Department for Education

Understanding progress in the 2020/21 academic year

Interim findings

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Renaissance Learning, Education Policy Institute

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About the Education Policy Institute

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Renaissance is a leading provider of assessment and practice solutions that put learning analytics to work for teachers, saving hours of preparation time while making truly personalised learning possible. Almost 7,000 schools nationwide use data-driven Renaissance solutions to analyse students' abilities and guide high-quality instruction to improve academic outcomes. Founded by parents, upheld by educators, and enriched by data scientists, Renaissance knows learning is a continual journey – from year to year, and for a lifetime. For more information, visit www.renlearn.co.uk

Summary

This report presents the Education Policy Institute and Renaissance Learning's first assessment of the learning loss experienced by pupils in England as a result of the coronavirus (COVID-19) pandemic.

The analysis is based on the results achieved by pupils in the first half of the 2020/21 autumn term (up to and including 25 October 2020) in comparison to pupils in previous years. Star Assessments are frequently used by schools as their baseline assessment for reading and maths, and as such the highest number of assessments are conducted during the autumn term.

In Part 1 we examine the achieved sample sizes. We find that:

- Just over 1 million assessments were carried out in the first half of the autumn term, the majority of which were in reading.
- The number of assessments in primary schools increased this year (by around 14 per cent), however there has been a drop in secondary schools (of around 23 per cent). The number of assessments is still higher in secondary than in primary schools.
- The achieved sample sizes mean that analysis is focussed on year groups 3 to 9.

In Part 2 we examine historic trends in Star Assessments to develop an approach to measuring learning loss. We find that:

- The progress that pupils make in terms of scaled scores changes as pupils get older. The difference in mean scores between one year group and the next is greater in primary schools than it is in secondary schools. In other words, the rate at which the average pupil improves in terms of scaled scores from one year to the next falls as they get older.
- Consistent with other assessments, progress is not consistent within school years. Pupils appear to make more progress at the start of the academic year, which then begins to flatten off later in the year, at some points results are actually lower than in previous assessments.
- To a certain extent, results in the autumn term of any year are likely to be subject to the effects of normal summer learning loss. In a limited number of instances, mean attainment in the autumn term was lower than it had been in the previous summer. Assessments of learning loss need to account for this.
- We present a method for estimating learning loss that is based on the expected progress for pupils based on their prior attainment and historic rates of progress for similar pupils.

In Part 3 we estimate the mean learning loss in reading (for primary and secondary pupils) and mathematics (for primary pupils only due to small sample sizes in secondary). We find that:

- All year groups have experienced a learning loss in reading. In primary schools these were typically between 1.7 and 2.0 months, and in year 8 and year 9, 1.6 and 2.0 months respectively.
- It is pupils who have just started year 7 where we see the smallest learning loss at 0.9 months. One possible explanation for this is that this year group was out of school for less time than others. Schools were expected to be open to reception, year 1, year 2 and year 6 from 1 June 2020 – while others were still receiving remote education. Though it should be noted that the sample size for this group is lower than other year groups and these results may be adjusted with more detailed data available later in the year.
- The learning losses in mathematics were greater. We estimate that, on average, pupils in primary schools have experienced a learning loss of just over three months. It has not been possible to derive robust estimates for pupils in secondary school in mathematics.
- There appear to be some regional disparities in the level of learning loss in reading with pupils in the North East and in Yorkshire and the Humber seeing the greatest losses. However, the differences between regions are relatively small once we control for historic rates of progress in these areas and all regions have experienced losses.
- We also find schools with high levels of disadvantage have experienced higher levels of loss than other schools, particularly in secondary (2.2 months in schools with high rates of free school meal eligibility and 1.5 months in schools with low rates of free school meal eligibility).
- At this stage it is not possible to break down results by pupil characteristics, or to model the progress typically made in Star Assessments by different pupil groups, but this will be possible when the data are matched with information held in the National Pupil Database and will be included in our full report.

Background

This is the first report from a collaborative and innovative research project carried out by Renaissance Learning UK Ltd (Renaissance) and the Education Policy Institute (EPI) on behalf of the Department for Education. The aim of the project is to measure the impact of coronavirus (COVID-19) on the academic development of children and young people in England.

In autumn 2020, over a million tests in Renaissance Learning's Star Reading and Maths were sat by pupils in England. These assessments employ computer adaptive tests that continually adjust the difficulty of a test, selecting assessment items based on a student's performance on each previously answered item. The Star Reading assessment measures students' performance on key reading skills via a brief standards-based test of general reading achievement, administering 34 questions that students complete, on average, in less than 20 minutes. The Star Maths assessment similarly comprises a brief assessment of 34 questions that students complete, on average, in less than 25 minutes. Both draw on item banks of over 6,000 items.[1]

The aim of this report is to use Renaissance's historical Star Assessment data alongside these tests to provide an estimate of the level of learning loss as a result of schools 'closing' for the majority of pupils in the summer term of 2019/20 with an associated move to remote learning.[2]

There have already been several studies that have attempted to estimate the extent of learning loss as a result of the pandemic and the effect of the pandemic on pupils from disadvantaged backgrounds.

In October 2020, the organisation No More Marking published their analysis of a writing exercise carried out by over 116,000 year 7 students at the start of the academic year. Through an assessment of pupils' work they concluded that the work pupils produced was similar to that of year 5 pupils from an exercise in November 2019.[3] In other words, they concluded, students were 22 months behind where they expected them to be. However, this analysis comes with important caveats. First, that year 7 students had not previously undertaken this exercise. Secondly, the exercise was carried out in the first half of the autumn term whereas previous assessments had been in the second half of the autumn term. In other words, there was no direct comparison with similar pupils in the past. It is also likely, as their analysis sets out, that the degree of learning loss will vary

[1] A more detailed discussion of Star assessments is available in *'Research Foundation for Star Adaptive Assessments – Science of Star'*, Renaissance White Paper, September 2020.
[2] The assessments used in this report were carried out in school. As remote learning has continued into the spring term of 2020/21, Renaissance Learning has encouraged the use of assessments remotely and these may be used in future reports. Evidence suggests that assessments are consistent between the two approaches except for the very youngest children
[3] D. Christodoulou, *'Baseline secondary writing: have year 7 pupils gone backwards?'*, October 2020.

by subject. For example, estimates of learning loss in reading may be lower since it is more likely that pupils will be reading regularly at home than undertaking written exercises.

In November 2020, RS Assessment (Hodder Education) published an analysis of tests taken by 250,000 primary school pupils in the autumn of 2020.[4] These tests included mathematics, reading, and grammar, punctuation, and spelling. They identified significant reductions in attainment which varied by levels of disadvantage and the age of pupils, though these were not translated into months of lost learning. These tests are normally carried out in the summer and the report sets out that differences will be caused by a combination of higher pupil age, the replacement of in-person teaching with remote learning, and home schooling, and the effects of learning loss during the school summer holiday.

Even with these limitations, it would suggest that pupils from different backgrounds have been affected by the pandemic in different ways. The Education Endowment Foundation (EEF) estimated that the disadvantage gap could widen by between 11 and 75 per cent and reverse progress in closing the gap since 2011.[5] However, as their report makes clear, there are several limitations to this analysis. Primarily that the school closures considered in the evidence review were somewhat different from those experienced in England in 2020. Subsequently, in analysis based on assessments taken in the autumn term of 2020/21 by 6,000 Year 2 pupils, the EEF estimated overall learning loss in reading and mathematics of around two months when compared to a group of Year 2 pupils assessed in 2017.[6] They also presented initial estimates of the effect on the disadvantage gap which suggest it may have widened but at the lower end of earlier estimates.

The key strength of the Renaissance assessment data, and hence this report, is that it allows us to link outcomes in the first half of the autumn term 2020/21 with outcomes at the same point in 2019/20 at pupil level and compare their progress with similar pupils in earlier academic years. The samples are also sufficiently large enough to allow us to see whether these results are consistent across different year groups. An analysis of Renaissance assessment data has already been carried out for students in the United States.[7] It found small negative impacts in reading and moderate impacts in mathematics. These varied by year group with some year groups up to 7 weeks behind in

[4] K. Blainey and T. Hannay, *'The impact of lockdown on children's education: a nationwide analysis'*, November 2020.
[5] EEF, *'Impact of school closures on the attainment gap: rapid evidence assessment'*, June 2020.
[6] EEF, *'Impact of school closures and subsequent support strategies on attainment and socio-emotional wellbeing in Key Stage 1: Interim Paper 1'*, January 2021
[7] Renaissance, *'How kids are performing – tracking the impact of COVID-19 on reading and mathematics achievement'*, October 2020.

reading and some year groups up to 12 weeks behind in mathematics. Students attending schools serving low-income families were also more negatively affected.

