the prior attainment of the student and in theory should no longer penalise these schools. Progress 8 scores for schools are calculated as follows:

- Calculate the Attainment 8 score for each student. This is the total points score for their eight highest scoring eligible qualifications. Points are based on the grade achieved (e.g., for GCSEs, points are on a 1 to 8 scale; 1 = G, 8 = A*).
- Compare this score with the mean Attainment 8 score for students with the same prior attainment (as measured by Key Stage 2 Average Fine Level[2]). The Progress 8 score for a student is the difference between the two, divided by 10 (this turns the score into a per qualification measure as the English and Maths points are double-weighted in the calculation).
- Calculate the mean Progress 8 score for all students in the school. This is the school’s Progress 8 score.

Therefore, the mean Progress 8 score for students with the same prior attainment is always zero.

However, despite the value-added structure of Progress 8, there have been various criticisms levelled at the new measure. At the level of the school, there is evidence that it is biased towards selective schools (e.g., Allen, 2016; Andrews, 2017). At student level, there is evidence that certain groups perform better than others. These include girls and those of Chinese ethnicity (Andrews, 2017), non-free school meals students (Andrews, 2017; Sherrington, 2017), and non-Pupil Premium and EAL students (Thomson, 2017b).

A further criticism is the influence of a few student-level outliers on the school-level score. Both Allen (2017) and Sherrington (2017) found that having just a handful of students who for one reason or another did not sit any eligible qualifications (and therefore achieved Attainment 8 scores of zero) can severely reduce a school’s overall Progress 8 score. A recent government policy document on school performance tables (DfE, 2017a) revealed that the DfE plans to consult with schools on this issue with a view to making changes to the methodology in future years.

[1] EBacc is the English Baccalaureate, a school performance measure which shows the proportion of pupils studying the ‘core’ academic subjects at Key Stage 4. Only specific qualifications (mainly GCSEs) are eligible for inclusion in the EBacc.
[2] Average Fine Levels are derived from the marks achieved on KS2 tests in Maths and English.

The purpose of this research was to delve deeper into the relationship between Progress 8 scores and various student and school-level factors. In particular, regression modelling was undertaken to infer which factors were most important in determining scores at student level.

## 2. Data and methods

The analysis used data from the 2015/16 academic year, as this was the latest available data. We were interested in both the school- and student-level Progress 8 scores. Students' Progress 8 scores were taken directly from the National Pupil Database (NPD). The NPD is administered by the Department for Education (DfE) and consists of examination results for all students in all qualifications and subjects in schools and colleges in England, as well as student and school background characteristics such as gender, ethnicity and level of income-related deprivation. Data on school-level Progress 8 scores was downloaded from the DfE website (https://www.compare-school-performance.service.gov.uk/download-data). This also included a school reference number, so that this data could be matched to data from the NPD and from other sources.

Information on the classification of each school was taken from Edubase (the DfE's register of educational establishments), in which schools are classified by their school 'type' and by their selection policy. For the purpose of this research, schools were grouped into one of the following six categories: Academy (Comprehensive); Academy (Modern); Academy (Selective); Comprehensive; Secondary Modern; Grammar. Free Schools were included in the relevant 'Academy' category. Independent schools and special schools were excluded from all analyses because they are not subject to the same accountability measures as state schools. Some Further Education and Sixth Form Colleges also offer GCSEs or other qualifications to students in Key Stage 4 (KS4). However, as this is a relatively rare occurrence, this data was also excluded.

The geographical region of each school was downloaded from a government website (https://get-information-schools.service.gov.uk). This also included information on which local authority the school was in and the date and result of its last Ofsted inspection.

An initial descriptive analysis of Progress 8 scores for different groups of students and schools was undertaken. This was followed by statistical modelling of Progress 8 scores at student level. A further regression analysis made some comparisons between the *Attainment* 8 measure and two alternative performance measures that could have been used instead. The purpose of this was to consider whether using a measure which restricts students to particular qualifications (i.e., those eligible for Attainment 8) was detrimental to specific groups of students, compared with using alternative measures.

For the analysis of Progress 8 scores, students were categorised by a number of different background characteristics. These were: prior attainment, gender, free school meal (FSM) status, deprivation, special educational needs (SEN) status, ethnicity, and whether or not they had English as an additional language (EAL). Students were also classified by the type of school they attended (using the Edubase categories), the 'gender' of the school, and the geographical region in which they lived.

Prior attainment

This was measured by students' Average KS2 Fine Level.

FSM status

Students were classified in the NPD by whether or not they had claimed for free school meals in any of the past six years.

Deprivation

A measure of deprivation commonly used in analyses of student performance is the Income Deprivation Affecting Children Index (IDACI). The IDACI measures the percentage of children in the area where the student resides who live in families that are income deprived. As such, it cannot tell us for certain that the students themselves are income deprived.

SEN status

Students with SEN were classified in the NPD into one of three categories: SEN support, Statement of SEN or Education, Health and Care Plan (EHCP). These categories are listed in order of the amount of extra support needed (low to high).

Ethnicity

The NPD categorised students into one of seven ethnic groups: White, Asian, Black, Chinese, Mixed, Other or Unknown. Chinese students were in a category of their own due to a well-known tendency to perform very well compared to other Asian students.

EAL status

The EAL classification in the NPD was into one of three categories: English, Other or Unclassified. It should be noted (see Strand, Malmberg & Hall, 2015) that the definition of EAL in the NPD only accounted for whether the student was exposed to an additional language in their home or community. It did not actually tell us their level of proficiency in English.

School type

Students were classified by their school, according to the Edubase classification: Academy (Comprehensive), Academy (Modern) Academy (Selective), Comprehensive, Secondary Modern, and Grammar.

School gender

As well as the type of school, students were also classified by the gender make-up of the school: Girls', Boys', or Mixed.

Region

Students were classified by the region in which they lived, as follows: South East, London, North West, East of England, West Midlands, South West, Yorkshire and the Humber, East Midlands, North East.

For the school-level analysis, various calculations were made to determine the make-up of students in each school, as the types of students attending a school were likely to have a significant impact on the Progress 8 score for that school. Furthermore, these were also of interest for the student-level analysis, as they may also have an impact on the Progress 8 scores for individual students. The following school-level variables were calculated (using the data in the NPD on students at the end of KS4):

- Mean prior attainment (KS2 Average Fine Level).
- Mean level of deprivation (as measured by the IDACI).
- Percentage of students who claimed for free school meals (FSM) in at least one of the past six years.
- Percentage of students with special educational needs (SEN). For the purpose of the school-level analysis the three SEN categories were combined to create a binary variable (student with SEN or not).
- Percentage of White students.
- Percentage of Black students.
- Percentage of Asian students.
- Percentage of students with English as an additional language (EAL).

Schools were also classified by their type (according to the Edubase categories), by their gender and by the region.

**2.1 Regression analyses**

A statistical model was fitted to determine which factors were most important in predicting the student-level performance on Progress 8. A multilevel model was used to account for the clustering of students within schools. The general form of the model was as follows:

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

Where $y_{ij}$ is the Progress 8 score for student i in school j, $x_{1ij}$ to $x_{kij}$ are the independent variables, $\beta_1$ to, $\beta_k$ are the regression coefficients, $\mu_j$ is a school effect (technically known as the Level 2 'random' effect) and $\varepsilon_{ij}$ is the residual difference between a student's predicted and actual Progress 8 score.

An additional analysis of student-level attainment was undertaken to estimate the impact on different groups of students of using the Attainment 8 measure, rather than alternative measures of performance that could have been used instead. Two variables, which took into account a wider range of qualifications than those eligible for Attainment / Progress 8, were selected for this purpose. Firstly, an uncapped total points score, which is calculated by totalling up the points for each of the grades achieved on **all** of the GCSE and equivalent qualifications taken. Secondly, the average points score per GCSE and equivalent qualification entry[3]. Three additional regression models were fitted with the Attainment 8 measure, the uncapped total points score and the average points score per entry as the dependent variable, but with the same predictor variables each time. Comparisons were then made between the alternative models in terms of the size of the effect of each predictor variable. In order to do this, each regression coefficient was standardised by dividing by the standard deviation of the dependent variable. The standardised coefficient for each variable in the models could then be directly compared between the different models.

[3] A third alternative was also considered. This was the capped total points score, which is calculated by totalling up the points achieved on **the best 8** GCSE and equivalent qualifications. However, initial investigations showed a very high correlation between this measure and the Attainment 8 measure (0.991), so it was decided not to include this alternative.

## 3. Results

### 3.1. Descriptive analysis of students' performance on Progress 8

This section presents the results of descriptive analyses of student level Progress 8 scores by various background factors. This summary is similar to that provided by the DfE (see https://www.gov.uk/government/statistics/revised-gcse-and-equivalent-results-in-england-2015-to-2016), although their analysis includes data from special schools and FE colleges, while ours does not. It should be noted that each factor is analysed separately and therefore takes no account of other factors which may be more important in determining Progress 8 scores. The statistical modelling in Section 3.3 provides more detail on which factors were most important.

Figure 1 and Table 1 present the distribution of Progress 8 scores by gender. Please note that in this and all subsequent figures at student-level outliers[4] are not displayed, because of the possibility of identifying the specific characteristics of the students with the highest and lowest Progress 8 scores. This shows a small, but noteworthy difference between the mean scores for girls (0.13) and boys (-0.12). This means that on average girls made the equivalent of ¼ of a grade more progress per subject than boys.

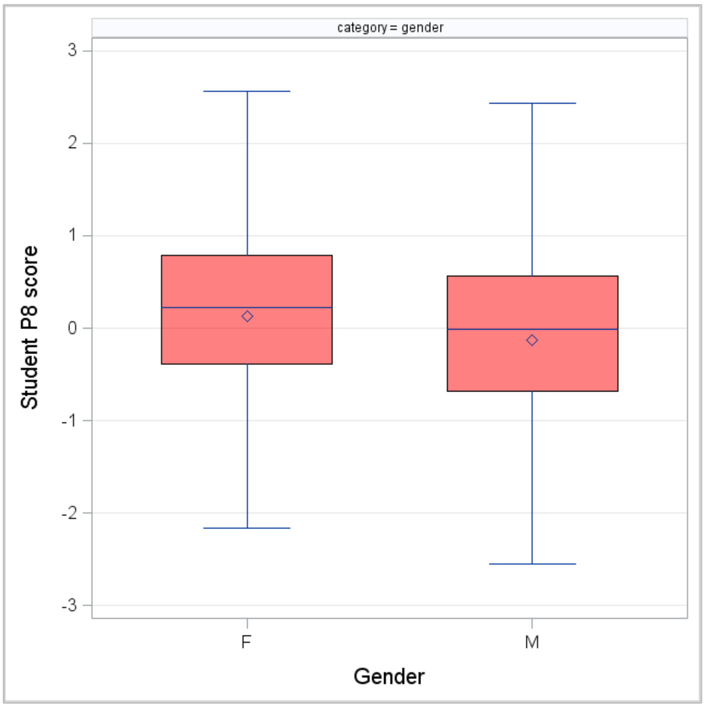


*Figure 1: Distribution of Progress 8 scores by gender*

*Table 1: Distribution of Progress 8 scores by gender*

| Gender | No. of students | Mean P8 | SD P8 | Min P8 | Max P8 |
|---|---|---|---|---|---|
| Girls | 248,547 | 0.13 | 1.02 | -7.15 | 5.40 |
| Boys | 253,257 | -0.12 | 1.08 | -7.39 | 5.58 |
| All | 501,804 | 0.00 | 1.06 | -7.39 | 5.58 |

[4] Outliers were defined as scores more than 1.5 times the inter-quartile range (the distance between the 25th and 75th percentiles) above the 75th percentile or below the 25th percentile. The top and bottom of the 'whiskers' in the figures show the maximum and minimum non-outlier scores.

The distribution of scores by FSM status is displayed in Figure 2 and Table 2. The FSM variable denotes whether the student claimed free school meals at least once in the past six years. Around a quarter of students were in the FSM category and, on average, they had substantially lower Progress 8 scores (-0.31) than students in the not FSM category (0.12).

