



Department  
for Education

## Statistical Working Paper

# Measuring disadvantaged pupils attainment gaps over time

Reference	SFR 40/2014
Date	19 <sup>th</sup> December 2014
Coverage	England
Theme	Children, Education & Skills
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### Working Paper Summary

This Statistical Working Paper sets out current thinking on supplementary measures to enhance the suite of available statistics on attainment gaps. It outlines a possible new methodology for a national Disadvantaged Pupils Attainment Gap Index at key stages 2 and 4. The Department is seeking views from external users on their needs in this area and the usefulness of the methodology presented.

This paper provides background information on existing disadvantage gaps at the expected levels of achievement for key stages 2 and 4. It then considers forthcoming changes to assessment and accountability arrangements, highlighting the challenges for measuring disadvantage gaps over this period and the need for additional supporting measures to interpret changes in the gaps over time.

After defining a working methodology for a Disadvantaged Pupils Attainment Gap Index, the paper discusses strengths and limitations identified during development of the measures to date, including the challenges in communicating a unitless index to all users.

The Department invites users to provide views on the working methodology, including any suggestions for alternative approaches. Please direct all comments and queries to the following email address: [Attainmentgap.INDEX@education.gsi.gov.uk](mailto:Attainmentgap.INDEX@education.gsi.gov.uk).

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## 1. Background: Existing Gap Measures

Disadvantaged pupils are defined as those eligible for the Pupil Premium; currently this means pupils who have been eligible for free school meals at any point during the last 6 years<sup>1</sup> (“ever6 FSM”) or those who have been in care continuously for at least six months<sup>2</sup> (“LAC” / “CLA”). “Other pupils” includes all pupils who are not known to meet this definition.

Currently, attainment gaps for disadvantaged pupils are derived by comparing the percentage of disadvantaged pupils achieving the expected standard with the percentage of all other (non-disadvantaged) pupils achieving the expected standard. The headline attainment gaps are communicated as percentage point differences in:

- achieving level 4 or above in reading, writing and mathematics **at key stage 2**; and,
- achieving at least 5A\*-C including GCSE English and mathematics **for key stage 4**.

### Figure 1: Key stage 2 headline attainment gap for 2012-2014<sup>3</sup>

Percentage of pupils achieving level 4 or above in reading, writing and mathematics

	2011/12	2012/13	2013/14
Disadvantaged pupils	61.5	63.3	67.4
All other pupils	79.8	80.6	83.5
All pupils	74.4	75.3	78.5
Percentage point gap	18.3	17.3	16.1

At key stage 2 the proportion of pupils achieving level 4 in reading, writing and mathematics has risen since 2012; 67.4 per cent of disadvantaged pupils and 83.5 percent of other pupils achieved the expected level in 2014. Attainment at this level has been rising faster among disadvantaged pupils meaning the gap has narrowed. The gap in level 4 attainment shrank by 1.3 percentage points in the latest year from 17.3 to 16.1 percentage points<sup>4</sup>. Since 2012 this gap has narrowed by 2.2 percentage points.

<sup>1</sup> During the first year of the Pupil Premium in 2011-12, only pupils currently eligible for free school meals and looked after children were eligible to receive the premium; however the 2012 attainment results in this working paper have been calculated on the current basis for consistency over time.

<sup>2</sup> Looked After Children’s eligibility has now been expanded to include those recorded as ever having been in care, resulting in a slight increase in the size of the overall cohort of disadvantaged pupils, but the former definition was applied to the results years that appear in this working paper.

<sup>3</sup> Percentages achieving and percentage point gaps have been calculated from the same underlying data as published data. Figures are presented to one decimal place for consistency with other tables at key stage 4 and so for example, the latest headline gap is given as 83.5 rather than 83 as previously published. This is due to rounding.

<sup>4</sup> Percentage point gaps and differences are calculated on unrounded data.

**Figure 2: Key stage 4 headline attainment gap for 2012-2014**

Percentage of pupils achieving 5 or more grades A\*-C including GCSE English &amp; mathematics

*2013/14 figures will be added to this table in a refresh of this document on 29th January*

	2011/12	2012/13	2013/14
Disadvantaged pupils	38.5	40.9	To be added 29 <sup>th</sup> Jan
All other pupils	65.7	67.9	
All pupils	58.8	60.6	
Percentage point gap	27.2	26.9	

At key stage 4, the proportion of pupils achieving 5A\*-C grades including GCSE English and mathematics increased and the gap decreased slightly between 2012 and 2013.

**2. Background: Assessment and Accountability Arrangements**

A number of planned changes to assessment and accountability arrangements in coming years will reduce the comparability over time for the existing headline gap measures. The most significant changes affecting attainment gap measurement are:

- **At key stage 2:** National Curriculum levels will be discontinued after 2014/2015 and replaced with new 'scaled scores' from 2015/2016 which will not have a direct translation into the current level 4 or above measure.
- **At key stage 4:** rule changes introduced in 2013/2014 have already had an effect on the percentage of pupils achieving at least 5A\*-C including GCSE English and mathematics; furthermore, from 2016/2017 new GCSE qualifications will be awarded using a 9 point grading scale instead of the current 8 point A\*-G scale.

Full details of the planned changes to assessment and accountability affecting the measurement of gaps are provided at annex A.

These changes do not prevent reliable comparisons between the percentage of disadvantaged and non-disadvantaged pupils achieving an expected standard within a given year. It will be possible to establish an expectation for good attainment using the new assessments. However, the reforms pose a significant challenge if we want to reliably assess changes in the gaps over time.

Consequently, the Department is developing new supplementary attainment gap measures to enable reliable comparisons over time. In the first instance, national level measures are under development; these would not be used for school accountability purposes or for the assessment of individual pupils. To be able to assess whether the gap at national level is improving (getting smaller) over time, any new supporting measures would need to:

1. Be resilient to changes in grading systems;
2. Be resilient to changes to assessments and curricula;

3. Not require any new assessments or changes to arrangements which have already been announced;
4. Provide meaningful and transparent information for users of attainment gap statistics.

