Technical appendix

Education in England: Annual Report 2018 examines trends in overall attainment and attainment gaps for the period 2011 to 2017. Except for our post-16 destinations analysis, all results are drawn from the National Pupil Database (NPD).[1]

Pupil population

We include pupils at all state-funded schools except for those whose sole, or main, registration was in alternative provision, a pupil referral unit, or a hospital school. Independent schools are not included, apart from a small number of providers in the Early Years Foundation Stage.[2]

Pupil attainment

Our report uses point scores rather than threshold measures to assess system performance.

Early Years Foundation Stage

For the early years, we use total points score in the Early Years Foundation Stage Profile (EYFSP) to measure attainment. The EYFSP is a teacher-assessed measure of pupil proficiency across seventeen learning goals, with children assessed as either meeting the level of development expected (score=2) at the end of the reception year, exceeding this (score=3), or not having reached the level (score=1). The total points score aggregates scores across the seventeen goals, ranging from a minimum score of 17 to a maximum of 51.

Key Stage 2

At Key Stage 2 (KS2), attainment is measured using the average of reading and mathematics scaled scores. Scaled scores for these domains are derived from national test results, and can take values between 80 and 120. We also take account of the teacher-assessed levels for pupils below the level of the test, whose scores range from 59 to 79. Where pupils are missing either result, the average takes the value of the subject they do have a score for. Where neither subject has a score, the pupil is not included in our analysis.

We do not draw on the spelling, punctuation and grammar assessment as it was only introduced in 2013, nor the assessment in writing as from 2012 it has been teacher-assessed.

2016 was the first year pupils were assessed against a new national curriculum, in tests that were designed to be more difficult, and with a new scoring system. These changes make it impossible to make direct comparisons between the 2016 results and years prior to then.

[1] www.gov.uk/government/collections/national-pupil-database

[2] E.g., in 2017, 246 children were registered across 35 independent and non-maintained schools.

Key Stage 4

We use average GCSE grade per subject to measure Key Stage 4 (KS4) attainment. While this measure excludes non-GCSE qualifications, it does include AS level qualifications completed in KS4. Scores range from 0 to 10.75.[3]

The average GCSE grade per subject measure is provided in the NPD through all years we analyse. To account for changes in the point scores grades are awarded in 2016 and again in 2017 (for unreformed GCSEs), we adjust average scores in prior years by mapping across the old score boundaries to the new, and interpolating to produce an adjusted figure. We make no adjustment for the introduction of the new nine grade scale (rather than eight) in 'reformed' GCSE English and Maths in 2017. The results from additional reformed GCSE subjects will appear in 2018 and 2019 NPD data. The gradual shift from unreformed to reformed GCSEs makes strict comparisons of results impossible, but this does not affect our ability to make disadvantage gap comparisons over time, as we are effectively measuring the change of within-year rank of various pupil groups, not absolute scores.[4]

We use average GCSE grade per subject as, unlike other measures (e.g. a broader measure of attainment that includes non-GCSE subjects in KS4, or Attainment 8 points), it has not been affected by changes in which non-GCSE qualifications count in DfE's school performance tables.[5]

To contextualise changes observed in the average GCSE grade per subject (when measuring the attainment gap), we also calculate the gap based on the average of GCSE English and maths. This provides a measure that while quite narrow, is not affected by changes in GCSE subject entry patterns.

Attainment gaps

We continue to report attainment gaps between specified pupil groups as per our prior 2017 ***Closing the Gap*** report.[6] We calculate these gaps using the same mathematical procedure as the DfE, though we present our results in 'months of progress' terms, and apply these calculations to different attainment measure inputs.[7] The steps followed to calculate the gap are:

1. Rank all pupils by score, as per the attainment measures described earlier.
2. Identify the relevant groups of interest, and calculate the mean rank of pupils in these groups.

[3] AS level, reformed GCSE and unreformed GCSE subjects count towards this measure, and each have their own grading scale and associated point scores. An average above 8.5 (the maximum score for unreformed GCSE subjects) is rare, accounting for fewer than 0.02 per cent of KS4 pupils in 2017. For information on the point score scales for contributing subjects, see: www.gov.uk/government/publications/key-stage-4-qualifications-discount-codes-and-point-scores

[4] For details of how the resilience of the ranking approach to grading system changes has been tested, please see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/398657/SFR_40_2014_Measuring_disadvantaged_pupils_attainment_gaps_over_time__updated_.pdf

[5] The 2011 Wolf Review recommended the removal of many non-GCSE qualifications from school performance tables, which saw over 3,000 of these qualifications removed in 2014.