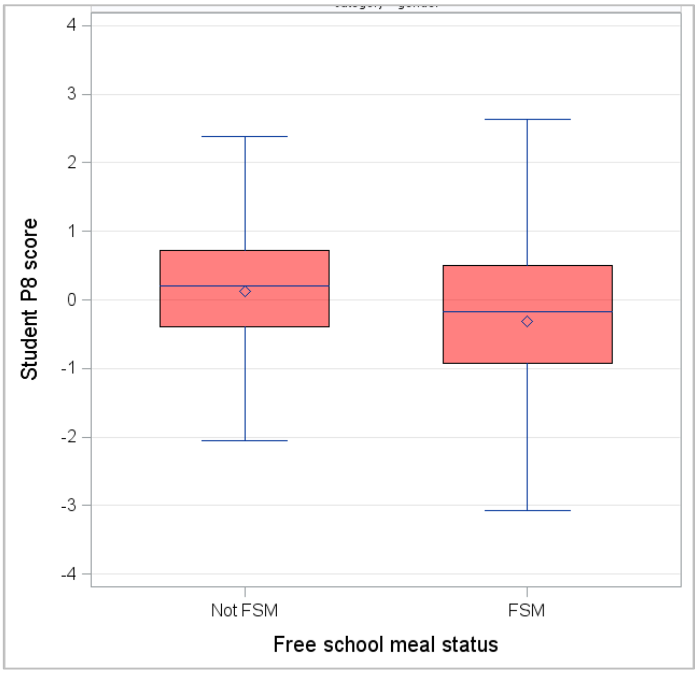


*Figure 2: Distribution of Progress 8 scores by FSM status*

*Table 2: Distribution of Progress 8 scores by FSM status*

| FSM | No. of students | Mean P8 | SD P8 |
|---|---|---|---|
| No | 367,843 | 0.12 | 0.95 |
| Yes | 133,406 | -0.31 | 1.24 |

Figure 3 displays the relationship between the deprivation experienced by students and their Progress 8 score. This shows a small, but statistically significant, negative relationship between the two measures (correlation = -0.14), indicating that more deprived students had lower Progress 8 scores on average. Reading off the line of best fit reveals that students with the minimum IDACI score (0.005) had an average Progress 8 score of 0.21, compared with an average score of -0.70 for students with the maximum IDACI (0.86).

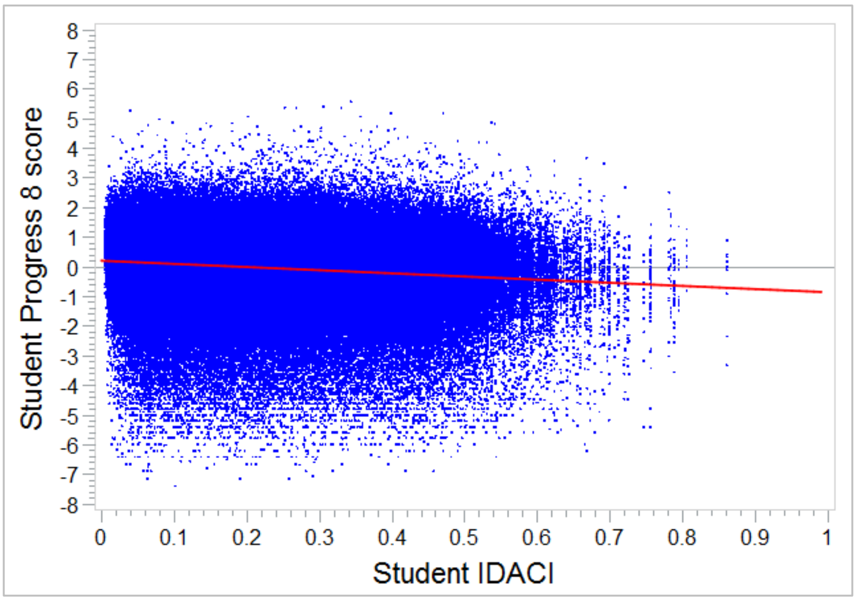


***Figure 3: Relationship between student IDACI and Progress 8 score***

The next analysis looked at the distribution of Progress 8 scores according to the SEN status of students. The government SEN categorisation allocates students to four groups, depending on the level of support they receive. These are (from low to high support level): None, SEN support, Statement, and Education, Health and Care Plan. The results are presented in Figure 4 and Table 3.

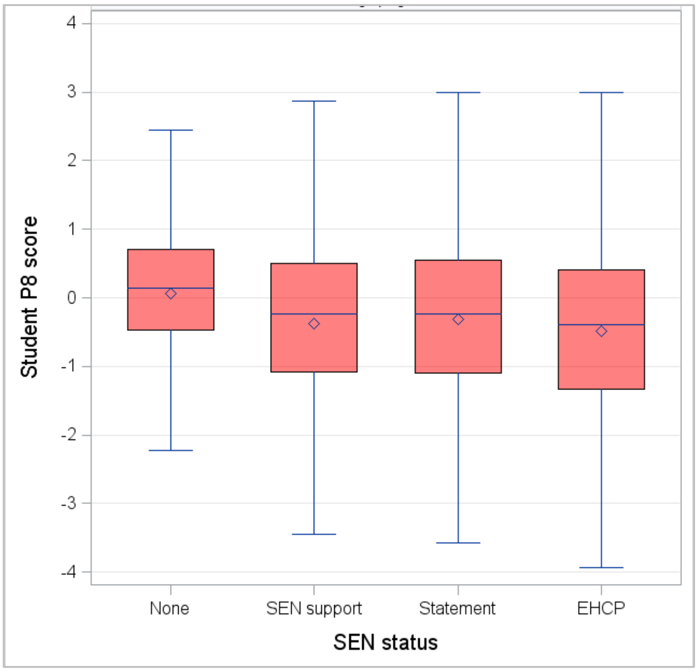


***Figure 4: Distribution of Progress 8 scores by SEN status***

*Table 3: Distribution of Progress 8 scores by SEN status*

| SEN status | No. of students | Mean P8 | SD P8 |
|---|---|---|---|
| None | 435,912 | 0.06 | 1.00 |
| SEN support | 55,397 | -0.38 | 1.32 |
| Statement | 8,019 | -0.31 | 1.31 |
| EHCP | 2,044 | -0.49 | 1.40 |

Thus, around 13% of students were categorised as having some level of SEN, of which most were in the SEN support category (11%). Only 1.6% of students had a statement of special needs and 0.4% had an EHCP. It is clear that students with no SEN had a much higher mean Progress 8 score than any of the SEN students. Students with EHCP had the lowest mean Progress 8 score, followed by those with SEN support and those with a Statement.

It is interesting that students with a Statement (i.e., a higher level of special needs) had better progress on average than those receiving SEN support (lower level).

The distribution of Progress 8 scores for students of different ethnicities was also calculated. In the NPD students are categorised into one of seven ethnic groups: Asian, Black, Chinese, Mixed, White, other, or unknown. These groups are combinations of finer categories: Asian includes Bangladeshi, Indian, Pakistani and other Asian; Black includes Black African, Black Caribbean and Black other; Mixed includes White & Asian, White & Black African, White & Black Caribbean and Other mixed; White includes White British and White Irish. Using these broad categories instead of the more detailed categories available inevitably loses some of the nuance in terms of differences. However, an investigation of Progress 8 scores for students from different ethnicities using the finer definition, found that students within a broader category tended to perform roughly the same on average. For example, the Asian category includes students from Bangladeshi, Indian, Pakistani and Other Asian backgrounds, all of whom had mean Progress 8 scores well above zero (0.35, 0.49, 0.16 and 0.51 respectively). Chinese students are separated from the Asian category because their exam performance tends to be substantially better.

Figure 5 and Table 4 present the distribution of Attainment 8 scores for each ethnic group. White students made up about 80% of the population, with 9% Asian and around 5% Black. Only about 0.3% of students were Chinese. The results show that Chinese students had the highest scores on average, followed by those in the ‘Other’ category and Asian students. The lowest mean was for White students (-0.06). Thus, all other ethnicities made more progress than Whites. However, this analysis takes no account of other factors, such as deprivation levels, which may be more important in determining Progress 8 scores.

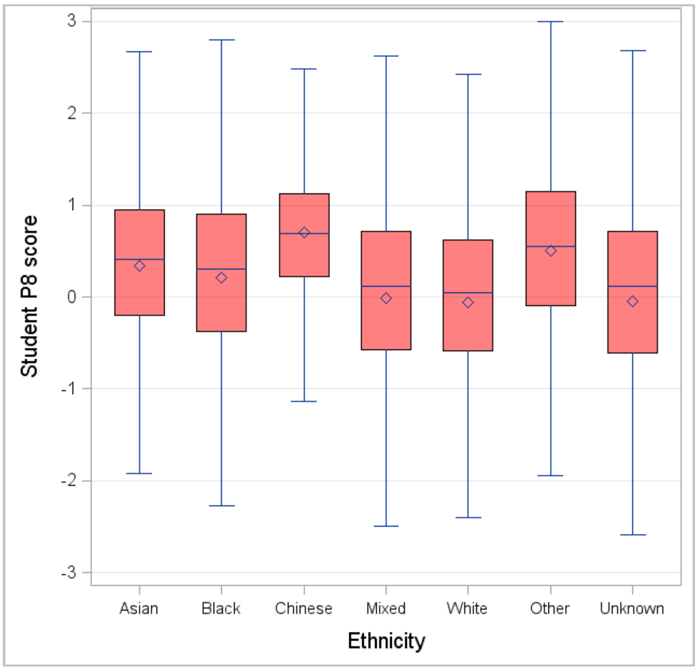


***Figure 5: Distribution of Progress 8 scores by ethnic group***

***Table 4: Distribution of Progress 8 scores by ethnic group***

| Ethnic group | No. of students | Mean P8 | SD P8 |
|---|---|---|---|
| Asian | 45,726 | 0.34 | 0.98 |
| Black | 23,688 | 0.21 | 1.04 |
| Chinese | 1,584 | 0.70 | 0.83 |
| Mixed | 20,858 | -0.01 | 1.12 |
| White | 399,119 | -0.06 | 1.05 |
| Other | 6,196 | 0.50 | 1.06 |
| Unknown | 4,236 | -0.05 | 1.16 |

Students were also categorised by their first language, into English or ‘other’. Where the first language was not known the student’s language was denoted as ‘unclassified’. Figure 6 and Table 5 present the distribution of Progress 8 scores by first language. This shows that around 87% of students were English speakers. Non-English speakers had a much higher mean (0.42) than English speakers (-0.06).

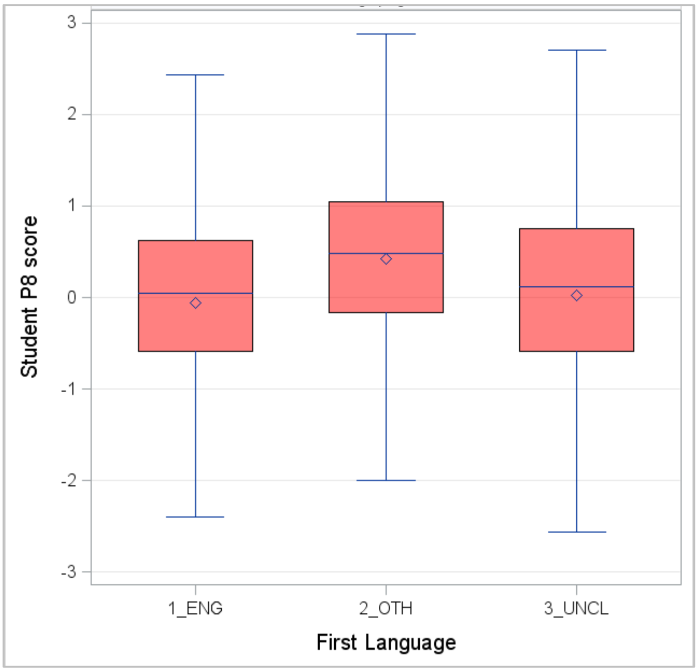


***Figure 6: Distribution of Progress 8 scores by first language***

***Table 5: Distribution of Progress 8 scores by first language***

| Language | No. of students | Mean P8 | SD P8 |
|---|---|---|---|
| English | 436,739 | -0.06 | 1.05 |
| Other | 63,842 | 0.42 | 1.03 |
| Unclassified | 826 | 0.02 | 1.18 |

Figure 7 and Table 6 present the distribution of Progress 8 scores for students attending different school types.

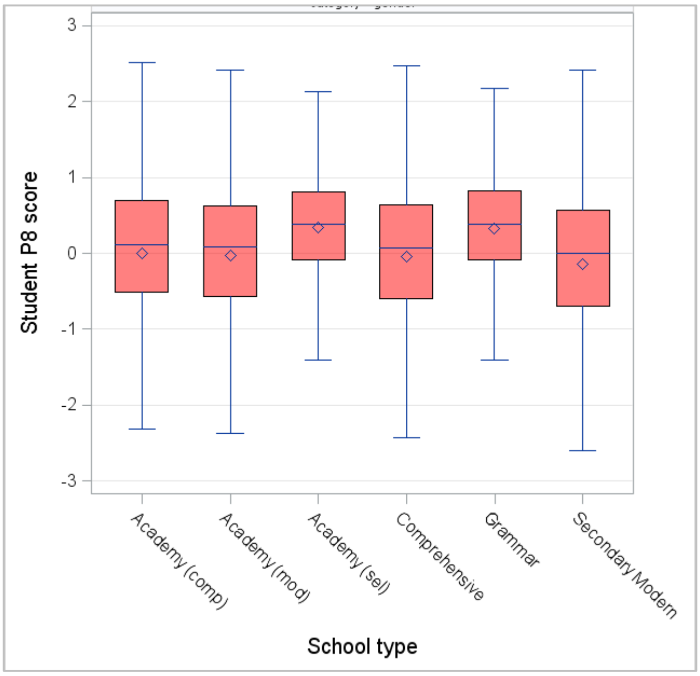


***Figure 7: Distribution of Progress 8 scores by school type***

***Table 6: Distribution of Progress 8 scores by school type***

| School type | No. of students | Mean P8 | SD P8 |
|---|---|---|---|
| Academy (comp) | 290,343 | 0.01 | 1.06 |
| Academy (sel) | 17,467 | 0.33 | 0.72 |
| Academy (mod) | 12,251 | -0.03 | 1.06 |
| Comprehensive | 172,900 | -0.04 | 1.08 |
| Grammar | 3,005 | 0.32 | 0.75 |
| Secondary Modern | 5,838 | -0.14 | 1.10 |

As well as school type, schools were also classified by whether they were single sex boys' or girls' or mixed schools. The distributions of scores by school gender are presented in Figure 8 and Table 7.