As well as headline findings for pupils in England, this report also includes some analysis by school level demographic data. Subsequent reports from the EPI/Renaissance project will incorporate data that have been linked with the National Pupil Database to enable analysis to carry out detailed analysis by pupil characteristics (such as pupils from disadvantaged backgrounds). It will also include further assessments taken during the 2020/21 academic year. This will enable us to assess the extent to which pupils who experienced a learning loss then catch-up.

Part 1: Assessments, data and sample sizes

Data is drawn from assessment data from Renaissance Learning's Star Reading and Star Maths, which are used by over 3,000 primary schools and nearly 2,000 secondary or all-through schools in England. The assessments provide criterion-based scores that run on a singular scale from year 1 to year 13.

Renaissance Learning provided a dataset to the Education Policy Institute comprised of all assessments undertaken in schools in England between 1 August 2017 and 25 October 2021. A total of 11,685,315 records were provided (one per assessment), a full list of variables is provided in the Annex.

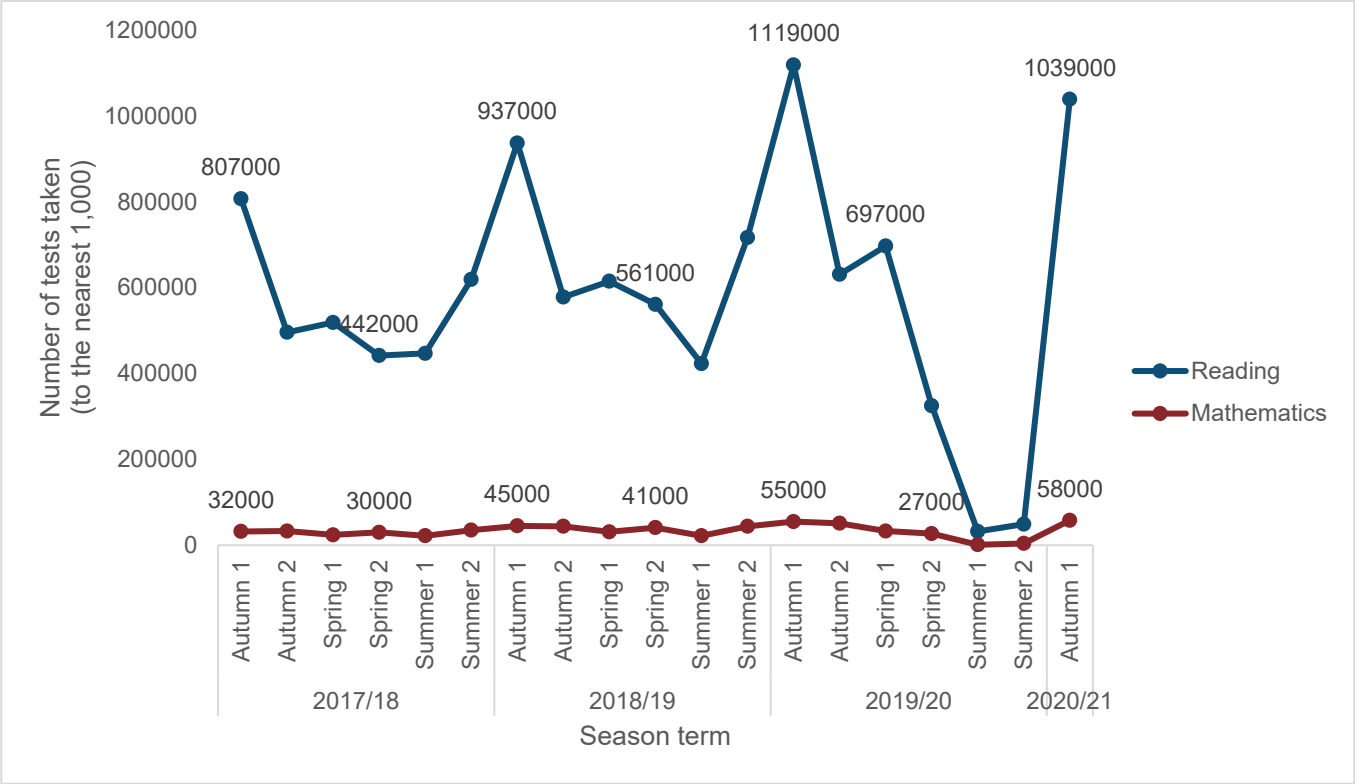
Figure 1.1 shows the patterns in the number of assessments undertaken in each of reading and mathematics by half-term from autumn 2017 onwards, a full record of the number of assessments is provided in the Annex.

The number of assessments undertaken in both reading and mathematics has been growing rapidly in recent years. In the first half-term of the 2017/18 academic year, just over 800,000 assessments in reading were undertaken; by the same point in the 2019/20 year this had grown to over 1.1 million. The number of assessments is typically much higher in the autumn than in the spring and summer terms as schools use them to provide baseline assessments at the start of the year. But the number during the spring and summer terms is still significant, reaching nearly 700,000 at the start of the spring term in 2019/20.

The number of assessments in mathematics has historically been much lower, though this figure is growing. At the start of the 2017/18 academic year there were 32,000 assessments in mathematics and by 2019/20 this had grown to around 55,000.

There was a slight drop in the number of assessments in 2020/21 with just over a million reading assessments taken, though the number in mathematics has held steady. There is some indication that schools delayed participation at the very start of the term before then returning to more normal numbers.

Figure 1.1: The number of assessments undertaken in Star Reading and Star Maths by half-term 2017/18 to 2020/21



The analysis above shows the total number of assessments taken. However, it is possible for pupils to take the assessments more than once; around 10% of pupils take more than one assessment in a half term. Figure 1.2 shows the number of individual pupils who undertook assessments in the first half of the autumn term for each of 2018/19, 2019/20 and 2020/21 broken down by year group. It shows that:

- Prior to 2020/21 the number of pupils taking assessments was increasing in all year groups.
- The largest numbers are seen in the first years of secondary school, in 2019/20 over 230,000 pupils took assessments in reading.
- In primary schools, the number of pupils taking assessments was higher in 2020/21 than it was in previous years. Overall, the number of pupils in years 3-6 taking assessments in reading grew by 14 per cent between 2019/20 and 2020/21.
- In secondary schools, the number of pupils taking assessments was lower in 2020/21 than it was in previous years. Overall, the number of pupils in years 7-9 taking assessments in reading fell by 23 per cent between 2019/20 and 2020/21.
- The number of pupils taking maths assessments in 2020/21 grew slightly but remains much lower than the number taking assessments in reading.

For much of the analysis presented here we are interested not only in the scores that pupils achieved this year but also what they have achieved in the past so we can measure relative progress. Therefore, in Figure 1.3 we show the number of pupils in each autumn first half-term who also had an assessment at the equivalent point in the previous academic year (which we will refer to as 'prior attainment').