The following section describes a working methodology developed by statisticians at the Department for Education which represents current thinking on how these requirements could be delivered. This has been titled the Disadvantaged Pupils Attainment Gap Index.

### **3. Working Methodology: A national Disadvantaged Pupils Attainment Gap Index**

The working methodology for a national Disadvantaged Pupils Attainment Gap Index is based on a mean rank difference. At both key stages an average point score for attainment in English and mathematics assessments has been used to order pupil attainment. English and mathematics elements are weighted equally and measured in the same units. These two subjects were selected because:

- They cover core skills in literacy and numeracy. Attainment in English & mathematics is highly correlated with other outcomes and future success; and,
- Participation in these subjects (entry in relevant accredited qualifications) is almost universal for pupils at the end of key stage 4; therefore a measure based on these subjects is not expected to be affected by changes to qualification entry behaviours or rule changes for headline accountability measures.

At key stage 2 the working methodology uses English and mathematics point scores until 2011 and reading, writing and mathematics point scores from 2012 (writing tests were replaced by writing teacher assessments (TAs) from 2012 and overall English levels are no longer calculated). Pupils without either test or TA results are excluded from the measure because no information about the relative level of their attainment is known and so these results cannot be ordered.

At key stage 4 the point score used is an average of each pupil's English and mathematics GCSE grades. Pupils achieving a U (ungraded) or not entering a relevant English or mathematics qualification by the end of key stage 4 receive a score of zero for that component. This reflects the expectation that all pupils should study these subjects to level 1/2. This measure will continue to be relevant following GCSE reforms but may be supplemented by an 'Attainment 8' point score to assess attainment across a broader curriculum (see annex B for more information on the point scores used in the proposed measure).

The Disadvantaged Pupils Attainment Gap Index is calculated by ordering all pupils' point scores and deriving a mean rank for all disadvantaged pupils and a mean rank for all non-disadvantaged pupils. The difference between the two mean ranks provides the mathematical basis for the Disadvantaged Pupils Attainment Gap Index. Separate indices are calculated for key stages 2 and 4.

### Calculating the Mean Rank Difference

In 2014 there are **552,809** pupils with a valid reading, writing and mathematics point score at KS2<sup>5</sup>.

The pupils are ordered from lowest to highest attainment with tied scores being assigned the same rank (the mid-point).

The average (mean) rank for all the disadvantaged pupils and all the non-disadvantaged pupils is found (where higher mean rank means *higher* attainment).

$$\text{Mean Rank}_{\text{non-disadvantaged}} = 303,375$$

$$\text{Mean Rank}_{\text{disadvantaged}} = 216,154$$

This is then divided by the total number of pupils in the cohort to give a decimal rank. A rank above 0.5 means that on average pupils are found more than halfway up the distribution, while a rank of less than 0.5 means they are found less than halfway up the distribution.

$$\frac{\text{Mean rank}_{\text{non-disadvantaged}}}{\text{total pupils in cohort}} = \frac{303,375}{552,809} = 0.549$$

$$\frac{\text{Mean rank}_{\text{disadvantaged}}}{\text{total pupils in cohort}} = \frac{216,154}{552,809} = 0.391$$

The decimal mean rank difference is the difference between the mean ranks of the disadvantaged and non-disadvantaged groups and is between 0 and 0.5 (or -0.5 if disadvantaged pupils were ahead).

$$\text{non-disadvantaged} - \text{disadvantaged} = 0.549 - 0.391 = 0.158$$

The mean rank difference ranges between +0.5 (every non-disadvantaged pupil has higher attainment than every disadvantaged pupil) and -0.5 (every disadvantaged pupil has higher attainment than every non-disadvantaged pupil). A value of zero would mean that there is no difference in attainment between disadvantaged and non-disadvantaged pupils.

This default value of the mean rank difference is not the easiest scale to understand intuitively. People tend to find whole numbers easier to interpret than fractions and for this reason, the decision has been taken to re-scale the mean rank difference to a base of 10. The result is that it takes a value between +10 and -10; this scale of “how many out of ten” is familiar from many everyday situations and makes it easier to understand the Index’s value as a proportion of the maximum possible gap and to judge comparisons between years and key stages.

<sup>5</sup> See Annex B for information on point scores

### Scaling the Disadvantaged Pupils Attainment Gap Index to a Base of 10

For presentation the mean rank difference is scaled to 10 and expressed in relation to the performance of the non-disadvantaged group (the comparator). This does not affect the behaviour of the indicator over time but gives the measure a value between 0 and 10 (or -10 if disadvantaged pupils had higher attainment than non-disadvantaged pupils).

The non-disadvantaged mean rank is (always) given a value of **10**.

The disadvantaged mean rank is expressed in relation to the non-disadvantaged rank as:

$$10 - \left[ \left( \frac{\text{Mean rank}_{\text{non-disadvantaged}}}{\text{total pupils in cohort}} - \frac{\text{Mean rank}_{\text{disadvantaged}}}{\text{total pupils in cohort}} \right) \times 20 \right]$$

$$= 10 - [(0.549 - 0.391) \times 20] = 6.84$$

The Disadvantaged Pupils Attainment Gap Index is the difference between these figures:

$$10 - 6.84 = 3.16$$

This is equivalent to the decimal mean rank difference multiplied by 20.

The minimum possible gap is 0 while the maximum gap is 10 (or -10 if disadvantaged pupils were ahead).