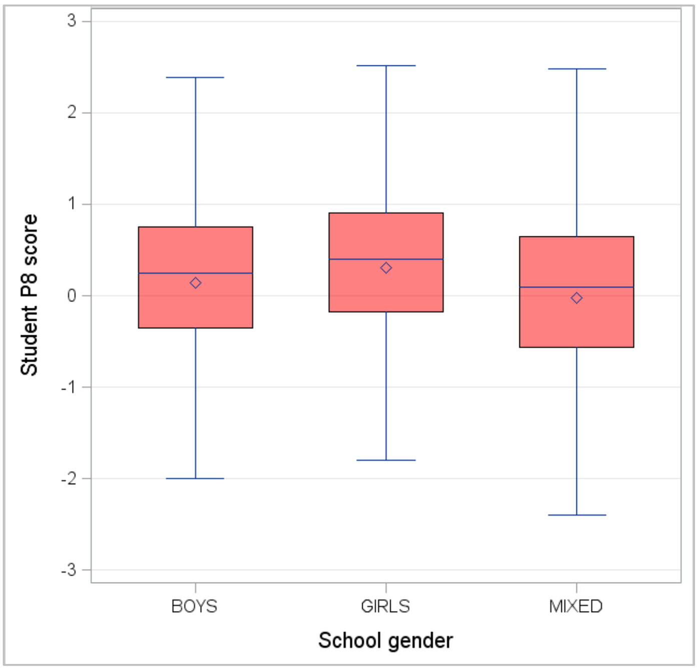


***Figure 8: Distribution of Progress 8 scores by school gender***

***Table 7: Distribution of Progress 8 scores by school gender***

| School gender | No. of students | Mean P8 | SD P8 |
|---|---|---|---|
| Mixed | 451353 | -0.03 | 1.07 |
| Boys | 20096 | 0.15 | 0.96 |
| Girls | 30355 | 0.31 | 0.95 |

Students in both types of single sex schools had higher Progress 8 scores on average than those in mixed schools. However, this may be in part due to a high proportion of single sex schools also being selective, and students in these schools made more progress on average (see Table 6). Students in girls' schools made more progress than those in boys' schools, which may be partly because girls made more progress than boys (see Table 1).

Finally, the distributions of Progress 8 scores by geographical region are presented in Figure 9 and Table 8.

The differences between regions were generally quite small. However, students in London had a notably higher mean (0.20) than any other region. The regions with the lowest means were North West (0.12), East Midlands and North East (both -0.11). Once again, we note that this analysis takes no account of the background characteristics of the students in each region, which may be more important in determining Progress 8 scores.

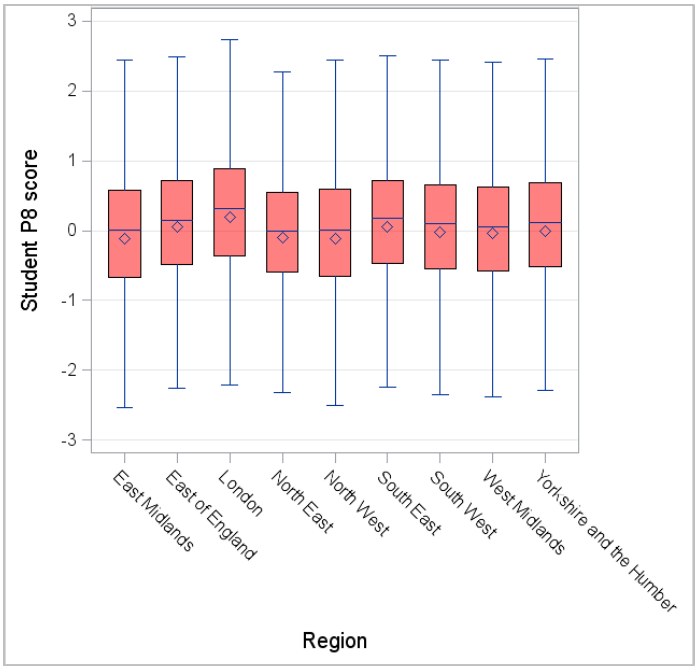


*Figure 9: Distribution of Progress 8 scores by region*

*Table 8: Distribution of Progress 8 scores by region*

| SEN status | No. of students | Mean P8 | SD P8 |
|---|---|---|---|
| East Midlands | 44,612 | -0.11 | 1.06 |
| East of England | 57,473 | 0.05 | 1.03 |
| London | 68,467 | 0.20 | 1.08 |
| North East | 24,552 | -0.11 | 1.04 |
| North West | 69,862 | -0.12 | 1.08 |
| South East | 79,486 | 0.05 | 1.04 |
| South West | 49,264 | -0.02 | 1.04 |
| West Midlands | 56,281 | -0.04 | 1.03 |
| Yorkshire and the Humber | 51,753 | -0.01 | 1.07 |

### 3.2. Descriptive analysis of schools' performance on Progress 8

This section presents some descriptive analyses of Progress 8 scores at school level, focussing on differences for different groups of schools.

Figure 10 and Table 9 outline the differences in the distributions of Progress 8 scores for different school types.

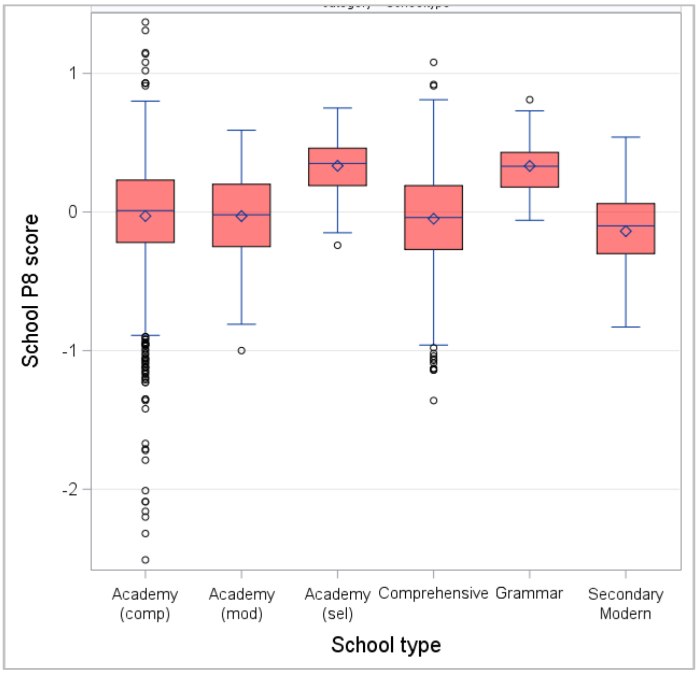


*Figure 10: Distribution of mean Progress 8 scores by school type*

*Table 9: Distribution of mean Progress 8 scores by school type*

| School type | No. of schools | Mean P8 | SD P8 | Min P8 | Max P8 |
|---|---|---|---|---|---|
| Academy (comp) | 1,745 | -0.03 | 0.41 | -2.51 | 1.37 |
| Academy (sel) | 139 | 0.33 | 0.20 | -0.24 | 0.75 |
| Academy (mod) | 79 | -0.03 | 0.32 | -1.00 | 0.59 |
| Comprehensive | 1,053 | -0.05 | 0.34 | -1.36 | 1.08 |
| Grammar | 23 | 0.33 | 0.21 | -0.06 | 0.81 |
| Secondary Modern | 43 | -0.14 | 0.35 | -0.83 | 0.54 |
| All | 3,082 | -0.02 | 0.38 | -2.51 | 1.37 |

The means by school type were very similar to the means by school type in the student-level analysis (see Table 6). Schools classified as selective academies or grammar schools had higher mean Progress 8 scores on average (0.33, compared with negative means for all other school types). The lowest mean was for non-academy secondary modern schools (-0.14).

There were very few grammar schools or selective academies with Progress 8 scores below zero. In contrast, the maximum Progress 8 scores for secondary modern schools was just 0.59 (i.e., their students made half a grade more progress than schools with a similar intake).

Schools were also categorised by whether they were a girls' school, boys' school or mixed. The distributions of Progress 8 scores for schools within these categories are shown in Figure 11 and Table 10.

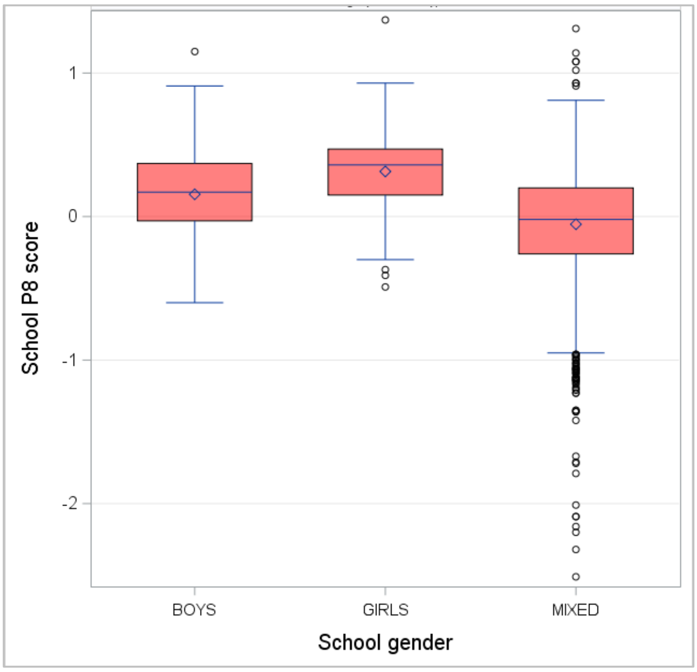


***Figure 11: Distribution of mean Progress 8 scores by school gender***

***Table 10: Distribution of mean Progress 8 scores by school gender***

| School type | No. of schools | Mean P8 | SD P8 | Min P8 | Max P8 |
|---|---|---|---|---|---|
| Mixed | 2,722 | -0.05 | 0.38 | -2.51 | 1.31 |
| Boys | 151 | 0.16 | 0.32 | -0.60 | 1.15 |
| Girls | 209 | 0.31 | 0.26 | -0.49 | 1.37 |

There is a clear difference with girls' schools having the highest mean Progress 8 score, followed by boys' schools. The difference between students in girls' schools and those in mixed schools (0.36) was equivalent to more than one third of a grade. These results were very similar to the results for students attending single sex or mixed schools (see Table 7), but it is worth noting that there were very few girls' schools with a negative Progress 8 score. The advantage that girls' schools had is likely to be partly because girls made more progress than boys, and also because girls' schools are more likely to be selective schools, which also make more progress on average (see Table 8).

The relationship between the mean prior attainment in schools and their Progress 8 score is outlined in Figure 12. The mean prior attainment was calculated as the mean of the prior attainment (at KS2) of each student in the school who was at the end of KS4 in 2015/16. To give an idea of what the prior attainment scale means, a student who only just achieved level 4 in English and Maths would have an Average Fine Level equal to 4.0 (this was the minimum expected level in each subject).

Figure 12 shows a distinct positive relationship between the two, suggesting that schools with higher prior attaining students also tended to get higher Progress 8 scores. The correlation between the two measures was 0.33. The slope of the line of best fit was 0.48, meaning that an increase in KS2 mean of 1 led to (on average) an increase in Progress 8 score of 0.48.

Note that there appears to be two separate groups of schools, with the main body of schools having KS2 means between 4 and 5, and a smaller group with KS2 means between about 5 and 5.5. Almost all of this second group were selective schools, who were able to select exclusively high-attaining students.