Figure 1.2: Pupils undertaking assessments in reading and in mathematics in the first half of the autumn term by year group – 2018/19 to 2020/21

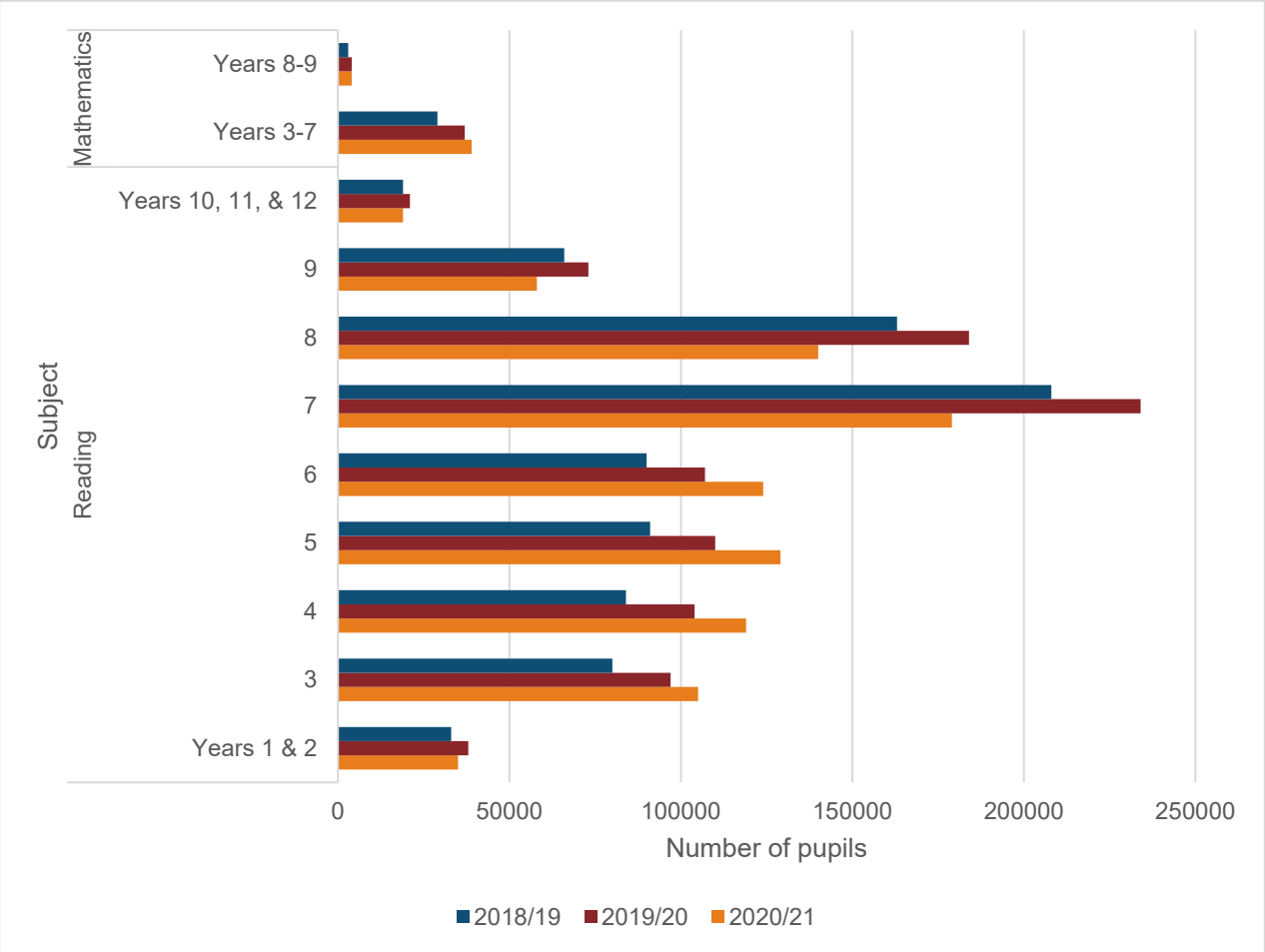
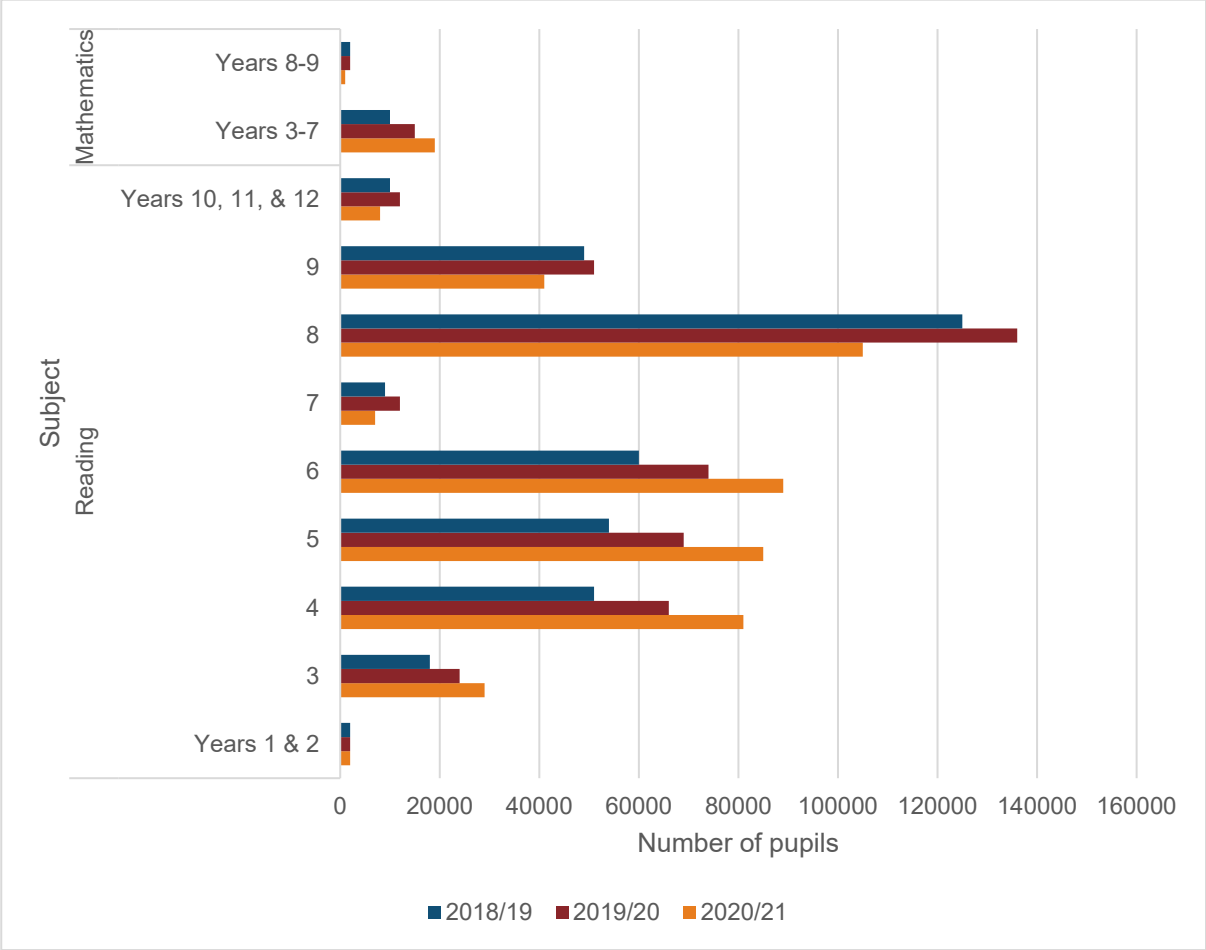


Figure 1.3: Pupils undertaking assessments in reading and in mathematics in the first half of the autumn term who also undertook assessments at the same point in the previous year by year group – 2018/19 to 2020/21



Again, we can see that the number of pupils in primary schools that meet this condition increased in 2020/21, though there were falls in the number in secondary schools. Note the significant difference between the overall number of pupils in year 7 and the number that also have prior attainment. This is likely to be because this is a transition point for the majority of pupils and the data linking method employed was unable to identify pupils if they had moved school (so would only be included if, for example, they are in an all-through or middle school). In subsequent reports we will use a wider set of pupil identifiers through the National Pupil Database to obtain larger sample sizes.

Similarly, the number of pupils in years 1 and 2 is very low. The number of pupils in years 10, 11 and 12 (combined) is of a similar order to that in year 7. However, the nature of participation in Star Reading is such that these pupils may not be representative of pupils as a whole – these pupils tend to have lower attainment.

Taking all of these findings combined, the majority of the analysis in this report focuses on outcomes in years 3 to 9. For mathematics we group pupils into primary and secondary year groups. Note that when considering learning loss, we include year 7

within primary as we are chiefly interested in the learning loss that occurred during the summer term when these pupils were in year 6.