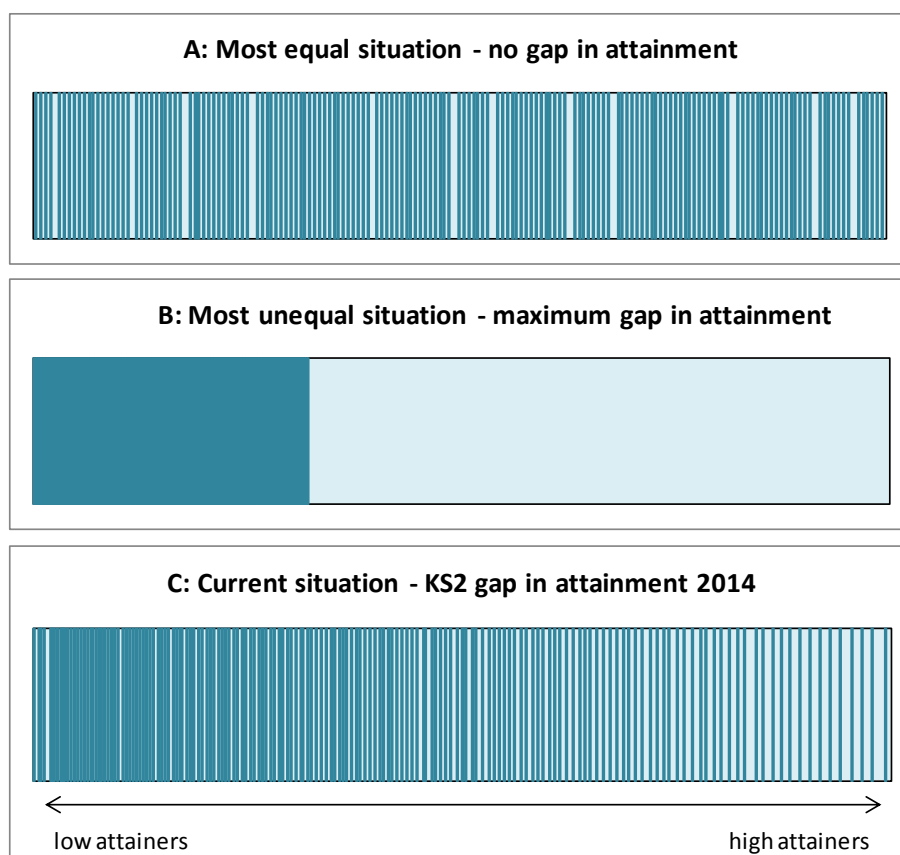
## 4. Presentation and Interpretation of the Disadvantaged Pupils Attainment Gap Index

A reduction in the Disadvantaged Pupils Attainment Gap Index means that nationally, we have moved further away from a situation where disadvantage systematically predicts lower attainment and closer to one where attainment is similar irrespective of disadvantage. The percentage change in the Index over time indicates whether, and how fast, the gap is closing.

The Index is more technically complex than existing percentage point gap measures and requires more explanation to ensure it is accessible to users. The logic underpinning the Index can be illustrated in graphical form to assist understanding of how the measure works and what it means.

### Figure 3: “Barcode” illustration of the Disadvantaged Pupils Attainment Gap Index

The bars represent pupils *ordered by attainment*. Dark stripes represent the position of disadvantaged pupils within the total pupil attainment distribution.



Bar A: most equal situation. No gap.

If outcomes are equal and there is no gap, disadvantaged pupils would be as likely to be found at any point in the attainment distribution as other pupils. Knowing that a pupil was disadvantaged would give you no information about whether they are likely to have achieved better or worse than another pupil.

Bar B: most unequal situation. Maximum possible gap.

In the most unequal situation every non-disadvantaged pupil would achieve a higher point score than every disadvantaged pupil. Knowing that a pupil was disadvantaged would tell you with 100% certainty that they did not do as well as a non-disadvantaged pupil.

Bar C: current situation.

The current situation for reading, writing and mathematics at key stage 2 in 2013 falls between these extremes. While disadvantaged pupils are present throughout the distribution, they are overrepresented among low attainers and underrepresented among high attainers.

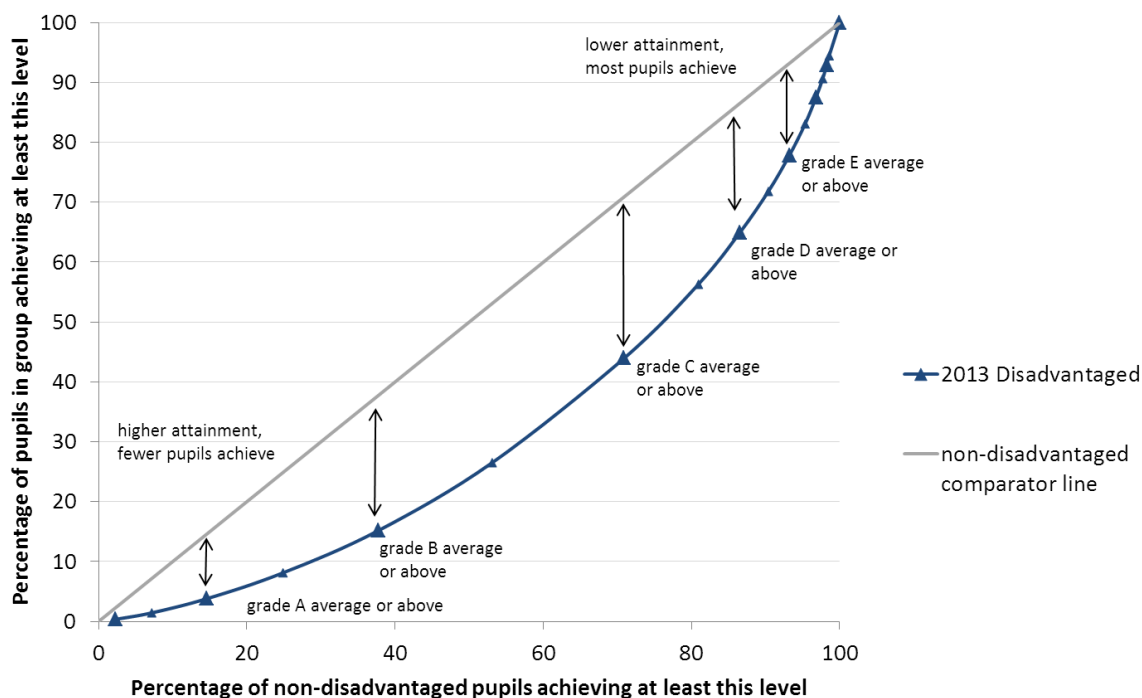
An alternative graphical representation of the Index can be constructed based on a Lorenz curve. The shape of the curve in this chart shows where in the attainment distribution the gap is situated. The curve allows a comparison of the attainment of disadvantaged pupils and