[6] J. Andrews, J. Hutchinson and D. Robinson 'Closing the Gap? Trends in Educational Attainment and Disadvantage', August 2017

[7] The DfE methodology for calculating attainment gaps for disadvantaged pupils can be found here: www.gov.uk/government/statistics/measuring-disadvantaged-pupils-attainment-gaps-over-time

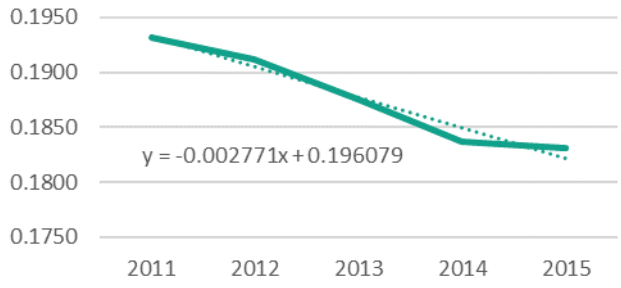
3. Subtract the rank of the group of interest from that of the reference group used.
4. Convert this rank difference to a months of progress measure.[8]

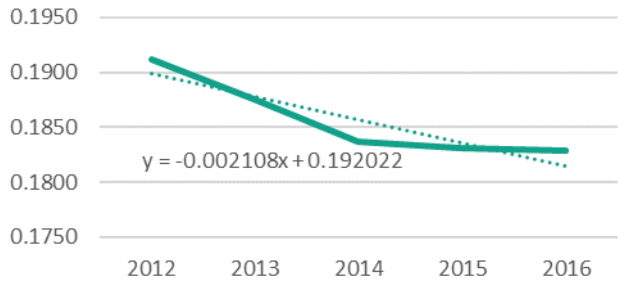
Key Stage 4 disadvantage gap projections

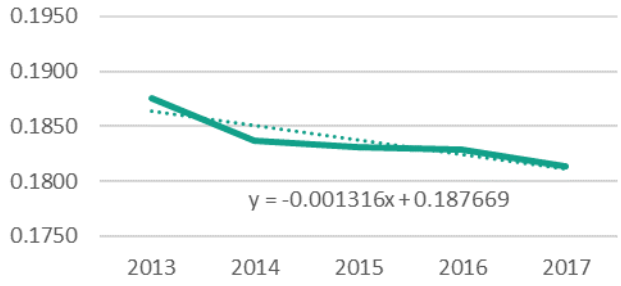
For the disadvantage gap, we also create a yearly projection of how long it will take the gap for a given key stage to close, based on the most recent five-years of data. A linear trendline is fitted to each five-year trend and the equation of this trend line is used to calculate the number of years until the gap reaches zero. This procedure was repeated for three five-year periods, as follows:

- 2011-2015
- 2012-2016
- 2013-2017

These trends are shown below; the vertical axis of the charts represents the difference in the percentile ranks of disadvantaged versus other pupils based on their attainment in GCSE English and maths.







[8] This updates the methodology used for calculating gaps in our 2016 annual report. For further discussion of that methodology see 'Education in England: Progress and goals' https://epi.org.uk/report/ambitions-forenglish-education/. We have applied the mean rank approach to earlier years to calibrate difference in ranks against months of progress.

The change in the number of years until the gap is expected to close is used to determine whether the gap is closing more quickly or more slowly in recent years than in prior years, which expresses changes in the gradient or 'steepness' of the trend line across the three five-year periods ending in 2015, 2016 and 2017.

Pupil characteristics

Disadvantaged

We define disadvantaged pupils as those who have been eligible for free school meals (FSM) in any of the prior six years. The reference group these pupils are ranked against are all those who have not received FSM in any of the prior six years.

Persistently disadvantaged

We define persistently disadvantaged pupils as those who have been eligible for free school meals (FSM) for 80 per cent or more of their time in school. The reference group these pupils are ranked against are all those who have neither met the definition of persistently disadvantaged student, nor received FSMs in any of the prior six years.

We do not report the attainment gap for pupils who fall outside of these two groups (e.g., those who are not persistently disadvantaged, but have been eligible for FSM in any of the last six years).

Ethnicity

For this characteristic, we express the gap for all ethnic groupings relative to White British pupils (who are by far the largest group).

Special Education Needs and Disabilities (SEND)

We report the gap for two SEND categories:

- pupils with a statement of special educational needs or an education, health and care plan; and
- pupils with an identified special educational need but without a statement or plan.