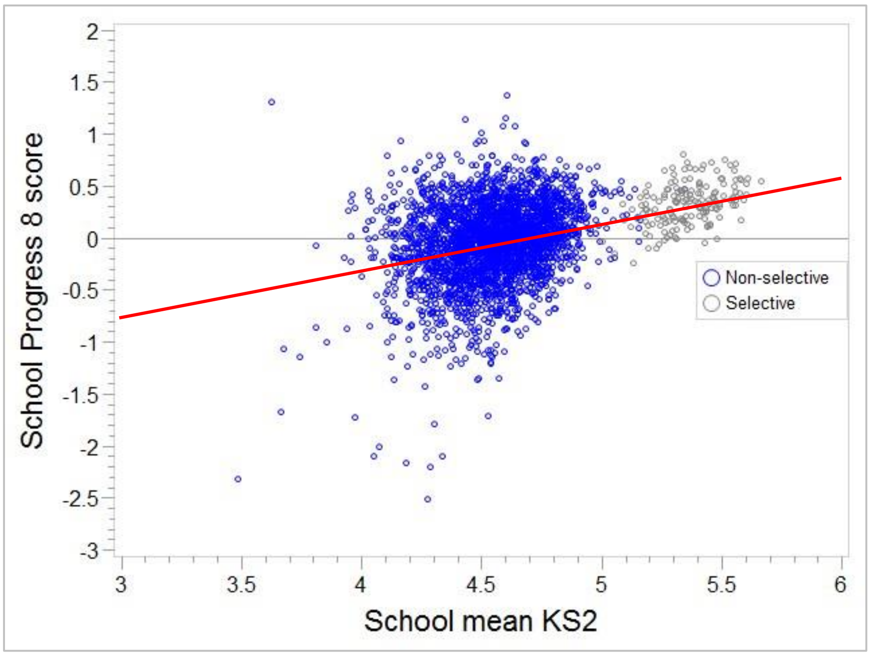


*Figure 12: Relationship between school mean prior attainment and Progress 8 score*

Next, Figure 13 presents the relationship between the percentage of students within a school who had claimed free school meals in at least one of the previous six years and the Progress 8 score for the school.

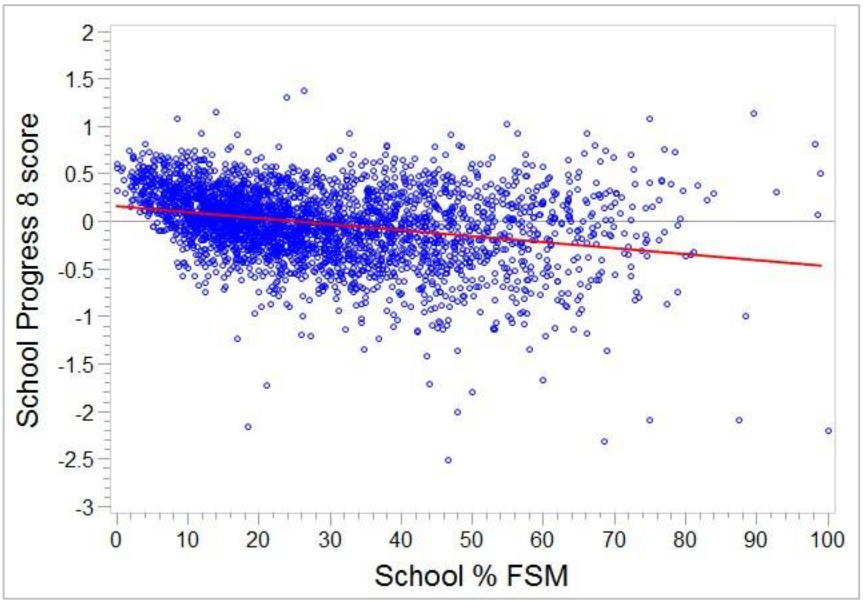


*Figure 13: Relationship between school FSM percentage and Progress 8 score*

There is a fairly clear negative relationship here, with schools having higher percentages of FSM students tending to have lower Progress 8 scores on average (correlation = -0.28). However, there were also many schools with high percentages of FSM students and positive Progress 8 scores and many with low percentages of FSM students and negative Progress 8 scores.

A similar relationship was also found between the mean level of deprivation (as measured by IDACI) experienced by students attending a school and the school Progress 8 score, as can be seen in Figure 14. The correlation between the two was -0.27. Given the negative relationship between disadvantage and Progress 8 score at an individual level, it is not surprising that the same relationship was also visible at school level.

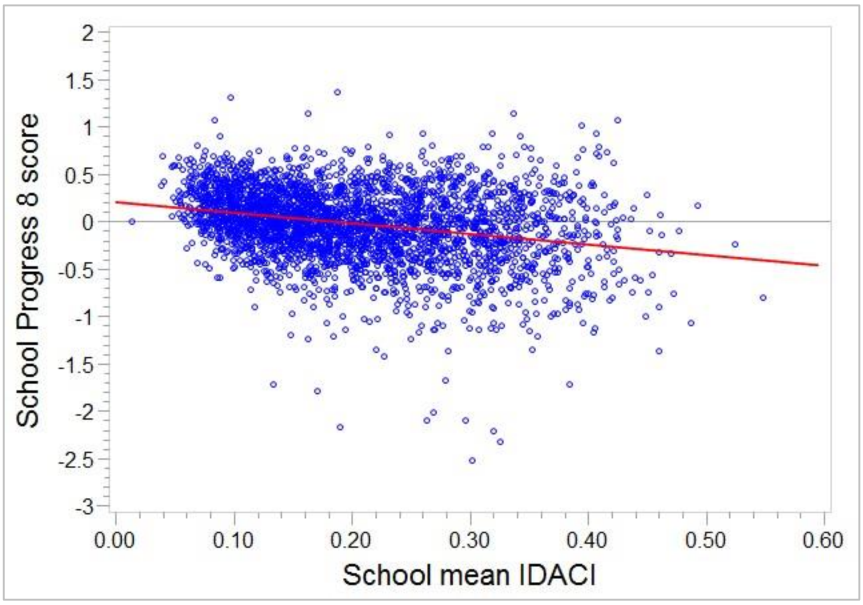


***Figure 14: Relationship between school mean IDACI and Progress 8 score***

The percentage of students in a school with any SEN was the next variable investigated. Figure 15 presents a plot of this against Progress 8 score.

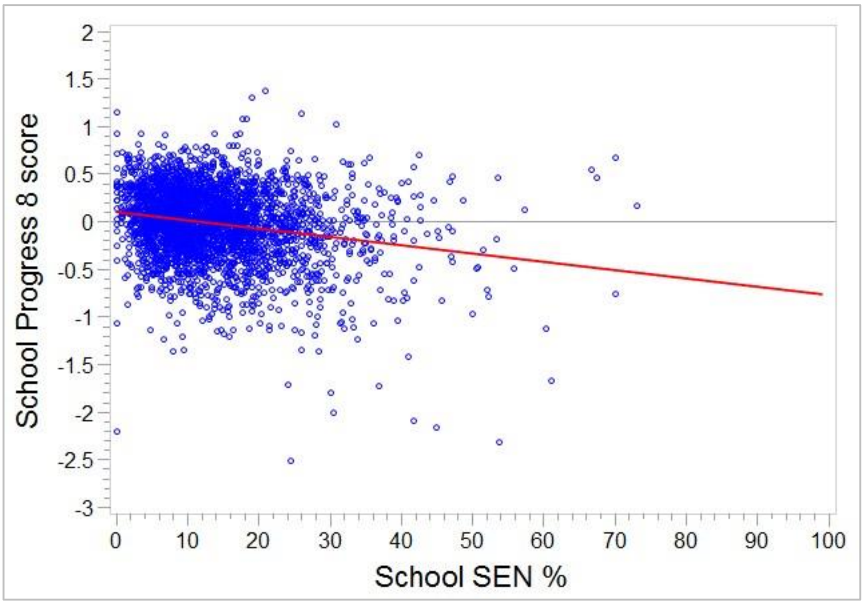


***Figure 15: Relationship between school percentage SEN and Progress 8 score***

This shows a negative relationship, with a correlation of -0.21. In other words, schools with higher percentages of SEN students tended to have lower Progress 8 scores. This is not a surprising finding, as students with special needs were shown to make less progress than other students (see Table 3).

The ethnic make-up of schools was also considered as a possible influence on Progress 8 scores. Figure 16 presents the relationship between the percentages of White, Asian, Chinese and Black students in schools and the Progress 8 score. Note that the scale on the graph for Chinese students is different, as the percentages in each school tended to be very low, with the highest being around 11%. In each case there was only a relatively weak (but significant) relationship between the percentage of the ethnic group and Progress 8 mean scores. The correlation was negative between the percentage of White students and Progress 8 score (-0.23) whilst correlations were positive between the percentages of Asian, Chinese or Black students and Progress 8 score (0.18, 0.17 and 0.14 respectively).

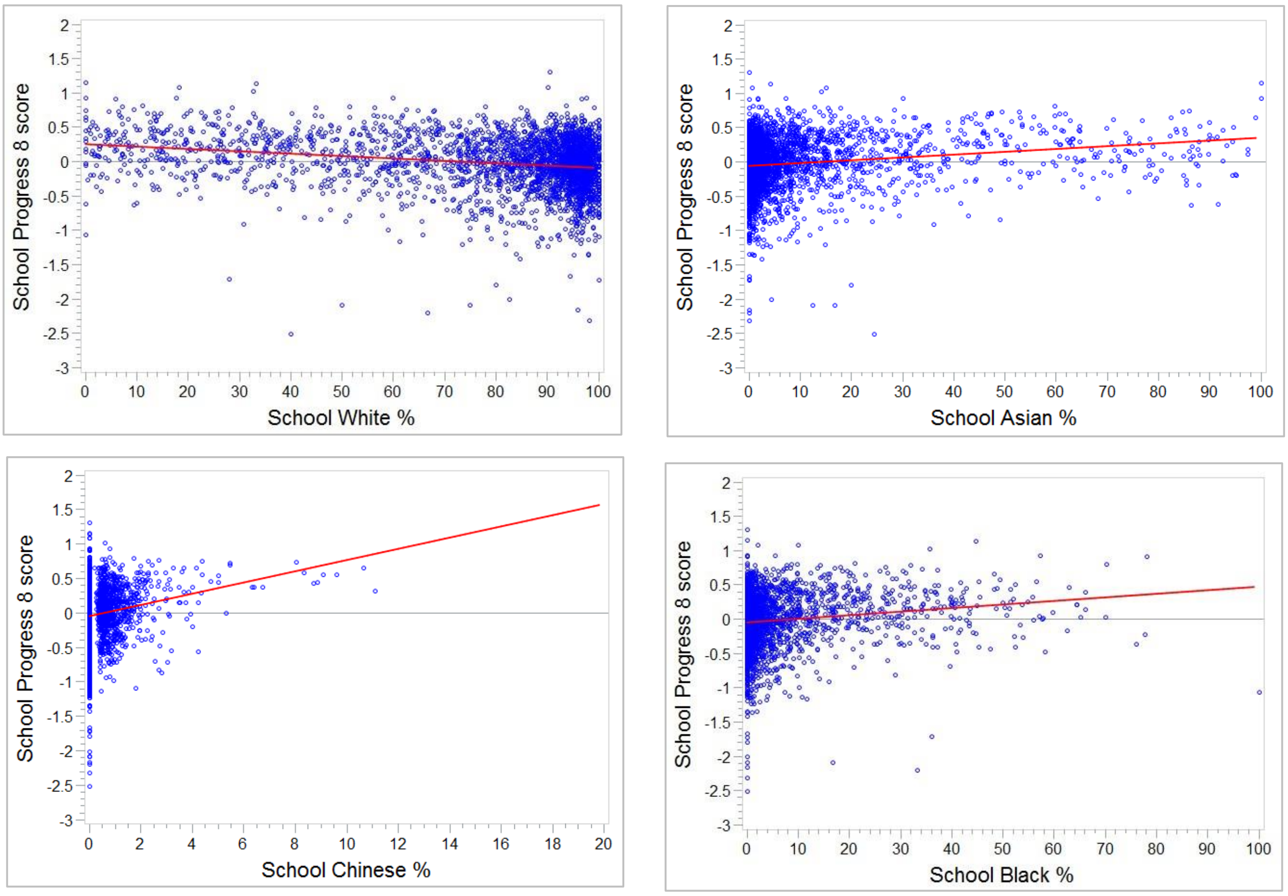


*Figure 16: Relationship between school percentage of different ethnicities and Progress 8 score*

The relationship between the percentage of students with English as an additional language and Progress 8 score is presented in Figure 17.