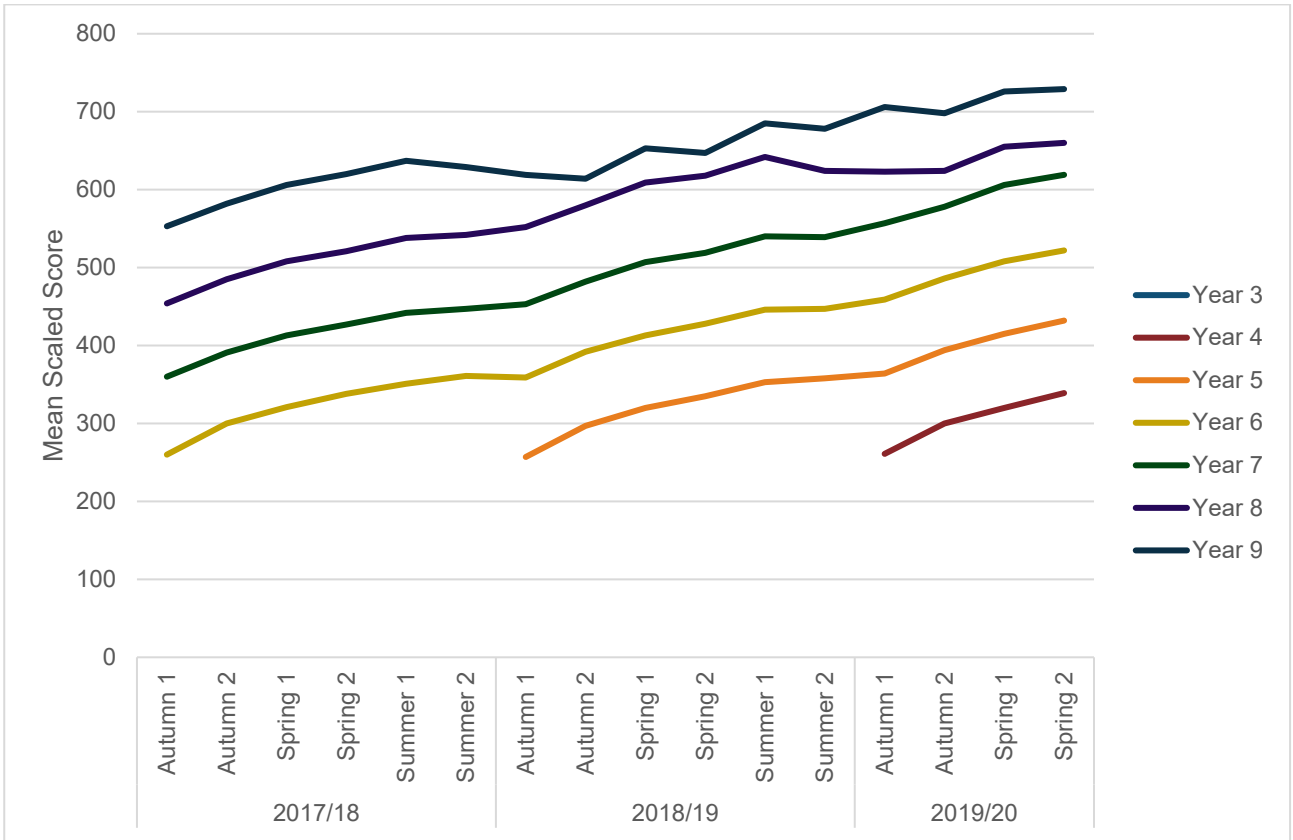
Part 2: Developing an approach to measuring learning loss

Patterns of progress in Star Assessments during time in school

Outcomes in Star Assessments are based on a continuous scaled score where pupil scores increase as they move through the school system. Pupils in year 3 taking an assessment at the start of the academic year typically achieve around 250 points on this scale. By the final year of primary school (year 6) this increases to around 550, and by year 9 to around 750.

Figure 2.1 shows the historic mean scores in Star Reading for each cohort as they have progressed through different years of schooling. For example, the top line on this chart shows the group of pupils who started year 9 in September 2020/21. The very left of the chart shows the mean score for this cohort in September 2017/18, when they were in year 6, and the very right shows their outcomes in the spring term of 2019/20, when they were in year 8 and just as the country entered a national lockdown and the majority of pupils received remote learning.

Figure 2.1: Historic outcomes for the 2020/21 cohort up to and including spring term 2019/20



Note that in this illustration we have taken the average of all pupils who took assessments at that point and therefore it is not necessarily the exact same group of pupils taking the assessments at each stage. However, these results suggest two things:

- **Progress is not consistent within school years.** Pupils appear to make more progress at the start of the academic year which then begins to flatten off later in the year, at some points results are actually lower than in previous assessments.
- **Progress is not consistent between school years.** The difference in mean scores between year groups is greater in primary schools than it is in secondary schools. In other words, the rate at which we expect pupils to improve in terms of scaled scores from one year to the next falls as they get older.

This pattern of results is consistent with other studies of pupil progress, including studies of pupil progress in England, and is not a particular feature of Star Assessment.[8]

Patterns of progress from term to term

We now consider progress within each academic year further. Rather than looking at average attainment across all pupils we can compare the outcomes of pupils who have results in two consecutive half terms and measure the average progress that they make between those points.

In Figure 2.2 we look at the mean change in scores in reading between each half-term for pupils in year 5 and in year 7. In Figure 2.3 we do the same for mathematics for pupils in years 3-6 and 7-9 (due to smaller sample sizes). We see that:

- the progress that pupils make between different half-terms generally diminishes through the year, this is particularly true for younger pupils;
- the largest increases are seen between the first and second halves of the autumn term, these are typically three times the size of the increases seen between the two halves of the summer term;
- the smallest increases are seen between the second half of the summer term and the subsequent autumn term. In fact, in mathematics we see a small fall in outcomes between these two points.

[8] Department for Education, *'How do pupils progress during Key Stage 2 and 3?'*, March 2011.

Figure 2.2: Change in outcomes in reading between half-terms for pupils in year 5 and year 7