non-disadvantaged pupils at specific levels of attainment; this reconciles the Index with existing percentage point gaps – in effect the curve defines all possible attainment levels at which gaps can be measured.

**Figure 4: Lorenz Curve “banana” chart of the Disadvantaged Pupils Attainment Gap Index (at KS4)**

The chart shows the proportion of the cohort exceeding each possible threshold of attainment in GCSE English and mathematics. The area between the lines represents the national Disadvantaged Pupils Attainment Gap Index.



Source: National Pupil Database

Top right = low attainment, almost all pupils achieve	100% of pupils (in both disadvantaged and non-disadvantaged groups) must have achieved the minimum measured level (which may be zero/fail).
Bottom left = high attainment, very few pupils achieve	0% of pupils (in both disadvantaged and non-disadvantaged groups) can have achieved higher than the maximum measured level.
Straight diagonal line = non-disadvantaged performance as comparator	The percentage of non-disadvantaged pupils achieving is on both axes of the chart, and forms a straight diagonal line by definition, as this has been selected as the comparator group against which the attainment of disadvantaged pupils is compared.

Curved line = disadvantaged performance (in relation to non-disadvantaged)	<p>The line shows the percentage of disadvantaged pupils achieving a given 'level' (on the vertical axis) compared to the percentage of non-disadvantaged pupils who achieved it (on the horizontal axis). If fewer disadvantaged pupils achieve a given level the disadvantaged line will be below the non-disadvantaged line.</p> <p>In general the gap in the percentage achieving is largest when around half of pupils achieve and smaller when almost all, or very few, pupils achieve the level. This means the line bows out in a Lorenz curve.</p>
Area inside 'banana' = Size of Disadvantaged Pupils Attainment Gap Index	<p>If you calculate the area beneath the two lines and subtract to find the area between them, this is the same as the decimal mean rank difference (with a value between 0 and 0.5).</p>
Points on line = particular point/grade thresholds	<p>These represent particular grades or levels specific to the assessments on which pupils have been ranked (e.g. level 3, level 4). The proportions reaching these levels are plotted on the axes and joined up to form the two lines.</p> <p>The vertical distance between these points is equivalent to a percentage point gap at this threshold.</p> <p>They are spaced along the axes unevenly, according to the proportion of pupils who achieve between these levels.</p>
Shape / symmetry of the 'banana' = inequality due to top or bottom	<p>If the banana is wider at the top-right (lower attainers) it means disadvantaged pupils are especially likely to have <i>very low</i> attainment.</p> <p>If the banana is wider at the bottom left (higher attainers) it means that disadvantaged pupils are especially <i>unlikely</i> to have <i>very high</i> attainment compared with other pupils.</p> <p>A symmetric banana means the educational disadvantage persists at each step with disadvantaged pupils becoming more overrepresented among increasingly lower attainers and more underrepresented among increasingly higher attainers.</p>

The Index is intentionally not anchored to a particular grading scale to allow it to be comparable over time. However, as it is a *unitless* measure this means it cannot be used to understand the *magnitude* of the difference in attainment between disadvantaged pupils and others in educational terms.

**However, the gap represented by the Index can be expressed in grades (the difference in the mean average attainment between disadvantaged pupils and non-disadvantaged pupils). This gap in grades reflects 'how big' the gap is in familiar educational terms, at a given point in time. As it reflects magnitude in terms that are not measured consistently between years the gap in grades cannot be compared directly over time. Expressing the Disadvantaged Pupils Attainment Gap Index in Grades**

Using the same average point scores in mathematics and English as the main measure and the same set of pupils the average (mean) attainment is calculated for each group.

In 2013 there were 571,322 pupils completing key stage 4 included in the measure.

The mean score for disadvantaged pupils was: **4.1 (equivalent to a D average grade)**

The mean score for non-disadvantaged pupils was: **5.2 (equivalent to just over a C average grade).**

The gap expressed in grades is the disadvantaged mean grade subtracted from the non-disadvantaged mean grade.

$$5.2 - 4.1 = 1.1$$

The gap in mean grades in 2013 was **1.1 GCSE grades**.

This approach alone does not solve the comparability problem because the units used to express this gap will change between years when reforms are introduced. However, the gap can be indexed to the latest year and expressed in grades relevant to that year. This approach is akin to expressing the real price of a consumer good in 2014 prices over a number of years to adjust for inflation/deflation.

#### Indexing to the latest year's grades

In 2014 the size of the key stage 2 gap, when considered as the gap in mean attainment, was equivalent to **0.42** National Curriculum levels.

The Disadvantaged Pupils Attainment Gap Index for 2014 was **3.16**

In 2012 the Disadvantaged Pupils Attainment Gap Index was **3.23**. To see what this was equivalent to in 2014 grades we can calculate:

$$\frac{\text{2014 grade gap}}{\text{2014 Attainment Gap Index}} \times \text{2012 Attainment Gap Index}$$

= 2012 gap indexed to 2014 grades

$$\frac{0.42}{3.16} \times 3.23 = \mathbf{0.43}$$

The indexed grades *do not* relate directly to the mean attainment of pupils in previous years but are a way of showing change over time in equalised grades or levels. In this way it would be possible to compare a gap based on current A\*-G GCSE grades to a gap based on new 9-1 GCSE grades, using the currency of 9-1 GCSE grades for both years.