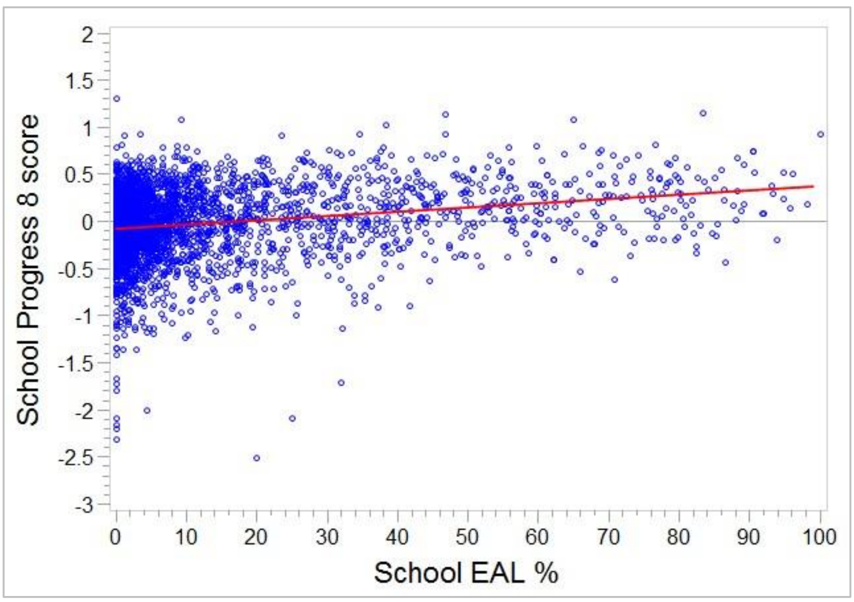


*Figure 17: Relationship between school percentage EAL and Progress 8 score*

There was a significant positive relationship between the two variables (correlation = 0.23). Schools with higher percentages of EAL students were more likely to have higher Progress 8 scores than those with low percentages of EAL. This result was expected, given that EAL students made considerably more progress on average than English speakers (see Table 5) Figure 18 and Table 11 present the distribution of P8 scores by English region.

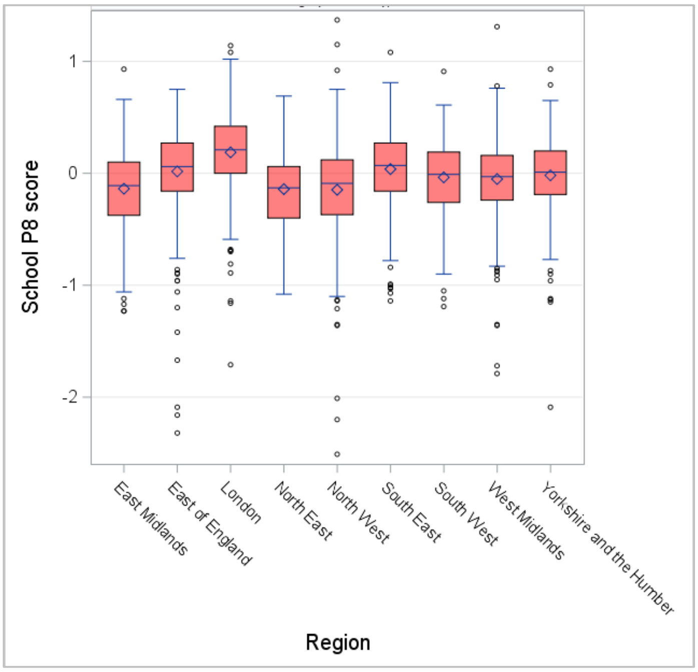


***Figure 18: Progress 8 scores by English region***

This shows that London had the highest mean Progress 8 scores by some distance (0.19). The only other regions with a positive mean were South East (0.04) and East of England (0.02). The regions with the lowest mean were North West (-0.15), East Midlands and North East (both -0.14). The 'London effect' is a well-researched phenomenon which has been attributed to a number of different factors (see Blandon, Greaves, Gregg, MacMillan & Sibieta, 2015), and the results here suggest it is present in terms of progression as well as attainment.

***Table 11: Progress 8 scores by English region***

| Region | No. of schools | Mean P8 | SD P8 | Min P8 | Max P8 |
|---|---|---|---|---|---|
| East Midlands | 268 | -0.14 | 0.37 | -1.23 | 0.93 |
| East of England | 345 | 0.02 | 0.41 | -2.32 | 0.75 |
| London | 429 | 0.19 | 0.35 | -1.71 | 1.14 |
| North East | 147 | -0.14 | 0.35 | -1.08 | 0.69 |
| North West | 445 | -0.15 | 0.42 | -2.51 | 1.37 |
| South East | 473 | 0.04 | 0.34 | -1.14 | 1.08 |
| South West | 307 | -0.04 | 0.33 | -1.19 | 0.91 |
| West Midlands | 371 | -0.05 | 0.37 | -1.79 | 1.31 |
| Yorkshire and the Humber | 295 | -0.02 | 0.36 | -2.09 | 0.93 |

### 3.3. Regression analysis of student level Progress 8 scores

Regression modelling provides a more nuanced approach than the descriptive data analysis and can determine which were the most important factors in accounting for variance in Progress 8 scores, and any interactions between factors. The results of the modelling of school-level Progress 8 scores are presented in Table 12. 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 random effects part of the table, we can calculate that around 11.5% of the variance was accounted for by schools[5]. This is a significant proportion of the variance in achievement and suggests that the use of a multilevel model was justified. Model 2 then included all of the predictor variables, whether at the student or school level, with statistical significance indicated by bold type. Model 3 added any significant interactions between fixed effects which were again added using a step-wise method and only included if they were statistically significant and they had a meaningful effect on the outcome (as judged by the researcher[6]). This second criteria was necessary due to the sample size being very large, so that a very small effect could still achieve statistical significance.

The size of each coefficient represents the change in Progress 8 associated with a particular category compared with the base category (for the categorical variables). As Progress 8 is essentially a mean grade measure, the coefficients represent the change in mean grade associated with a particular category. For continuous variables, the coefficients represent the change in mean grade associated with a unit increase in that variable.

We begin with the results of model 2. It was surprising to discover a significant effect of prior attainment, since this is already accounted for in the calculation of Progress 8. The size of the effect (-0.23) suggests that an increase of one KS2 level was associated with a fall in Progress 8 of between one fifth and one quarter of a grade. This was thought to be because of the presence of two different prior attainment effects, which cancel each other out overall: a between-school effect where schools with higher performing intakes tended to display higher progress 8 scores (see the *School KS2 mean* coefficient), and a within-school effect where, within any given individual school, students with the highest prior attainment were likely to be those with the lowest progress 8 scores[7].

The results also showed that girls made more progress than boys (0.25 of a grade on average). More disadvantaged students tended to make less progress, with students who had claimed for free school meals associated with a significantly lower Progress 8 score (by 0.39 of a grade) and with an increase in the level of deprivation being significantly associated with a fall in Progress 8 score (by 0.09, for each increase in IDACI of 0.1). Furthermore, even after accounting for these effects at individual level, schools having a larger proportion of their students receiving FSM was associated with lower Progress 8 scores (although this effect was very small – an increase of 20% in the percentage of FSM students was associated with a fall in Progress 8 of 0.04). In terms of SEN, each SEN status

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[5] As calculated by the intraclass correlation coefficient (ICC). ICC = school variance / (school variance + error variance) = 0.1307 / (0.1307+1.0078) = 0.115.

[6] The criterion used for this was whether any effect was at least 0.1 (i.e., was associated with a change of 0.1 of a grade compared with the reference category).

[7] This within-school effect was confirmed by grouping students within each school into five groups based on their prior attainment. Each successively higher prior attaining group had a lower mean P8 score (0.05, 0.04, 0.01, -0.02, -0.08).

was associated with less progression, with the biggest effect being for those with EHCP (-0.691).

Compared to White students, all other ethnic groups were associated with significantly more progress, even after accounting for other factors such as deprivation. The largest effect was for Chinese students (0.43 of a grade), followed by students from an ‘Other’ ethnic background (0.32), Black students (0.23) and Asian students (0.19). Having English as a second language was associated with better progress (by 0.39 of a grade), compared with students who spoke English. There were some significant school-type effects, with being in a selective academy associated with significantly higher Progress 8 scores (by 0.10 of a grade) and being in a secondary modern (non-academy) associated with significantly lower Progress 8 scores (by 0.11 of a grade), compared with being in a comprehensive academy. There was also a statistically significant effect of attending a comprehensive school, but this was very small. It is interesting that the effect of attending a grammar school (either academy or not) was much reduced compared to that found in the descriptive analysis (see Table 6). In fact, attending a non-academy selective school was not significantly different from a comprehensive academy. This is probably because the effect seen in the descriptive analysis was more due to attending a school with a high-level prior attainment than to attending a selective school.

Students in single sex boys’ schools made significantly more progress than those in mixed schools, even after accounting for the fact that these schools tended to have a higher attaining intake and were more likely to be selective than were mixed gender schools. However, whilst the descriptive analysis showed that students in girls’ schools made the most progress on average, there was no significant difference between girls’ school students and mixed school students in the statistical model. This is likely to be because the effects of gender and perhaps school mean prior attainment were more important in determining Progress 8 scores.

There were a number of school-level effects which were statistically significant, but were very small. These included the percentages of SEN, EAL and Asian students in a school. The coefficients for these effects ranged from -0.004 to 0.003. An effect of -0.004 meant that a change of 20 per cent was associated with a change in the Progress 8 score of just 0.08. This was judged to be too small an effect to be included in model 3.

***Table 12: Student Progress 8 score: Regression coefficients (standard errors in brackets)***

| ***Fixed effects*** | | ***Model 1*** | ***Model 2*** | ***Model 3*** |
|---|---|---|---|---|
| Intercept | | -0.012 (0.014) | 0.027 (0.022) | **0.072 (0.017)** |
| KS2 Average Fine Level | | | **-0.226 (0.002)** | **-0.228 (0.002)** |
| Gender | Boys | | | |
| | Girls | | **0.249 (0.003)** | **0.267 (0.003)** |
| Ever FSM | No | | | |
| | Yes | | **-0.393 (0.003)** | **-0.437 (0.004)** |
| IDACI | | | **-0.933 (0.013)** | **-1.027 (0.014)** |
| SEN status | None | | | |
| | SEN support | | **-0.480 (0.005)** | **-0.378 (0.014)** |
| | Statement | | **-0.503 (0.011)** | **-0.421 (0.034)** |
| | EHCP | | **-0.691 (0.022)** | **-0.556 (0.067)** |
| Ethnic group | White | | | |
| | Asian | | **0.188 (0.007)** | **0.348 (0.015)** |
| | Black | | **0.232 (0.007)** | **0.036 (0.015)** |
| | Chinese | | **0.428 (0.024)** | **0.458 (0.068)** |
| | Mixed | | **0.068 (0.007)** | **0.075 (0.016)** |
| | Other | | **0.318 (0.013)** | **0.228 (0.032)** |

| Fixed effects | | Model 1 | Model 2 | Model 3 |
|---|---|---|---|---|
| | Unknown | | -0.029 (0.016) | 0.038 (0.039) |
| EAL | No | | | |
| | Yes | | **0.386 (0.006)** | **0.563 (0.009)** |
| | Unknown | | **0.091 (0.034)** | -0.029 (0.061) |
| School type | Academy (comp.) | | | |
| | Academy (mod.) | | -0.051 (0.036) | -0.056 (0.036) |
| | Academy (sel.) | | **0.095 (0.040)** | **0.085 (0.037)** |
| | Comprehensive | | **-0.039 (0.012)** | **-0.044 (0.012)** |
| | Grammar | | 0.066 (0.070) | 0.057 (0.069) |
| | Secondary Modern | | **-0.113 (0.048)** | **-0.120 (0.048)** |
| School gender | Mixed | | | |
| | Boys | | **0.112 (0.028)** | **0.125 (0.028)** |
| | Girls | | 0.022 (0.024) | 0.030 (0.024) |
| School KS2 mean | | | **0.232 (0.043)** | **0.272 (0.030)** |
| Ever FSM percentage | | | **-0.002 (0.001)** | N/A |
| IDACI mean | | | 0.165 (0.144) | N/A |
| SEN percentage | | | **0.002 (0.001)** | N/A |
| EAL percentage | | | **0.003 (0.001)** | N/A |
| Asian percentage | | | **-0.004 (0.001)** | N/A |
| Black percentage | | | 0.000 (0.002) | N/A |
| White percentage | | | -0.001 (0.001) | N/A |
| Region | London | | | |
| | East Midlands | | **-0.163 (0.030)** | **-0.232 (0.025)** |
| | East of England | | -0.047 (0.029) | **-0.104 (0.023)** |
| | North East | | -0.021 (0.037) | **-0.105 (0.030)** |
| | North West | | **-0.117 (0.028)** | **-0.204 (0.022)** |
| | South East | | **-0.060 (0.028)** | **-0.113 (0.022)** |
| | South West | | **-0.080 (0.030)** | **-0.134 (0.024)** |
| | West Midlands | | **-0.064 (0.028)** | **-0.142 (0.023)** |
| | Yorkshire and the Humber | | -0.015 (0.030) | **-0.078 (0.024)** |
| Gender*SEN status | Boys – None | | | |
| | Girls – SEN support | | | **-0.108 (0.009)** |
| | Girls – Statement | | | **-0.271 (0.024)** |
| | Girls – EHCP | | | **-0.373 (0.047)** |
| Ever FSM* Ethnic group | No – White | | | |
| | Yes – Asian | | | **0.236 (0.011)** |
| | Yes – Black | | | **0.243 (0.014)** |
| | Yes – Chinese | | | **0.238 (0.068)** |
| | Yes – Mixed | | | **0.053 (0.015)** |
| | Yes – Other | | | **0.238 (0.026)** |
| | Yes – Unknown | | | 0.038 (0.034) |
| SEN status* Ethnic group | None – White | | | |
| | SEN support – Asian | | | **-0.157 (0.021)** |
| | SEN support – Black | | | **-0.092 (0.022)** |
| | SEN support – Chinese | | | **0.302 (0.124)** |
| | SEN support – Mixed | | | **-0.125 (0.022)** |
| | SEN support – Other | | | **-0.083 (0.041)** |
| | SEN support – Unknown | | | **-0.123 (0.048)** |
| | Statement – Asian | | | **-0.331 (0.054)** |
| | Statement – Black | | | **-0.304 (0.056)** |
| | Statement – Chinese | | | 0.292 (0.249) |
| | Statement – Mixed | | | -0.091 (0.054) |
| | Statement – Other | | | **-0.239 (0.107)** |
| | Statement – Unknown | | | 0.051 (0.106) |
| | EHCP – Asian | | | -0.101 (0.105) |
| | EHCP – Black | | | -0.030 (0.100) |
| | EHCP – Chinese | | | **-0.868 (0.430)** |
| | EHCP – Mixed | | | **-0.236 (0.103)** |
| | EHCP – Other | | | 0.060 (0.210) |
| | EHCP – Unknown | | | -0.184 (0.214) |
| SEN status* EAL | None – No | | | |
| | SEN support – Yes | | | 0.005 (0.018) |
| | SEN support – Unknown | | | -0.041 (0.109) |
| | Statement – Yes | | | **-0.152 (0.049)** |
| | Statement – Unknown | | | 0.175 (0.237) |
| | EHCP – Yes | | | **-0.303 (0.093)** |
| | EHCP – Unknown | | | -0.217 (0.436) |