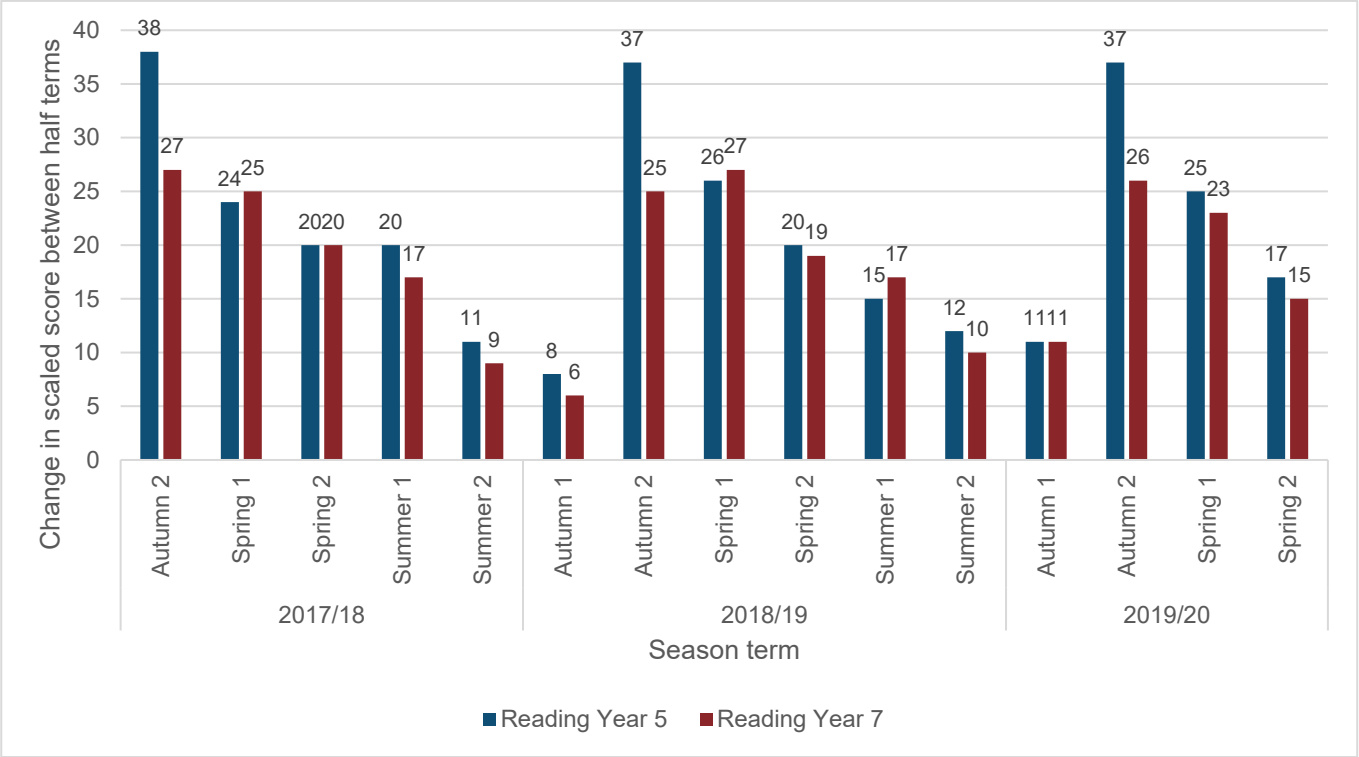
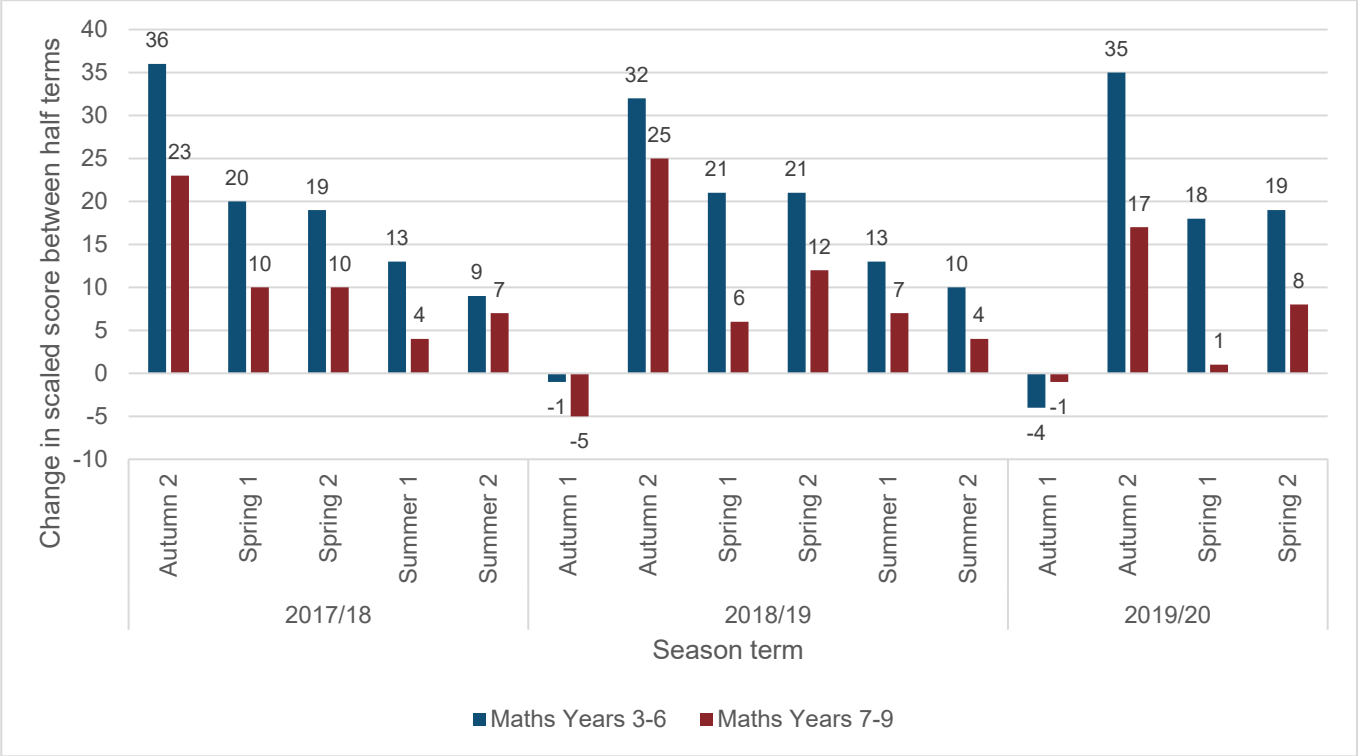


Figure 2.3: Change in outcomes in mathematics between half-terms for pupils in primary and secondary schools



These results suggest some degree of learning loss over the summer. This does not necessarily mean that learning has been truly 'lost', pupils may simply be out of practice with the tasks being assessed, more generally not academically engaged over the summer, and their performance then improves rapidly once they have been back in school for a while (and this may explain why the differences are more pronounced in mathematics than reading, which is perhaps more likely to continue at home).

This means that any assessment of learning loss based on assessments early in the autumn term that then draw direct comparisons with other points in the academic year risk overestimating the learning loss due to the pandemic.

This leads us to our first two principles for our measurement of learning loss:

- we should not make direct comparisons between different points of the academic year without controlling for the usual differences that occur between them (the simplest way, as we use here, is to compare between the same point within each academic year – i.e. the autumn term).
- in as far as this is practical given sample sizes, analysis should be conducted separately by year group to allow for differential rates of progress by the age of the pupil (or at the very least, grouped with similar ages).

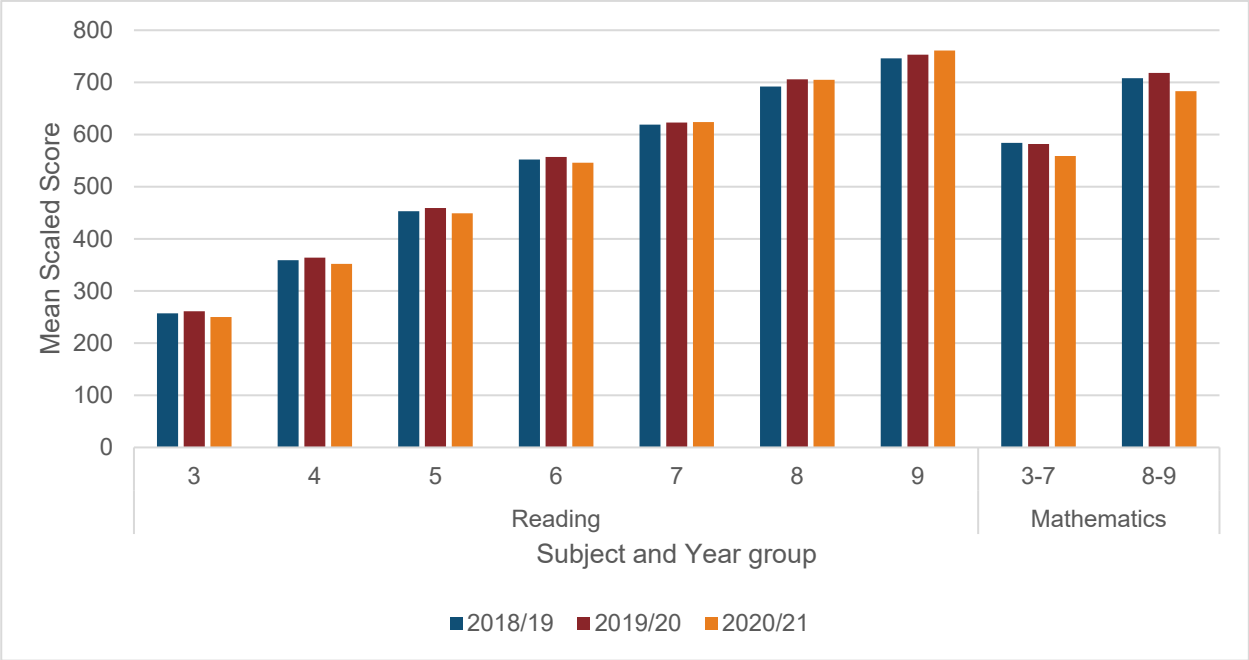
Changes in mean attainment in 2020/21

Our first analysis of outcomes in 2020/21 considers the average outcomes in Star Reading and Star Maths in the first half of the autumn term in each of the last three years by year group (Figure 2.4).