## 5. The Disadvantaged Pupils Attainment Gap Index: National Working Methodology Data for 2012-2014

### Figure 5: The gap at key stage 2

The table shows working data for the Disadvantaged Pupils Attainment Gap Index at key stage 2 for 2012-2014<sup>1</sup>

		2011/12	2012/13	2013/14
<b>Number of pupils in national results tables<sup>2</sup></b>	<b>All pupils</b>	537,262	533,115	553,286
<b>Number of pupils included in measure<sup>3</sup></b>	<b>Disadvantaged pupils</b>	157,158	164,026	170,937
	<b>All other pupils<sup>4</sup></b>	379,757	369,349	381,872
	<b>All pupils</b>	536,915	533,375	552,809
<b>Disadvantaged Pupils Attainment Gap Index</b>		<b>3.23</b>	<b>3.16</b>	<b>3.16</b>
<b>percentage change since previous year</b>		na	-2.3%	-0.1%
<b>Gap Indexed to 2014 National Curriculum levels</b>		0.43	0.42	0.42
<b>Gap Indexed to months progress</b>		10.3	10.1	10.1

Source: National Pupil Database

- Figures for 2014 are based on revised data. Figures for 2012 and 2013 are based on final data.
- Includes pupils in state-funded schools eligible to be included in national test results for reading, writing and mathematics. Includes pupils with valid results codes of A (absent), or T (unable to access test) or D (disapplied) who cannot be included in rankings.
- Includes only those pupils for whom a valid test level from 3-6 or teacher assessment level from W (working towards level 1) to 6 could be determined in each of reading, writing and mathematics. This number may therefore differ from those included in previously published test results.
- Includes all pupils for whom Pupil Premium eligibility had not been determined.

### Figure 6: The gap at key stage 4

The table shows working data for the Disadvantaged Pupils Attainment Gap Index at key stage 4 for 2012-2013<sup>1</sup>

**2013/14 figures will be added to this table in a refresh of this document on the 29<sup>th</sup> January**

		2011/12	2012/13	2013/14
<b>Number of pupils in national results tables<sup>2</sup></b>	<b>All pupils</b>	561,305	571,325	To be added 29th Jan
<b>Number of pupils included in measure<sup>3</sup></b>	<b>Disadvantaged pupils</b>	142,098	154,018	
	<b>All other pupils<sup>4</sup></b>	419,207	417,304	
	<b>All pupils</b>	561,305	571,322	
<b>Disadvantaged Pupils Attainment Gap Index</b>		<b>3.89</b>	<b>3.81</b>	
<b>percentage change since previous year</b>		na	-2.1%	
<b>Gap Indexed to 2013 GCSE Grades</b>		1.2	1.1	

Source: National Pupil Database

- Figures for 2012 and 2013 are based on final data.
- Includes pupils at the end of key stage 4 in state funded schools that are eligible to be included in national results. 2013 final data as currently published follows performance tables rules and differs slightly in the inclusion of pupils from that expected in attainment by characteristics publication.
- Includes pupils at the end of key stage 4 in state funded schools that are eligible to be included in national results. Pupils who did not enter a relevant maths or English qualification are scored 0 for that element of the point score.
- Includes all pupils for whom Pupil Premium eligibility had not been determined.

The Index takes a positive value at both key stages indicating that disadvantaged pupils typically have lower attainment than non-disadvantaged pupils at ages 11 and 16. The gap decreased both between 2012 and 2014 at key stage 2, and between 2012 and 2013 at key stage 4.

At key stage 2 the gap, as measured by the Disadvantaged Pupils Attainment Gap Index, narrowed by 2.3 per cent between 2012 and 2013 to 3.16 and then remained at a similar level between 2013 and 2014<sup>6</sup>. On average, other pupils achieved the equivalent of more than one sublevel higher (0.42 National Curriculum levels) in reading, writing and maths assessments at the end of primary school than pupils identified as disadvantaged, equivalent to around ten months expected progress at this age.

At key stage 4 the gap, as measured by the Disadvantaged Pupils Attainment Gap Index, narrowed by 2.1 per cent between 2012 and 2013 to 3.81 but remained larger than the gap at key stage 2. On average, disadvantaged pupils achieved just over one GCSE grade lower in their maths and English GCSEs than other pupils.

A comparison of the key stage 2 and key stage 4 gap confirms a point which is often assumed based on the relative size of the percentage point gaps; that the gap at key stage 4 is larger than the gap at key stage 2. The difference in the size of the key stage 2 and key stage 4 gaps is attributable to two main factors:

- a) Cohort / prior attainment effects whereby, as the gap has been decreasing over time, disadvantaged pupils now completing key stage 4 already had a lower starting point relative to their peers at the end of primary school than is the case for current key stage 2 pupils.
- b) Progress effects whereby disadvantaged pupils make less progress between key stages even when compared with pupils with similar prior attainment.