| ***Fixed effects*** | | ***Model 1*** | ***Model 2*** | ***Model 3*** |
|---|---|---|---|---|
| IDACI* Ethnic group | White | | | |
| | Asian | | | **0.578 (0.046)** |
| | Black | | | **0.784 (0.056)** |
| | Chinese | | | **1.160 (0.197)** |
| | Mixed | | | **0.355 (0.055)** |
| | Other | | | **0.420 (0.100)** |
| | Unknown | | | 0.148 (0.123) |
| EAL* Ethnic group | No – White | | | |
| | Yes – Asian | | | **-0.456 (0.014)** |
| | Yes – Black | | | **-0.233 (0.016)** |
| | Yes – Chinese | | | **-0.345 (0.055)** |
| | Yes – Mixed | | | **-0.126 (0.023)** |
| | Yes – Other | | | **-0.253 (0.031)** |
| | Yes – Unknown | | | 0.005 (0.047) |
| | Unknown – Asian | | | 0.160 (0.094) |
| | Unknown – Black | | | 0.070 (0.118) |
| | Unknown – Chinese | | | 0.590 (0.309) |
| | Unknown – Mixed | | | -0.065 (0.161) |
| | Unknown – Other | | | **0.587 (0.159)** |
| | Unknown – Unknown | | | 0.030 (0.091) |
| SEN status* School KS2 mean | None | | | |
| | SEN support | | | **0.140 (0.020)** |
| | Statement | | | **0.128 (0.055)** |
| | EHCP | | | -0.093 (0.104) |
| Ethnic group* School KS2 mean | White | | | |
| | Asian | | | -0.045 (0.024) |
| | Black | | | **-0.097 (0.032)** |
| | Chinese | | | **-0.291 (0.071)** |
| | Mixed | | | -0.043 (0.029) |
| | Other | | | **-0.164 (0.053)** |
| | Unknown | | | 0.018 (0.066) |
| EAL* School KS2 mean | No | | | |
| | Yes | | | **-0.209 (0.021)** |
| | Unknown | | | -0.057 (0.127) |
| SEN status * Region | None – London | | | |
| | SEN support – East Midlands | | | **-0.044 (0.020)** |
| | SEN support – East of England | | | -0.002 (0.019) |
| | SEN support – North East | | | **0.054 (0.024)** |
| | SEN support – North West | | | -0.008 (0.018) |
| | SEN support – South East | | | **-0.085 (0.017)** |
| | SEN support – South West | | | **-0.091 (0.019)** |
| | SEN support – West Midlands | | | **0.048 (0.018)** |
| | SEN support – Yorks and the Humber | | | -0.029 (0.019) |
| | Statement – East Midlands | | | 0.059 (0.049) |
| | Statement – East of England | | | 0.052 (0.043) |
| | Statement – North East | | | **0.217 (0.062)** |
| | Statement – North West | | | **0.153 (0.043)** |
| | Statement – South East | | | **0.132 (0.043)** |
| | Statement – South West | | | **-0.160 (0.049)** |
| | Statement – West Midlands | | | 0.041 (0.043) |
| | Statement – Yorks and the Humber | | | **0.101 (0.049)** |
| | EHCP – East Midlands | | | **-0.214 (0.096)** |
| | EHCP – East of England | | | 0.113 (0.089) |
| | EHCP – North East | | | -0.074 (0.118) |
| | EHCP – North West | | | **0.213 (0.088)** |
| | EHCP – South East | | | **0.159 (0.081)** |
| | EHCP – South West | | | 0.012 (0.085) |
| | EHCP – West Midlands | | | **-0.353 (0.110)** |
| | EHCP – Yorkshire and the Humber | | | 0.002 (0.097) |
| Ethnic group * region | White – London | | | |
| | Asian – East Midlands | | | **0.074 (0.025)** |
| | Asian – East of England | | | -0.005 (0.024) |
| | Asian – North East | | | 0.013 (0.038) |
| | Asian – North West | | | **0.049 (0.021)** |
| | Asian – South East | | | 0.034 (0.020) |
| | Asian – South West | | | **0.133 (0.036)** |
| | Asian – West Midlands | | | **-0.113 (0.019)** |

| ***Fixed effects*** | | ***Model 1*** | ***Model 2*** | ***Model 3*** |
|---|---|---|---|---|
| | Asian – Yorkshire and the Humber | | | **-0.161 (0.022)** |
| | Black – East Midlands | | | **0.150 (0.034)** |
| | Black – East of England | | | **0.211 (0.028)** |
| | Black – North East | | | **0.310 (0.086)** |
| | Black – North West | | | **0.208 (0.032)** |
| | Black – South East | | | **0.197 (0.027)** |
| | Black – South West | | | 0.049 (0.047) |
| | Black – West Midlands | | | **0.114 (0.025)** |
| | Black – Yorkshire and the Humber | | | **0.170 (0.036)** |
| | Chinese – East Midlands | | | 0.191 (0.108) |
| | Chinese – East of England | | | 0.060 (0.086) |
| | Chinese – North East | | | 0.273 (0.160) |
| | Chinese – North West | | | 0.144 (0.077) |
| | Chinese – South East | | | 0.140 (0.078) |
| | Chinese – South West | | | **0.235 (0.109)** |
| | Chinese – West Midlands | | | **0.220 (0.099)** |
| | Chinese – Yorkshire and the Humber | | | 0.135 (0.111) |
| | Mixed – East Midlands | | | -0.009 (0.028) |
| | Mixed – East of England | | | -0.010 (0.025) |
| | Mixed – North East | | | **0.128 (0.055)** |
| | Mixed – North West | | | 0.018 (0.026) |
| | Mixed – South East | | | 0.006 (0.023) |
| | Mixed – South West | | | -0.022 (0.031) |
| | Mixed – West Midlands | | | 0.000 (0.024) |
| | Mixed – Yorkshire and the Humber | | | -0.027 (0.029) |
| | Other – East Midlands | | | **0.149 (0.072)** |
| | Other – East of England | | | 0.066 (0.057) |
| | Other – North East | | | **0.280 (0.101)** |
| | Other – North West | | | **0.205 (0.047)** |
| | Other – South East | | | -0.016 (0.049) |
| | Other – South West | | | 0.019 (0.071) |
| | Other – West Midlands | | | **0.144 (0.044)** |
| | Other – Yorkshire and the Humber | | | **0.111 (0.056)** |
| | Unknown – East Midlands | | | -0.035 (0.066) |
| | Unknown – East of England | | | **-0.113 (0.055)** |
| | Unknown – North East | | | -0.192 (0.106) |
| | Unknown – North West | | | **-0.163 (0.057)** |
| | Unknown – South East | | | -0.088 (0.053) |
| | Unknown – South West | | | -0.047 (0.060) |
| | Unknown – West Midlands | | | -0.076 (0.059) |
| | Unknown – Yorkshire and the Humber | | | -0.020 (0.069) |
| ***Random effects*** | | | | |
| Level 1 | | **1.008** | **0.895** | **0.888** |
| Level 2 – intercept | | **0.131** | **0.085** | **0.085** |
| *Model fit* | | | | |
| AIC | | 1437290 | 1373034 | 1369147 |

Finally, there were significant effects of being in a different geographical region. Compared with London, being in another region was associated with lower Progress 8 scores. However, the size of the effects were smaller than those seen in the descriptive analysis (and were not significant for some regions). Even so, there is evidence that the London effect was present, even after accounting for other factors.

For interpretation of the interaction effects added in model 3, several figures are presented below. These show the predicted Progress 8 scores (according to the model) for different groups of students.

*Gender x SEN status*

Figure 19 presents predicted Progress 8 scores for boys and girls, with different levels of SEN status[8]. This shows that girls with no SEN had a substantially higher predicted score than boys, but this gap was smaller for students with SEN. For those with a Statement or EHCP there was almost no difference in predicted scores between boys and girls.

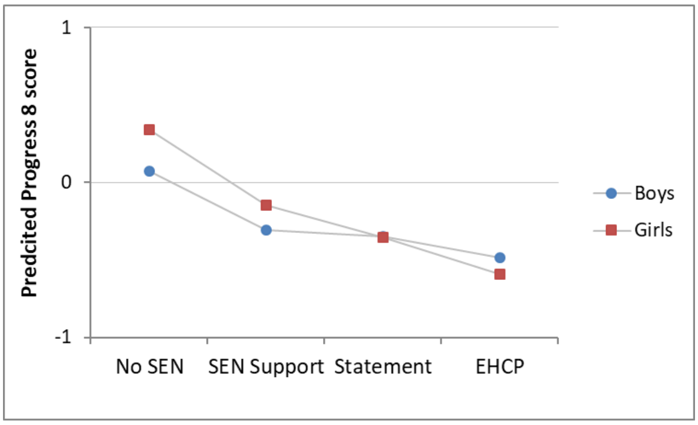


***Figure 19: Predicted Progress 8 scores for boys and girls with different levels of SEN***

*FSM x Ethnic group*

Figure 20 shows predicted Progress 8 scores for students from different ethnic backgrounds, split between those who claimed for FSM and those that did not. This reveals that the effect of FSM was particularly big for White and Mixed race students and smallest for Black students.

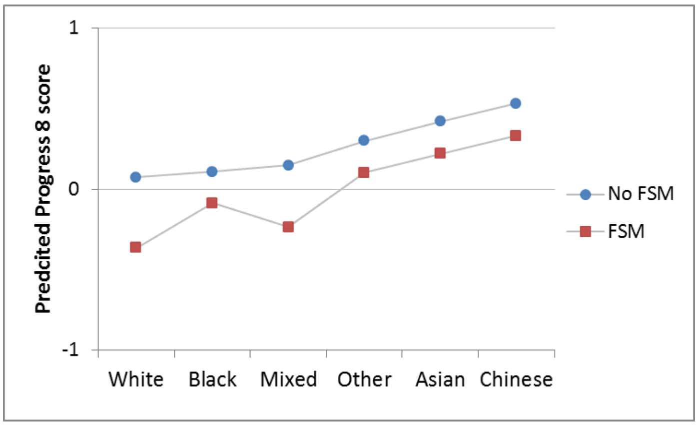


***Figure 20: Predicted Progress 8 scores for students with different ethnic background and FSM status***

*IDACI* Ethnic group*

For the interaction of deprivation and ethnic group, the relationship between IDACI score and Progress 8 score for the main ethnic groups is presented in Figure 21. This shows that there were significant differences between ethnicities. The overall pattern was that increased IDACI was associated with lower Progress 8 scores, but for Chinese students this effect was reversed, so that increased IDACI was associated with very slightly higher Progress 8

[8] For this and all subsequent graphs, the predicted scores are for students in the baseline categories for all other categorical variables and with values of the continuous variables equal to the mean.

scores. In terms of the other ethnicities, the effect of IDACI was largest for White students and was very small for Black students.