When we compare results in 2020/21 with those in previous years, we find that:

- In primary year groups the average results in reading in 2020/21 are lower than in both 2018/19 and 2019/20 – by between 10 and 12 scale points.
- In secondary year groups the average results in reading in 2020/21 are broadly the same as in 2019/20 and for year 9 pupils have increased slightly.
- In mathematics, results in 2020/21 are substantially lower than in 2019/20 for both primary and secondary pupils. For primary pupils, results are 23 scale points lower than in 2019/20 and for secondary pupils, results are 35 points lower than in 2019/20 (though note that the sample sizes here are relatively small).

Figure 2.4: Mean scores in reading and mathematics in the first half of the autumn term 2018/19 – 2020/21



These headline results suggest some degree of learning loss in reading that is more pronounced in younger than in older age groups (where results have remained steady). There appear to be larger learning losses in mathematics, these are observed in both primary and secondary aged pupils with older pupils seeing larger falls.

But these results also have two key limitations. Firstly, they do not account for the fact that the number of pupils taking these assessments has been growing, and the profile of pupils (in terms of average rates of progress) may be changing. Secondly, they do not account for the fact that outcomes have been improving slightly. If, for example we consider this year's year 6 pupils. As a cohort they achieved an average score of 459 at the start of year 5, 6 points higher than the cohort that preceded them.

By comparing results this year with results last year, we make an assumption that they should be the same. However, these two limitations suggest that this is not necessarily the case. We therefore introduce a third principle into our measurement of learning loss:

- we should consider how we might have expected results to differ this year because of changes to the pupil population.

Methodology for estimating expected progress and learning loss

In this section we introduce an approach to measuring learning loss that builds on these three principles. We calculate an expected outcome for pupils this year based on what they achieved last year and applying historic rates of progress for pupils with similar prior attainment.

Step 1: We construct a model of the relationship between outcomes and prior attainment using historic data: using data from 2018/19 and 2019/20 we examine the relationship between what pupils achieved in the autumn of 2018/19 and what they went on to achieve in 2019/20. We use a regression model to fit a statistical line of best fit through the data. We do this for each year group in each subject (see figures 2.6 and 2.7).

Step 2: We then use the model to calculate an "expected outcome" for each pupil based on their prior attainment: We use the derived regression line to calculate the 'expected' outcome for a pupil in autumn 2020 if they followed similar patterns of progress as in previous years.

Step 3: Given that we now have a known prior attainment and an expected outcome, we can calculate an expected progress and actual progress: as the same scale is used throughout, the expected progress is simply the expected outcome minus the prior attainment score. Actual progress is simply the actual outcome minus the prior attainment score.

$$\text{Expected progress} = \text{expected outcome} - \text{prior attainment}$$

$$\text{Actual progress} = \text{actual outcome} - \text{prior attainment}$$

The principle of this calculation is the same as that of school performance tables 'value added' measures such as Progress 8. We compare the outcomes achieved to the outcomes of those with similar prior attainment.

Step 4: We can now calculate the estimate of learning loss as the difference between expected progress and actual progress: in terms of scale points this is simply subtracting one number from the other.

$$\text{Learning loss in scale points} = \text{actual progress} - \text{expected progress}$$

We can also convert this into months of learning. Since we are considering the progress from one year to the next this is the expected progress over a 12-month period. Therefore, the learning loss in months is given by:

$$\text{Learning loss in months} = \frac{\text{actual progress} - \text{expected progress}}{\text{expected progress}} \text{X } 12$$

Note that such an approach does not provide a strong prediction for an individual (typically the prior attainment of a pupil explains between 50 and 60 per cent of the variation in outcomes) but becomes more reliable when taken in aggregate.[9] We calculate regression lines for each year group and for each subject. This is to allow for any different rates of progress in different year groups from otherwise similar starting points.[10]

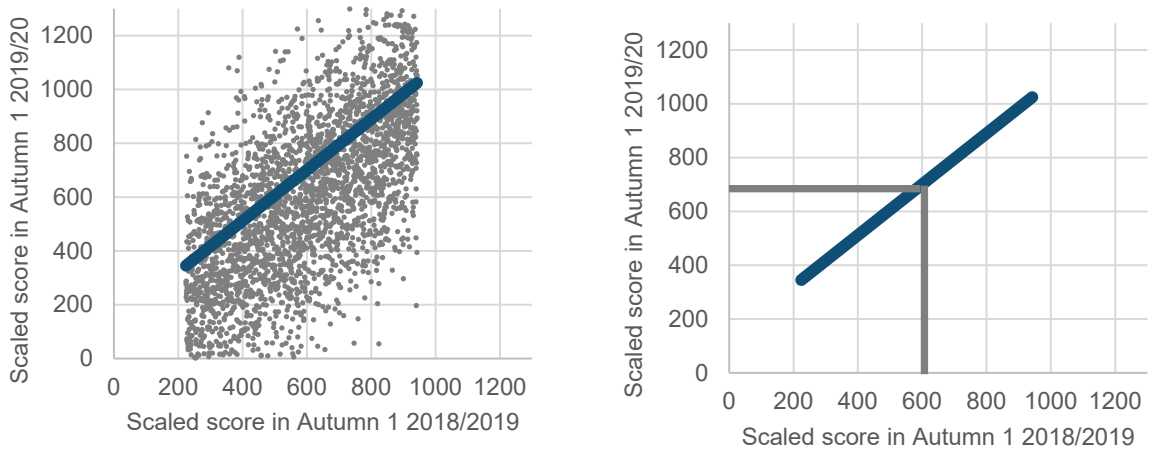
Example

In this example, a pupil has prior attainment of 600 points in 2018/19 and scores 675 points in 2019/20.

Step 1: We construct a model of the relationship between outcomes and prior attainment using historic data which for this pupil is shown in figure 2.5.

Step 2: Using this model we find that the expected outcome for this pupil is 700 points.

Figure 2.5: Example regression line used to generate expected scores and hence expected progress[11]



Step 3: Using the expected outcome and prior attainment scores we can calculate the expected and actual progress

$$\text{Expected progress} = 700 - 600 = 100 \text{ points}$$

$$\text{Actual progress} = 675 - 600 = 75 \text{ points}$$

[9] Note that this explanatory power is similar to that of the model used in Progress 8.
[10] Prior to calculating the reading models, we remove the top and bottom 5 per cent of the prior attainment distribution to minimise the effect of extreme values. In mathematics we remove the top and bottom 10 per cent.
[11] Note the data presented in this example have been randomly generated due to privacy concerns. They do not represent actual scores achieved by pupils who undertook assessments.