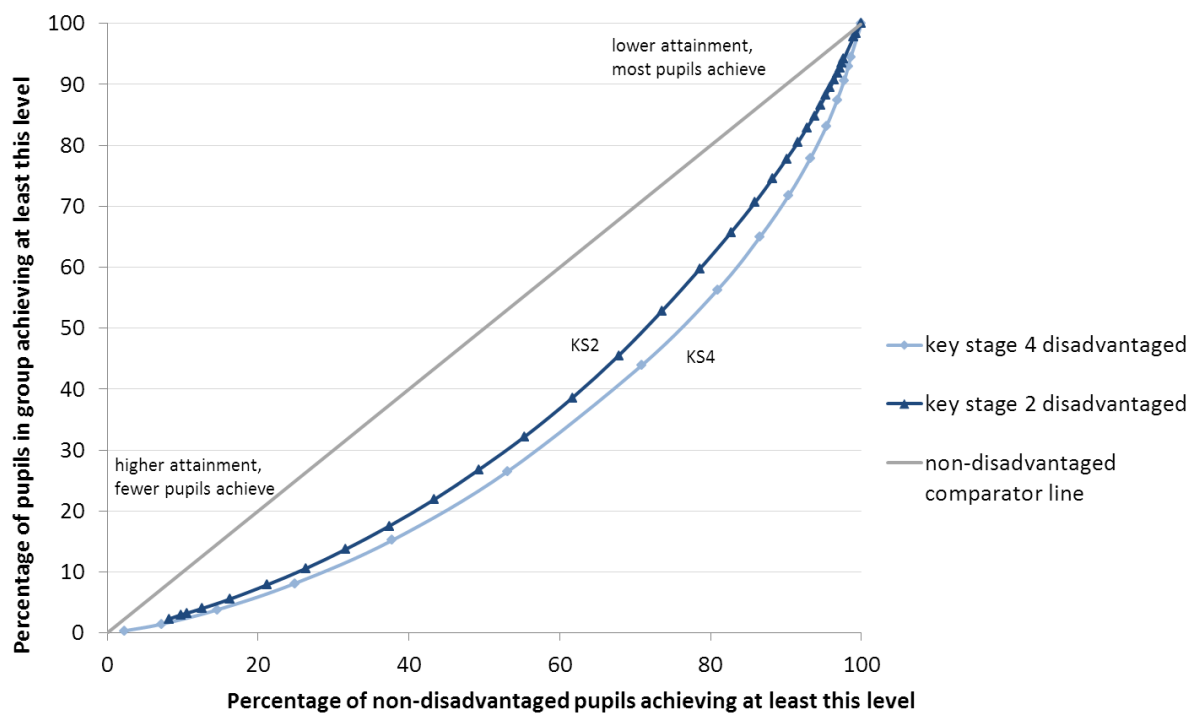
A larger gap is observed at key stage 4 even if progress scores (not shown) are substituted for attainment scores, indicating that the gap does indeed widen during secondary school, although not by as much as a raw comparison of key stage 2 and key stage 4 Index values in the latest year would suggest. Much of the difference between key stages comes from the time lag / cohort effect. There has been a decreasing trend in the gap over time, as shown by the longer time series of measures for pupils eligible for free school meals. Pupils sitting GCSEs in 2013 will usually have completed key stage 2 in 2008 and the decreasing trend suggests that there was already a larger difference in outcomes for current GCSE pupils at age 11 than for the most recent key stage 2 cohorts. Prior attainment has a very strong influence on achievement at GCSE so we would expect to see a lag in the reduction of the gap at key stage 4.

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<sup>6</sup> The Disadvantaged Pupils Attainment Index as published appears to show the same value for 2013 and 2014, however the percentage change is calculated on unrounded data which demonstrates a fractional decrease of -0.1% between 2013 and 2014.

### Figure 7: Comparing key stage 2 (reading, writing & mathematics) with key stage 4 (English & mathematics GCSEs), 2014

The chart compares the proportion of the cohort exceeding each possible threshold of attainment for disadvantaged and other pupils. The area between the comparator and each disadvantage line represents the Disadvantaged Pupils Attainment Gap Index.



Source: National Pupil Database

The Disadvantaged Pupils Attainment Gap Index allows results for the two key stages to be plotted on the same axes. Figure 7, above, shows that among low attainers the gap is noticeably wider at key stage 4 than at key stage 2. The key stage 4 gap is also larger than the key stage 2 gap at the expected level of attainment, but more similar to the key stage 2 gap among high attainers.

## 6. Strengths and Limitations of the Working Methodology

This section considers how the Index working methodology is likely to perform against the 4 criteria identified as desirable for a supplementary gap measure in section 2.

Several scenarios have been tested in which the point scores received by pupils are changed despite there being no change in the underlying ability of any pupil; these aim to mirror the possible impacts of forthcoming assessment and accountability changes in order to test the performance of the Index as a consistent measure of the gap over time.

A comparison of the Index with measures based on a simple average point score difference between disadvantaged and non-disadvantaged pupils was performed for each test to help assess the stability of the Index relative to alternative possible measures.

These tests were carried out over a longer time series using eligibility for Free School Meals as a proxy for disadvantage.

### 1. Be resilient to changes in grading systems

The ordering of pupils' attainment point scores is only minimally affected by the choice of a particular grading structure (although scales with fewer distinctions may result in more ties between pupils which would make the ordering less precise).

Test analysis has demonstrated that the Index can accommodate changes to the extremes of the grading structure; the highest attainers generally are the highest attainers regardless of how much stretch is recognised in the scoring system. This has been verified by including and excluding level 6 paper scores (which are administered separately to the main level 3-5 tests) from the key stage 2 Index; this resulted in negligibly small differences in the Index.

If additional grades were added or removed from the top or bottom of the grading structure (as has been the case in the past with A\* grades at GCSE and A level and level 6 at key stage 2) the Index is expected to remain stable despite increases or decreases to the measured average attainment level of pupils.

### 2. Be resilient to changes to assessments and curricula

A change to the assessed curriculum in English can be simulated by including then excluding writing assessments from the point score used in the Index (comparing an Index based on reading, writing and mathematics with an index based on reading and mathematics only).

An additional natural experiment occurred in 2012 when the key stage writing assessment mode was changed from standardised tests to teacher assessment.