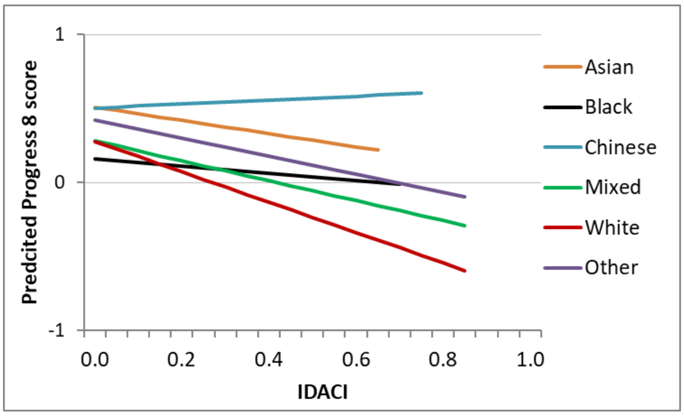


***Figure 21: Predicted Progress 8 scores for students of different ethnicity by IDACI score***

*SEN status* Ethnic group*

Figure 22 presents the predicted scores for different ethnic groups with different levels of SEN. There was no clear pattern, even though the effects were statistically significant. Perhaps the most interesting pattern was for Chinese students: those with SEN support had only very slightly lower predicted scores than those with no SEN. This was also the case for Chinese students with a Statement, but this was not included in the plot as the number of students in that particular category was very low (n = 15).

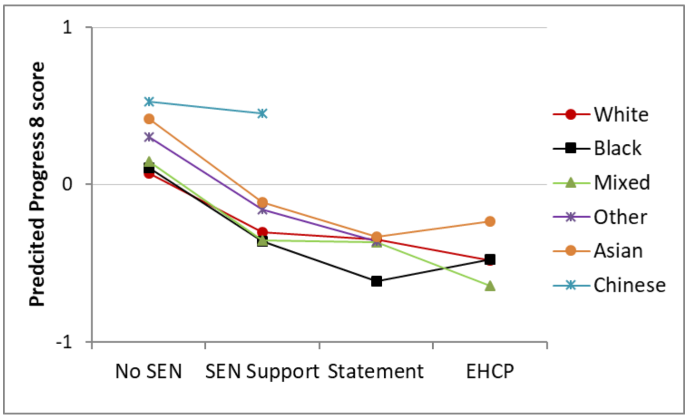


***Figure 22: Predicted Progress 8 scores for students with different ethnic background for each level of SEN***

*SEN status* EAL*

Figure 23 presents the predicted Progress 8 scores for students with different levels of SEN, by their EAL status.

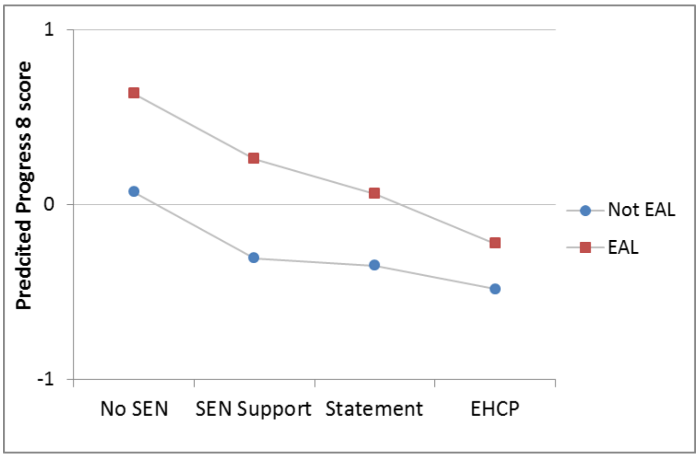


***Figure 23: Predicted Progress 8 scores for students with each EAL status for each level of SEN***

This shows that for students with no SEN or with SEN support only, the predicted Progress 8 score was much higher for EAL students. However, the gap was somewhat smaller for students with an EHCP.

*EAL* Ethnic group*

Figure 24 presents the predicted Progress 8 scores for students from different ethnicities, by their EAL status.

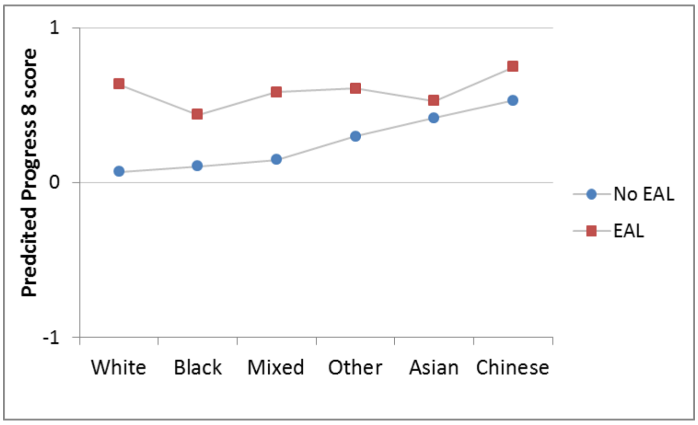


***Figure 24: Predicted Progress 8 scores for students of different ethnicity by EAL status***

This shows that the effect of having EAL was different for each ethnicity. The effect was significantly larger for White students than any other ethnicity, and was smallest for Asian students.

*SEN status* School KS2 mean*

Figure 25 presents the predicted Progress 8 scores for students attending schools with different levels of mean prior attainment by their SEN status.

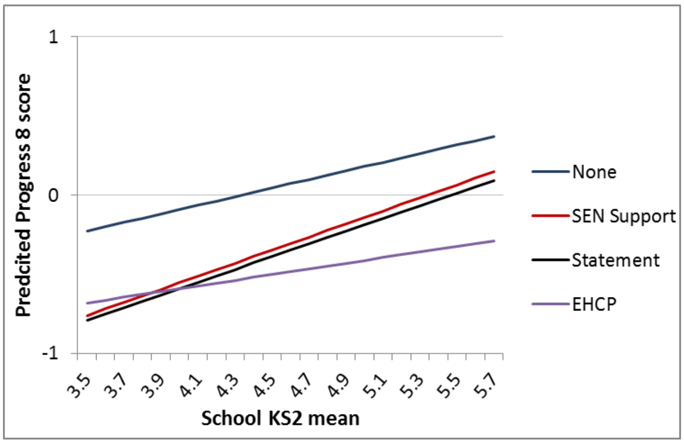


***Figure 25: Predicted Progress 8 scores for students with different SEN status by school KS2***

The overall pattern was for higher Progress 8 scores for students in schools with a higher attaining intake. However, this effect was larger for students with SEN support or a Statement. There was no significant difference between students without SEN and those with an EHCP, in terms of the effect of school prior attainment.

*Ethnic group* School KS2 mean*

The effect of school prior attainment was also significantly different for students from different ethnic backgrounds, as shown in Figure 26. Specifically, students from Chinese, Black, or Other backgrounds all had scores which were less sensitive to changes in school-level prior attainment, compared with White students. The biggest difference was for Chinese students, for whom school prior attainment had essentially no effect on their predicted Progress 8 score.

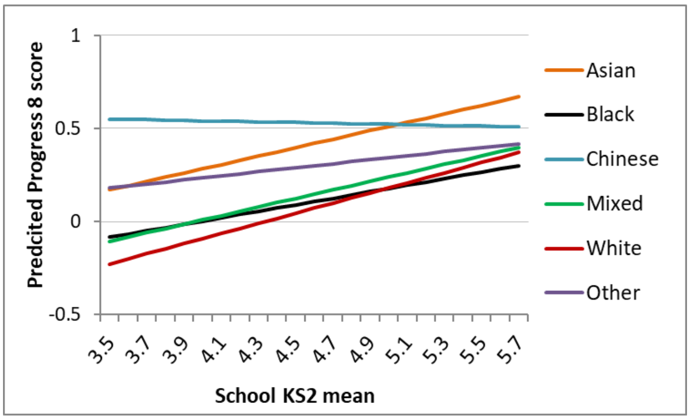


***Figure 26: Predicted Progress 8 scores for students from different ethnic background by school KS2***

*EAL* School KS2 mean*

Figure 27 presents the predicted Progress 8 scores for students attending schools with different levels of mean prior attainment, by their EAL status. This shows that the effect of school-level prior attainment was much less for students with EAL, than English speakers.

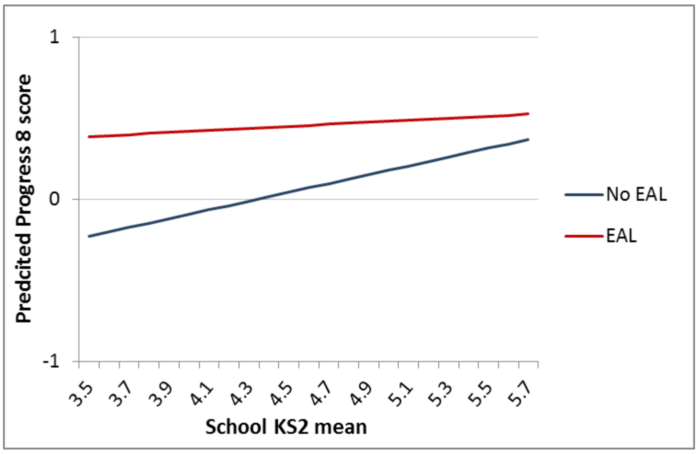


***Figure 27: Predicted Progress 8 scores for students with different EAL status by school KS2***

*SEN status * Region*

The predicted scores for each region, by SEN status are presented in Figure 28. In all regions students with no SEN had the highest predicted scores and in most regions those with an EHCP had the lowest. EHCP students in East Midlands and West Midlands had particularly low predicted scores.

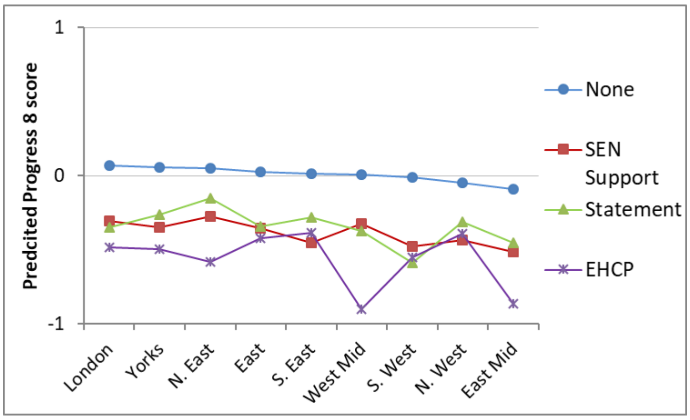


***Figure 28: Predicted Progress 8 scores for students of different ethnicity by SEN status***

*Ethnic group * Region*

The final interaction was between ethnic group and region. The results are presented in Figure 29. This shows that in all regions the predicted Progress 8 score was lowest for White students (closely followed by students with a mixed ethnic background). It also shows that the gap between White students and other ethnicities was smallest in London. This suggests that the 'London effect' was greater for White students than for non-Whites.

Chinese students had the highest predicted Progress 8 score in each region, and had particularly high predictions in the North East. In fact, for all of the non-White ethnicities apart from Asian the highest predicted scores were in the North East.

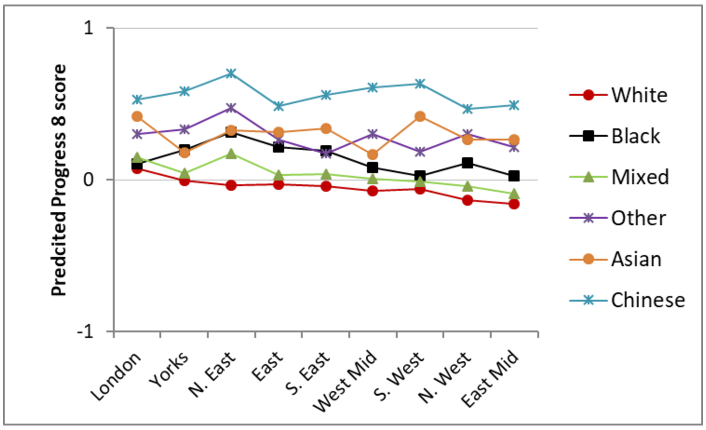


*Figure 29: Predicted Progress 8 scores for students of different ethnicity by region*

### 3.4. Regression analysis of student-level Attainment 8 scores and comparisons with alternative measures

To make comparisons between the alternative measures of student performance, multilevel regression models were fitted, with each of the three measures in turn (Attainment 8, total points score, average points score) as the dependent variable. For consistency, the same independent variables were used as those included in the model predicting the Progress 8 score (Model 2). Only the main effects were investigated, not the interactions.

In order to make direct comparisons between the effects of the independent variables in the three models, they needed to be standardised, as the scales for the different measures were different. The differences are demonstrated in Table 13.

*Table 13: Comparison of different measures of student achievement at end of KS4*

| Measure | No. of students | Mean | S.D. | Min | Max |
|---|---|---|---|---|---|
| Attainment 8 | 501,804 | 51.03 | 16.15 | 0 | 86.00 |
| Total points score | 501,804 | 49.31 | 18.97 | 0 | 133.75 |
| Average point score | 501,804 | 4.96 | 1.48 | 0 | 9.27 |

To account for this, the parameter estimates in each model were converted into effect sizes by dividing by the standard deviation (sd.) of the outcome variable. This made the effects directly comparable between the three models. Each effect can be interpreted as the change in the outcome variable (in terms of standard deviation units) associated with a one unit increase in the predictor variable.