Both are reported relative to pupils with no identified SEND.

Late arriving English as an additional language (EAL)

We define late arriving EAL pupils as those who are recorded as having EAL, and who have entered the English state-school system in either year 10 or year 11. The reference group these pupils are ranked against are all those who have been recorded with English as their first language in the current year, and who have never in the past been recorded as having EAL.

We do not report the attainment gap for pupils who fall outside of these two groups (e.g., those who are EAL, but appeared in the state school system prior to the last two years).

Geographic breakdowns

We also report the gap on an geographic basis, covering Opportunity Areas, Local Authorities (LAs), Regional School Commissioner regions, and City Regions. In each we construct the gap by ranking the disadvantaged and persistently disadvantaged pupils in the area relative to the national mean rank of those who are neither. We do this rather than express the rank in terms of the difference between disadvantaged and non-disadvantaged pupils *within* the area to allow for a consistent

reference point across areas. This avoids representing disadvantage gaps as being especially large in certain geographic areas based on very high attainment of non-disadvantaged children in the area, rather than low attainment by disadvantaged children.

Change in gap for LAs with similar gaps in 2012

To illustrate how LA attainment gaps have shifted over time, we compare relative changes in the size of gap from 2012 to 2017.[9] We first regress present 2017 gaps on 2012 gaps for all LAs. For each LA, we then use this regression model to estimate the 2017 gap (in effect, an estimate of the gap compared to LAs that had similar gaps in 2012). The change in the gap shown is the difference between each LA's estimated 2017 gap and their actual gap (positive figures indicating the LA has narrowed more than the estimate, and vice versa). This approach is used as the actual change in gap (2017 gap minus 2012 gap) is heavily correlated with the size of the 2012 gap, and therefore tells us little about relative local authority performance in narrowing the gap.

Destination gaps at Post-16

To measure segregation in the post-16 destinations of KS4 pupils, we use an 'index of dissimilarity'.[10] This index has been applied to measure several forms of segregation in educational contexts previously.[11]

Our dissimilarity index measures segregation across the following post-KS4 destinations:

- Further education (FE) college or other FE
- 6th form: college or secondary school
- Other education destination (e.g. includes special schools, independent schools, alternative provision, higher education institutions, and post-16 specialist institutions)
- Sustained employment and/or training destination[12]
- Destination not sustained (e.g. those who participated in education or employment for less than two terms, or who had no participation and claimed out-of-work benefits).

Simply put, the index measures how evenly two groups (in our case disadvantaged and non-disadvantaged pupils) are distributed across destinations relative to their share of the total pupil population. For example, if London has a 1:10 ratio for disadvantaged pupils to all other pupils, then the index will quantify how far away we are from achieving a 1:10 ratio in each post-16 destination.

The formula used to generate the index is:

$$S = \frac{1}{2}\sum_{i=1}^{N}\left|\frac{d_i}{D} - \frac{a_i}{A}\right| \; x \; 100$$

[9] For the early years we use 2013 rather than 2012 as our baseline year, as this was the first year to use the EYFSP.

[10] This is the only piece of analysis that does not draw on the NPD. Instead we use DfE Destinations data available here: https://www.gov.uk/government/collections/statistics-destinations

[11] See Allen, B. & Vignoles, A. (2006) *What Should an Index of School Segregation Measure?* Centre for the Economics of Education, London School of Economics and Political Science. Available: http://cee.lse.ac.uk/ceedps/ceedp60.pdf; and Whitehurst, G.J., Reeves, R.V., & Rodrigue, E. (2016) *Segregation, Race and Charter Schools: What do we know?* Brookings Institute. Available: https://www.brookings.edu/wp-content/uploads/2016/10/ccf_20161021segregation_version-10_211.pdf

[12] To count as a 'sustained' destination, the young person has to be participating for at least 'two terms' or 'six months' of the academic year after they have completed Key Stage 4.

$S =$ Dissimilarity index

$d_i =$ number of disadvantage pupils in destination i

$D =$ total population of disadvantage pupils

$a_i =$ all other pupils in destination i

$A =$ total population of all other pupils

The index can take a value between 0 and 100. 0 indicates a complete absence of segregation and 100 indicates total segregation. The result can be interpreted as the proportion of the disadvantaged cohort who would need to change destinations to achieve an absence of segregation.

It is important to note that this measure does not assume any hierarchy of post-16 destinations in terms of desirability. It simply quantifies how alike the post-16 trajectories of disadvantaged pupils and their peers are.