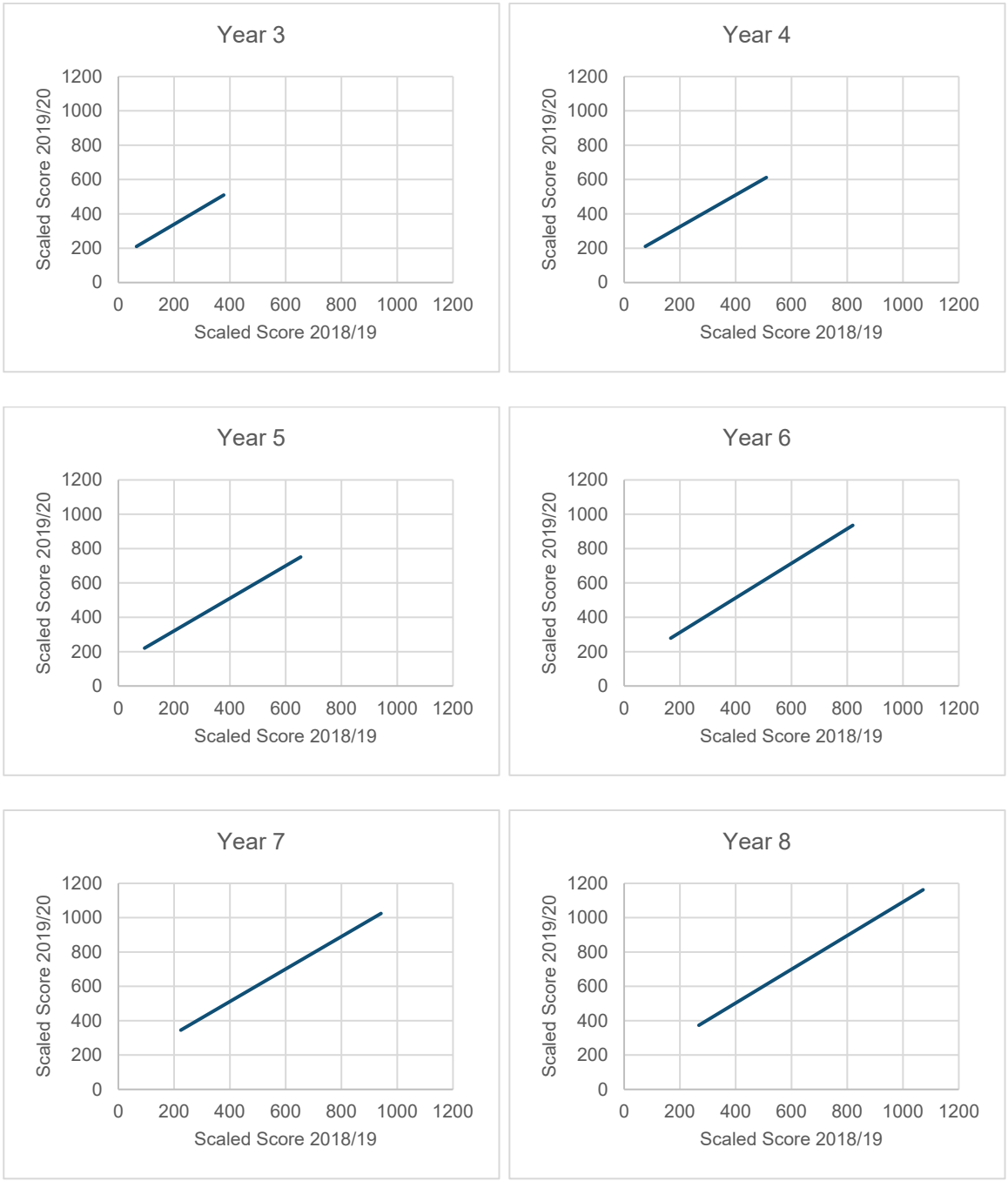
Step 4: Using the expected and actual progress scores we can calculate the learning loss in scale points and in months.

$$\text{Learning loss in scale points} = 75 - 100 = 25 \text{ points}$$

$$\text{Learning loss in months} = \frac{75\ -100}{100} \text{X } 12 = 3 \text{ months}$$

Therefore, in this example the pupil has experienced learning loss of 25 points which is equivalent to 3 months of learning.

Figure 2.6: Regression lines used to generate expected scores and hence expected progress for each year group – reading



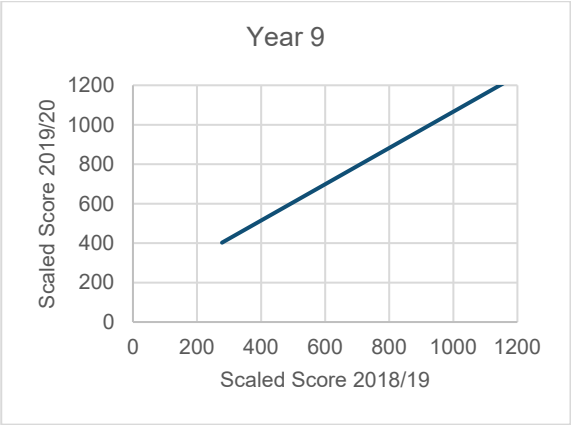
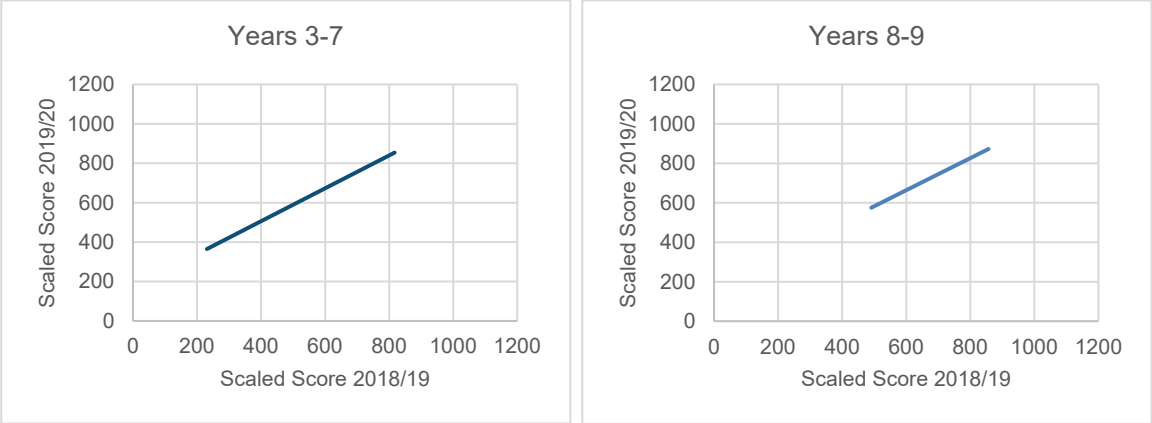


Figure 2.7: Regression lines used to generate expected scores and hence expected progress for each year group – mathematics



A full set of regression coefficients is provided in the Annex.

An aspect we do not control for is the precise length of time between tests. Our calculation assumes exactly one year passes between tests, but pupils may have taken the test at the start of the half term in one year and the end of the half term in the other. This would be particularly problematic if this pattern changed from one year to the next. However, in the Annex we present analysis of the distribution of the number of days between tests by year group and find little difference between this year and last. We also find that the median length of time between tests is broadly one year for all year groups.[12] As we refine our models in subsequent reports – including adding a range of contextual factors to the models – we will assess whether including this as a factor improves the reliability of our estimates.

Having calculated a mean learning loss (or indeed gain) for each individual pupil we are then able to aggregate up to our groups of interest. For this initial report this is largely the pupil's year group, but in subsequent reports we will be able to consider a range of pupil

[12] At the extreme, the median length of time was one year plus 6 days.

characteristics such as deprivation and ethnic group. We have concluded that the sample sizes for secondary mathematics are too small to provide robust estimates at this stage.

Throughout this report, when we say ‘learning loss’ what we really mean is loss in comparison to a situation where pupils make the same progress as similar pupils did last year. But the true ‘counterfactual’ may have differed from this. For example, results in 2019/20 were generally higher than they were in 2018/19. It is possible that, in the absence of the coronavirus (COVID-19) pandemic, results in 2020/21 may have been higher still. Alongside the results we provide an illustration of how this may affect our results and may be incorporated into future modelling.

Part 3: Estimated learning loss

Estimates of learning loss in reading and mathematics

Having calculated estimated learning loss for individual pupils we now aggregate up to pupil year groups.

In Figure 3.1 we present the modelled learning loss of pupils in Star Reading in years 3-9. We find that all year groups appear to have experienced a learning loss and these were of a similar magnitude, of around 2 months, across ages – i.e. there does not appear to be any real difference between primary-aged and secondary-aged pupils. Pupils who have just started in year 6 and pupils who have just started year 9 experienced the largest losses (2.0 months) but this is not materially greater than those in years 3, 4, 5, and 8.

It is pupils who have just started year 7 where we see the smallest learning loss of 0.9 months. One possible explanation is that this year group was out of school for less time than others. Schools were expected to be open to reception, year 1, year 2, and year 6 from 1 June 2020 – while others were still receiving remote education.

It should also be noted that this is the smallest group for which we are presenting results and the number of pupils included is significantly lower than in last year's data. It is therefore possible that there is a systematic bias in the schools that have participated in Star Reading assessments to this point (e.g. schools that have historically demonstrated lower results of progress or pupil groups that make less progress on average). We will be able to assess this as more data becomes available, including pupil characteristics data, and we will include further analysis in our second report.

As we set out above, the learning losses presented here are essentially relative to what the pupils would have achieved had they followed the same pattern of progress as pupils last year. But it is possible for these relationships to change over time – for example if standards improve, the characteristics of the cohort vary considerably, or schools that are particularly high or low performing leave or join the programme of assessments.