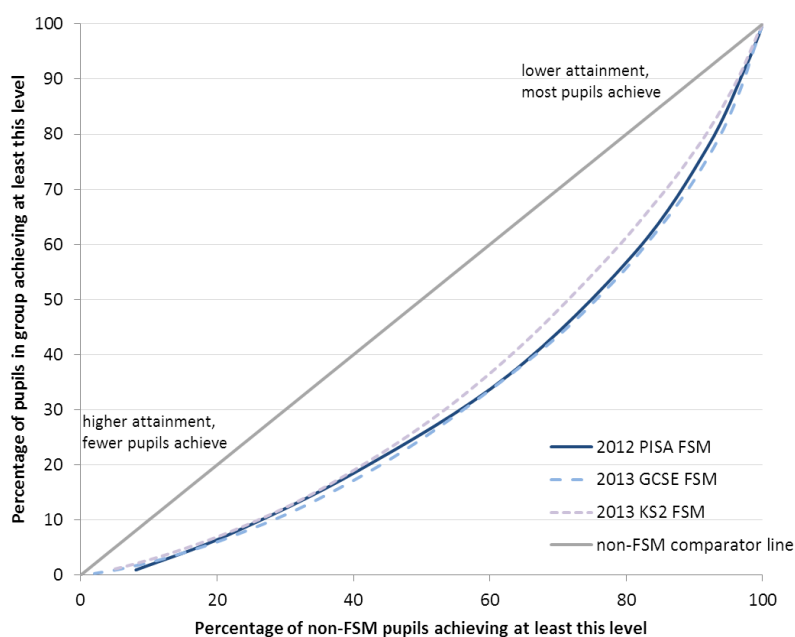
Observing alternative versions of the index, including across the change in writing assessment, resulted in little difference to the behaviour of the Index from either the broader inclusion/exclusion of writing as a component of English, or the change in assessment mode for writing.

A more fundamental change to the assessments and curricula used can be simulated by comparing the key stage 4 Index based on GCSE English and maths with an alternative version based on PISA reading and mathematics scores for a sample of the same cohort. The GCSE and PISA Index values were much closer to one another than either was to the key

stage 2 Index value. Furthermore, the shape of the GCSE and PISA Lorenz curves was highly similar. While there is still a possibility of reform effects which do not reflect changes in underlying ability, and regular robustness assessments of the Index would be needed, the risk of substantial non-comparability due to changes to GCSEs appears to be small.

Figure 8: Gap using average of PISA 2012 reading and mathematics (expected) scores compared to GCSE English and Mathematics average grade and KS2 gap

The chart shows the shape of the FSM Attainment Gap Index for PISA 2012, and KS2 and KS4 2013 results.



Source: PISA 2012 and National Pupil Database

**3. Not require any new assessments or changes to arrangements which have already been announced.**

The Index working methodology has been tested using existing key stage 2 assessments and GCSE results. The robustness checks described above have assessed that the Index is expected to provide a good level of comparability over time when planned changes to assessments and curricula take place. Therefore no additional assessments or changes to the arrangements already announced are required for the Index to be introduced as a supplementary gap measure.

**4. Provide meaningful and transparent information for users of attainment gap statistics.**

The Department invites users to provide views on the working methodology. Comments on the transparency and usefulness of the Index working methodology are welcomed, as are comments on limitations in meeting criteria 1-3 above. Please direct all comments and queries to the following email address: [Attainmentgap.INDEX@education.gsi.gov.uk](mailto:Attainmentgap.INDEX@education.gsi.gov.uk).



### **Additional features**

A by-product of using the mean rank difference as the basis for the Disadvantaged Pupils Attainment Gap Index is that it gives a value which can be compared easily across key stages, because it is based on percentile rank and it does not matter that attainment is measured differently at different ages or that expected standards for each key stage are set at levels which more or fewer pupils achieve.

### **Known Limitations**

The Disadvantaged pupils Attainment Gap Index tells us whether the gap is widening or closing over time, but not what the magnitude of the gap in educational terms is. Supplementing the Index with the difference in mean attainment in English and mathematics between disadvantaged and non-disadvantaged pupils ('the gap in grades') tells us how much difference disadvantage makes (on average) to an individual pupil's attainment in the latest year.

The Index does not tell us whether pupils (either disadvantaged or non-disadvantaged) are reaching a 'good' level of attainment. The purpose of the Index is limited to assessing the inequality in attainment between disadvantaged pupils and other pupils. Even if 100% or 0% of pupils achieved the expected level of attainment, it is likely there would still be a gap between disadvantaged pupils and others in how far above or below this level they had reached. The Index value reflects these differences as well as those at the expected level of attainment to compare the two groups and so complements other indicators which monitor whether pupils from either group are reaching expected standards.

## 7. Annex A: Planned Changes to Assessment & Accountability

National Curriculum levels discontinued	Key stage 2 assessments will be reported in terms of <a href="#">levels for the last time in 2015</a> and move to a new 'scaled score' basis from 2016 meaning the current level 4 threshold will not exist.
Assessment changes to KS2 writing	The move from tests to teacher assessment in writing from 2012 means there is a break in comparability in the time series.
5A*-C threshold no longer key	Achieving 5 A*-C including GCSE English and mathematics has been considered the key indicator of secondary education for a number of years. <a href="#">From 2016 this will no longer be the headline accountability measure</a> or floor standard, and <a href="#">changes to the qualifications which can be counted in performance measures</a> will affect its comparability in the longer term.
New style GCSE qualifications	From 2017 new GCSE qualifications will be awarded and grades A* to C will be replaced by a new grading system from 9-1.
Changes to GCSE assessment impact attainment	<a href="#">Reforms to GCSE qualifications</a> mean that assessment will be more linear and only first entries will count in performance measures. A more limited set of qualifications will be reported as GCSE 'equivalents'.
Move away from 'threshold' measures of success	New accountability measures to be introduced from 2016 move away from binary measures which are either achieved or not achieved by each pupil and towards an assessment of the scores achieved by all pupils.