Table 14 presents the effect sizes for each variable in the three models, and the difference between the effect sizes in the Attainment 8 model and the effect sizes in the models using the alternative measures.

Most of these differences are very small. However, there are a few which are worth commenting on. If we ignore the intercept, the effect with the greatest difference between the total points score model and the Attainment 8 model was being in a selective academy school (compared with being in a comprehensive academy). In the Attainment 8 model this effect was equal to 0.14 of a standard deviation, compared with 0.30 in the total points score model. The reason for the bigger effect in the total points score model was due to students in these schools taking more qualifications and therefore increasing their total points score (but not their Attainment 8 score). The next largest difference was the effect for students of Chinese ethnic background (compared to White students), with a larger effect in the total points score model (0.36 of a sd.) than the Attainment 8 model (0.27). Again, this was because Chinese students were more likely to take a higher number of qualifications, compared with other ethnic groups.

In terms of the differences between the average points score model and the Attainment 8 model, the largest differences in main effects were in relation to SEN category. The effect of having an EHCP (compared with no SEN) was much smaller in the average points score model (0.03 of a sd.) than the Attainment 8 model (-0.23 of a sd.). Furthermore, the effect of having a Statement (compared with no SEN) was actually positive in the average points score model (0.05 of a sd.), compared with a negative effect in the Attainment 8 model (-0.12). This is likely to be because SEN students often take fewer than the eight eligible qualifications for Attainment 8 and were therefore penalised on this measure. Finally there was a difference in the effect of school KS2 mean, with a larger positive effect in the average points score model (0.28 of a sd.) than in the Attainment 8 model (0.17).

***Table 14: Model parameter effect sizes for alternative measures of student performance***

| ***Fixed effect*** | | ***Att 8*** | ***Tot. points score*** | ***Av. Points score*** | ***Tot. points score-Att.8*** | ***Av. Points score-Att.8*** |
|---|---|---|---|---|---|---|
| Intercept | | 3.21 | 2.64 | 3.45 | -0.57 | 0.24 |
| KS2 Average Fine Level | | 0.94 | 0.89 | 0.93 | -0.05 | -0.01 |
| Gender | Boys | | | | | |
| | Girls | 0.16 | 0.18 | 0.22 | 0.02 | 0.06 |
| Ever FSM | No | | | | | |
| | Yes | -0.25 | -0.24 | -0.25 | 0.01 | 0.00 |
| IDACI | | -0.60 | -0.59 | -0.64 | 0.01 | -0.04 |
| SEN status | None | | | | | |
| | SEN support | -0.26 | -0.22 | -0.20 | 0.04 | 0.06 |
| | Statement | -0.12 | -0.05 | 0.05 | 0.07 | 0.17 |
| | EHCP | -0.23 | -0.15 | 0.03 | 0.08 | 0.26 |
| Ethnic group | White | | | | | |
| | Asian | 0.10 | 0.08 | 0.11 | -0.02 | 0.01 |
| | Black | 0.13 | 0.10 | 0.13 | -0.03 | -0.00 |
| | Chinese | 0.27 | 0.36 | 0.28 | 0.09 | 0.01 |
| | Mixed | 0.04 | 0.04 | 0.05 | 0.00 | 0.01 |
| | Other | 0.20 | 0.21 | 0.20 | 0.01 | -0.01 |
| | Unknown | -0.02 | -0.02 | -0.01 | 0.00 | -0.01 |
| EAL | No | | | | | |
| | Yes | 0.26 | 0.29 | 0.25 | 0.03 | -0.01 |
| | Unknown | 0.06 | 0.05 | 0.07 | 0.00 | 0.01 |
| School type | Academy (comp.) | | | | 0.00 | |
| | Academy (mod.) | -0.05 | -0.03 | -0.06 | 0.02 | -0.01 |
| | Academy (sel.) | 0.14 | 0.30 | 0.12 | 0.15 | -0.02 |
| | Comprehensive | -0.02 | -0.03 | -0.03 | -0.01 | 0.00 |
| | Grammar | 0.11 | 0.07 | 0.09 | -0.04 | -0.02 |
| | Secondary Modern | -0.09 | -0.08 | -0.10 | 0.00 | -0.01 |
| School gender | Mixed | | | | | |
| | Boys | 0.07 | 0.07 | 0.08 | 0.00 | 0.01 |
| | Girls | 0.02 | -0.02 | 0.03 | -0.04 | 0.01 |
| School KS2 mean | | 0.17 | 0.22 | 0.28 | 0.05 | 0.11 |
| Region | London | | | | | |
| | East Midlands | -0.15 | -0.20 | -0.17 | -0.05 | -0.02 |
| | East of England | -0.07 | -0.07 | -0.09 | 0.00 | -0.02 |
| | North East | -0.07 | -0.08 | -0.08 | -0.01 | -0.01 |
| | North West | -0.13 | -0.16 | -0.12 | -0.03 | 0.01 |
| | South East | -0.09 | -0.09 | -0.10 | 0.00 | -0.01 |
| | South West | -0.10 | -0.10 | -0.12 | 0.00 | -0.02 |
| | West Midlands | -0.09 | -0.11 | -0.10 | -0.02 | -0.01 |
| | Yorkshire and the Humber | -0.06 | -0.06 | -0.08 | 0.00 | -0.01 |

These results suggest that the decision to use the restricted definition of Attainment 8, rather than a more inclusive measure of performance, did not have a big effect on which students performed well on the measure.

## 4. Discussion

Many of the findings presented in this report match those of previous research which investigated progress in secondary schools amongst different groups of students. We found that girls made on average a quarter of a grade (per qualification) more progress than boys. This advantage in terms of progress in secondary school for girls was similar to that found in previous research (e.g., Sammons, 1995; Burgess, McConnell, Propper and Wilson, 2004). One possible explanation for this is the fact that, in the past, GCSEs had a substantial proportion of coursework or controlled assessment, which tend to favour girls. More recent research (Bramley, Vidal Rodeiro & Vitello, 2015) has shown that girls also outperform boys in written examinations at GCSE, but by not as much as in coursework. It will be interesting to see whether the introduction of reformed GCSEs (most of which will no longer have coursework) leads to the gender gap closing somewhat.

We also found that students eligible for free school meals made less progress than other students, by around 0.4 of a grade on average. Students experiencing higher levels of deprivation also made less progress. This negative relationship between progress and higher levels of disadvantage has been found in previous studies (e.g., Sammons, 1995; Strand, 2014; Sammons, et al. 2014) and has been linked to more disadvantaged students having less support at home and lower educational aspirations.

The next finding was that all ethnic groups made more progress than White students, even after accounting for other factors, such as deprivation. The largest effect was for Chinese students (around 0.4 of a grade on average). Black and Asian students made about 0.2 of a grade more progress on average. This fits in with the findings from previous research (e.g., Sammons, 1995; Wilson, Burgess and Briggs, 2011, Strand, 2014). The most likely explanation for this is the importance of high aspirations in many minority ethnic families and communities.

We also found that students with EAL made about 0.4 of a grade more progress than English speakers. Again, this agrees with previous research (e.g., Strand, Malmberg and Hall, 2015). However, part of this effect may be due to a change in the true EAL status over time. The NPD defines EAL students as those exposed to an additional language in their home or community, taking no account of their actual proficiency in English. We know that all of the students included in the analysis have been in the country for at least five years, because we have their KS2 test results. It may be that for a lot of these students their knowledge of English will have improved significantly in that time and this may explain why their progress was so much greater.

Many of the school-level effects from the regression models were very small, but there were three variables (all closely linked) which were important. In the descriptive analysis, we found that students in selective schools (whether academies or not) or in single sex schools made considerably more progress on average. However, in the regression model some of those differences disappeared or became much smaller, because other factors were more important. In particular, the fact that students in schools with a higher attaining intake (as measured by KS2 mean) made more progress led to a big fall in the school type differences, presumably because selective schools have a much higher attaining intake than other school types. Even so, some school type effects were still present after accounting for school mean KS2, with students in selective academies performing better by about one tenth of a grade and those in non-Academy secondary moderns performing worse by 0.11 of a grade than students in comprehensive academies. The girls' school advantage disappeared completely in the statistical model. This is likely to be due to two separate reasons: first, girls' schools were likely to have a high performing intake; secondly, the effect of gender was more important.

The region in which students attended school also had a significant effect on Progress 8 scores, with lower mean scores for all regions compared with London. However, the effects seen in the regression model were smaller than those in the descriptive analysis (and were not significant for some regions). For example, the North East had the second lowest mean Progress 8 score (-0.14) and was also highlighted in a recent DfE report (DfE, 2017b) as having the highest percentage of schools below the floor standard. However, this effect was not significant once other factors were taken into account. Despite these qualifications, there was still evidence that the London effect was present, even after accounting for other factors.

Some interesting interaction effects were also present. The advantage for girls was much smaller (or disappeared completely) if they had any SEN. The FSM gap (and similarly the effect of increasing IDACI) was greatest for White students, compared with other ethnic backgrounds. Figures 20 and 21 showed that White students from more deprived backgrounds made the least progress on average. This confirms the findings of previous research (e.g., Strand, 2014), and suggests that the importance of high aspirations in non-White ethnic backgrounds extends to those from poorer families. One possible reason for this is that education is thought of as a way out of poverty for minority ethnic groups.

Another set of significant interactions were found in relation to school prior attainment. Specifically, the positive effect of increasing school-level prior attainment was found to differ by student characteristics. Thus, students with SEN support or a Statement of SEN, those from an Asian, White or Mixed ethnic background or those speaking English as their first language were all more sensitive to changes in school level KS2 mean.

The impact of using Attainment 8 to measure performance instead of some possible alternatives was found to be mostly very small in terms of which factors were important in a regression model. However, there were a few differences which were notable. The first of these found that SEN status was much less important in the model with average points score as the outcome, compared with the Attainment 8 model. This was presumably because these students tended to take fewer than eight qualifications, but their performance in the qualifications they did take was not significantly lower than non-SEN students (with the same prior attainment). The effect of school-level prior attainment was also more important in the average points score model. This may be due to schools with lower attaining intakes managing to boost their Attainment 8 scores by entering students for as many qualifications as possible, but perhaps at the expense of many of them performing less well in each qualification.

Being in a selective academy school (compared with being in a comprehensive academy), was more important in the model with total points score as the outcome than in the

Attainment 8 model. This was likely to be because students in these schools took more qualifications (10.9 on average compared with 9.6 in comprehensive academies) and therefore increased their total points score (but not their Attainment 8 score). It is interesting that the same difference was not found in relation to selective non-academies. Similarly, the effect of being Chinese was greater in the total points score model, because Chinese students took more qualifications on average than any other ethnic groups (10.8, compared with 9.6 amongst White students).

The descriptive analysis of Progress 8 scores at school level showed some interesting differences between different types of schools. Perhaps of most importance was the finding that, despite the measure taking account of prior attainment at the student level, Progress 8 systematically penalised schools with a lower performing intake. The size of the effect was substantial; if we take the line of best fit in Figure 12 as a measure of the average Progress 8 score for different levels of prior attainment in a school, then the difference between a school with a KS2 average of 4.25 and a school with an average of 4.75 was 0.24, or one grade in every fourth qualification. This pattern was present for both selective and non-selective schools, which suggests that the difference seen between school types was more due to the prior attainment of the students than to the type of school *per se*. This confirms previous findings (e.g., Yang & Woodhouse, 2001) that students make more progress in schools with higher attaining intake. It is not clear why this would be the case, but three possible explanations have been suggested by Thomson (2015). These are: students in higher attaining schools receive more help at home; competition amongst students may drive up attainment; and higher attaining schools may be more effective because they can recruit better teachers. It may also be the case that in high-attaining schools students are not held back by having to go at the pace of lower attaining students, so tend to make more progress.

Otherwise, the effects at school level mainly reflected the student make-up of the school. Thus, schools with higher percentages of FSM, SEN or White students tended to have lower Progress 8 scores on average. These results suggest that some schools are penalised for factors which are beyond their control, and therefore, it is questionable that Progress 8 should be used as a measure for comparing schools, or for bringing them to the attention of the Office for Standards in Education (Ofsted) (if they are below the floor standard). It could be argued that a fairer way of judging schools would be to take account of some of these factors when calculating school performance measures. However, as outlined by Allen (2015), this makes the assumption that effective schools are equally distributed amongst wealthy and deprived communities. It may be that this is not the case, with higher attaining schools more able to recruit better and more effective teachers (Allen, Burgess & Mayo, 2018). In other words, some of the advantage seen in terms of Progress 8 scores for these schools may be because they are genuinely more effective.

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