## 8. Annex B: English and mathematics point scores

### Key stage 2: Average point scores

This takes pupils' fine grade level of attainment in tests where level 3 to 5 is achieved. A Teacher Assessment adjustment for pupils achieving below level 3 and for pupils not sitting the tests is included to maximise both coverage and the level of differentiation between pupils' scores.

#### Reading, writing & mathematics average point score

The average point score used from 2012 is the same as that used in key stage 1-2 Value Added performance measures.

The weighting is:

$$\frac{\left(\frac{\text{reading} + \text{writing TA}}{2} + \text{mathematics}\right)}{2}$$

Writing tests were replaced by teacher assessments from 2012 and an overall English level is no longer calculated. In writing assessments, as in other cases when the teacher assessment level is used, pupils are awarded points equivalent to the midpoint of the level (e.g. 4.5).

### Key stage 2: Fine grade calculation

For reading and mathematics assessments where a level of 3 to 5 is awarded in the test, the fine grade is calculated by:

$$\text{Basic level} + \frac{\text{actual test mark} - \text{bottom of level threshold}}{\text{top of level threshold} - \text{bottom of level threshold} + 1}$$

For example in 2013 the reading test threshold range for level 4 was 19-35 marks. A pupil scoring 31 marks in the reading paper receives a fine grade of:

$$4 + \frac{31 - 19}{35 - 19 + 1} = 4 + \frac{12}{15} = 4.8$$

And rounded to 2 decimal places.

### Key stage 2: Teacher Assessment adjustment

Pupils with **B**, **N** or **2** in the tests are awarded the midpoint of their Teacher Assessment (TA) level: **W=0.5**, **1=1.5**, **2=2.5**. Pupils not achieving level 3 in the tests but awarded higher than level 2 in their TA are still awarded 2.5. This allows distinction among pupils working below level 3 to be made which the tests cannot discriminate.

Pupils without a valid level from the test (for example awarded A=absent) but otherwise eligible to be included in national results and with a TA level are awarded the midpoint of their TA level from **0.5 to 6.5**. This increases the coverage of the indicator.

#### Key stage 4: English & Mathematics GCSEs

Points are awarded to English and mathematics GCSE qualifications in the way outlined in the table below. The average of the point scores achieved in the pupil's best included English and mathematics qualifications are used to order pupils' outcomes.

Those who reach the end of key stage 4 with no GCSE are awarded zero points regardless of whether this is due to failure or non-entry. Both outcomes are similarly negative for succession to further education or employment.

Grade	Points	Grade	Points
A*	8	E	3
A	7	F	2
B	6	G	1
C	5	U	0
D	4	No Entry in relevant qualification	0

#### Key stage 4: What about Attainment 8 scores?

At key stage 4 the new accountability measures from 2016 will focus on attainment across a suite of eight subjects (English & mathematics double-weighted, plus three English Baccalaureate subjects, plus any other three subjects). Ordering pupils by their Attainment 8 scores may therefore provide an alternative basis for assessing relative outcomes in the same way across a wider curriculum.

However, Attainment 8 scores are strongly influenced by the subjects entered by pupils. Currently disadvantaged pupils are likely to enter fewer of the relevant qualifications and score lower for this reason alone. Uptake in both groups is expected to increase once the measure is embedded and therefore use of this score to order pupil outcomes will be investigated in 2016.

## 9. Where the numbers come from

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We use the National Pupil Database (NPD)

Data from the National Pupil Database (NPD) were used to calculate the Disadvantaged Pupils Attainment Gap Index. The NPD is a longitudinal database linking pupil/student characteristics (e.g. FSM status or pupil premium eligibility) to school and attainment information for children in schools in England.

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## 10. How the numbers are shown

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We preserve confidentiality

The Code of Practice for Official Statistics requires we take reasonable steps to ensure that our published or disseminated statistics protect confidentiality.

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So we only show numbers for groups of pupils

As figures are split by pupil characteristics any figures representing fewer than 6 pupils have been combined into larger categories. Underlying data using individual pupil ranks has therefore not been published.

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## 11. Essential points to note

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The Department is seeking views on the working methodology

We would welcome your views on the possible methodology and presentation described in these experimental statistics. Please direct all comments and queries to the following email address: [Attainmentgap.INDEX@education.gsi.gov.uk](mailto:Attainmentgap.INDEX@education.gsi.gov.uk).

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Coverage of data – state-funded schools in England only

The gap in attainment only reports information from state-funded schools in England (including academies and free schools). There are some differences in the exact set of pupils included compared with other statistics because not all pupils have a score which can be ordered. No data below national level is currently being published.

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## 12. Where to go for further details

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Attainment by characteristics at key stage 2

We publish data on [National curriculum assessments at key stage 2](#) annually showing breakdowns for pupils by FSM status, ethnicity, gender and more.

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Attainment by characteristics at key stage 4

We publish data on [GCSE and equivalent attainment by pupil characteristics](#) annually showing breakdowns for pupils by FSM status, ethnicity, gender and more.

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Outcomes at other key stages	We also publish information on attainment and outcomes for pupils by characteristics such as FSM status, ethnicity, gender and more at <a href="#">Early Years Foundation Stage</a> , <a href="#">key stage 1</a> , <a href="#">attainment by age 19</a> . And <a href="#">Destination measures</a> .
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Information on the governments reforms	Information on the reforms to <a href="#">national assessments at key stage 2</a> , <a href="#">GCSE reforms</a> and <a href="#">accountability reforms</a> is available from the DfE website.
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### 13. Got a query? Like to give feedback?

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If from the media	Press Office News Desk, Department for Education, Sanctuary Buildings, Great Smith Street, London SW1P 3BT. 020 7925 6789]
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If non-media	Kylie Hill, Department for Education, Sanctuary Buildings, Great Smith Street, London SW1P 3BT. 020 7340 8277. <a href="mailto:Attainmentgap.INDEX@education.gsi.gov.uk">Attainmentgap.INDEX@education.gsi.gov.uk</a>
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