To illustrate the potential size of these year-on-year fluctuations we apply the same approach to historic data (in other words, calculating similar measures for 2019/20 using progress data from 2018/19). These are presented in Figure 3.2. Pupils in 2019/20 typically made more progress than pupils in 2018/19, equivalent to between 0.4 and 0.8 months of learning.

It is not possible to say exactly what would have happened in the absence of the coronavirus (COVID-19) pandemic and at this stage we believe an assumption of similar rates of progress as last year represents the best approach. However:

- If the system had continued to improve at the same rate as between 2018/19 and 2019/20 then the degree of learning loss is potentially higher – 0.4 to 0.8 months.
- If 2019/20 was in fact a high-point, then the learning loss is potentially lower – again between 0.4 and 0.8 months.

We will continue to investigate these differences as more data becomes available, particularly as we gain access to pupil characteristics data which will enable us to better control for differences between pupil cohorts.

Figure 3.1: Estimated learning loss in reading 2020/21

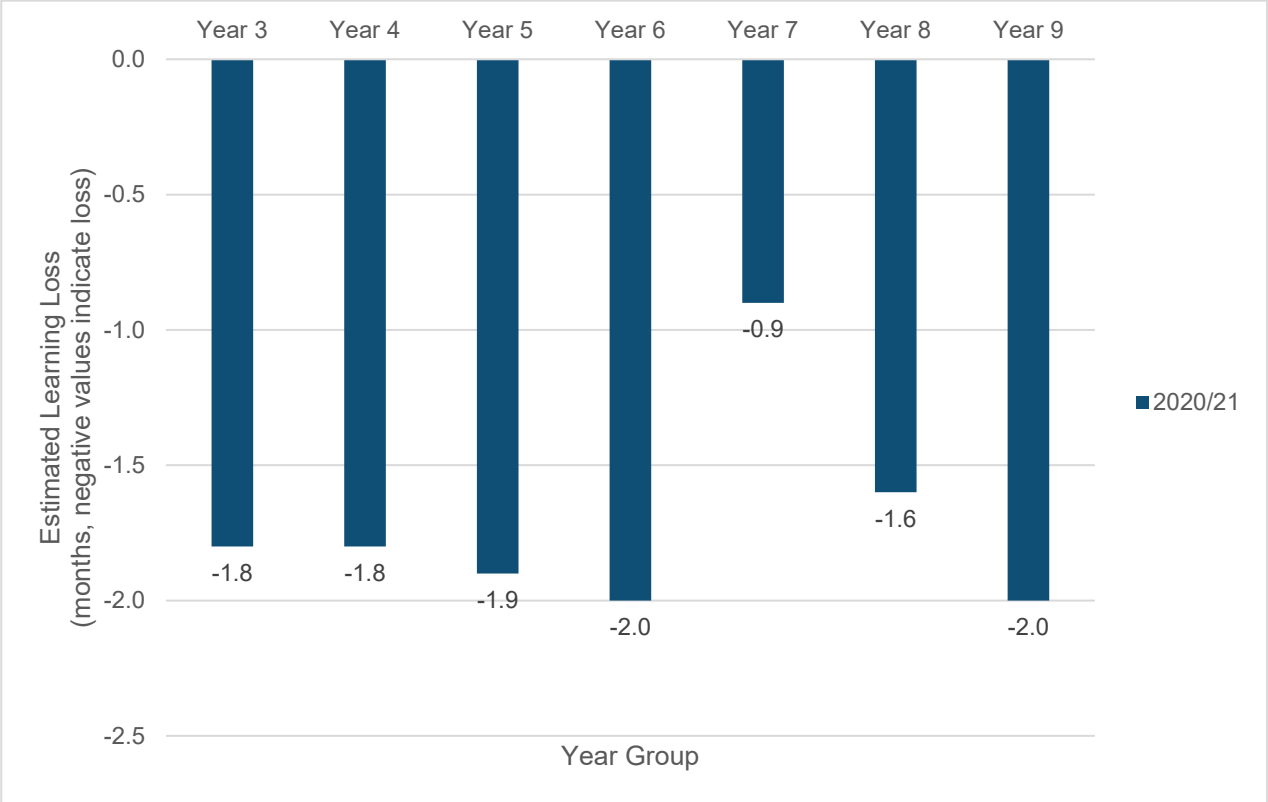
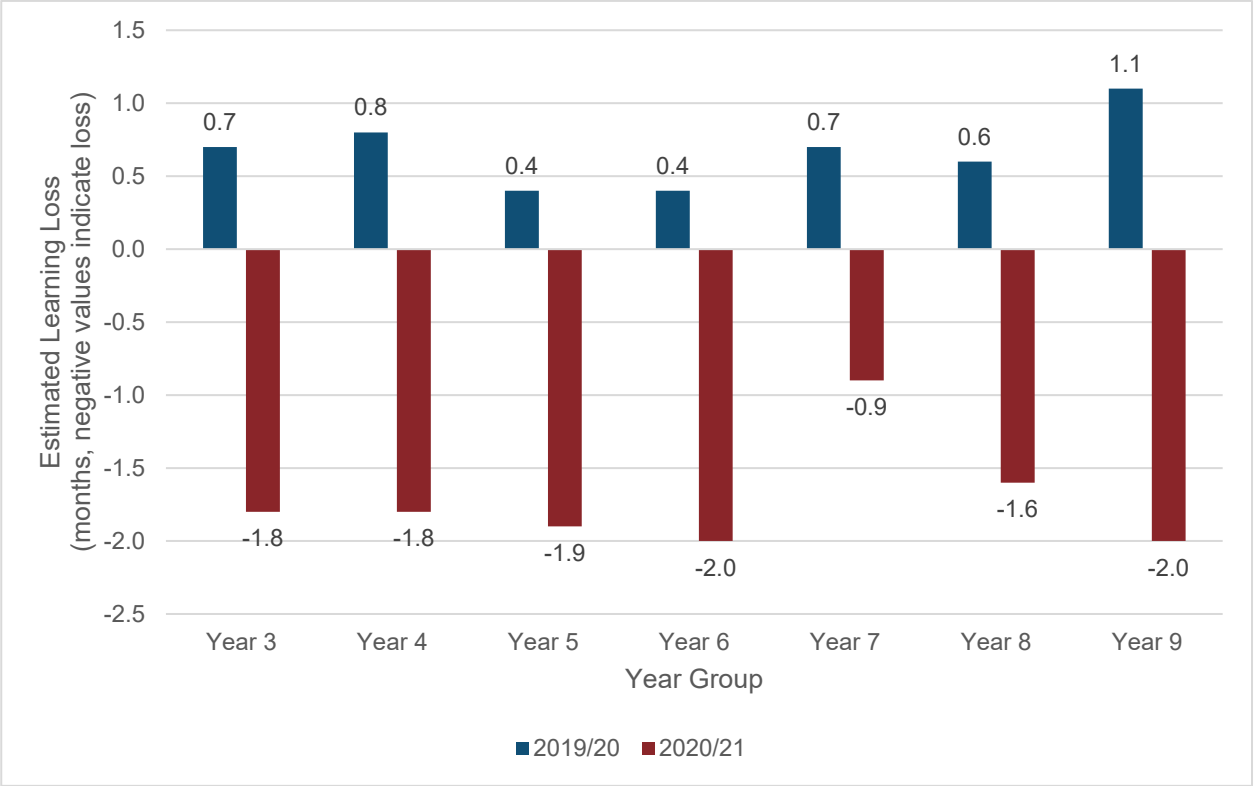


Figure 3.2: Estimated learning loss in reading 2020/21 in comparison to estimates made in a similar way for outcomes in 2019/20



The number of cases in mathematics is significantly lower than in reading. As shown in Figure 1.3 they amount to 19,000 cases in primary school and just over 1,000 in secondary. This means that in primary there is some degree of uncertainty around estimates in mathematics and the results are sensitive to the exact specification of the model used and the specific circumstances of the pupils included. We expect to be able to improve the robustness of these estimates as more data becomes available – for example, when we are able to link outcomes to pupil characteristics we will be able to better control for any systematic differences between cohorts and the schools that are included in the analysis.

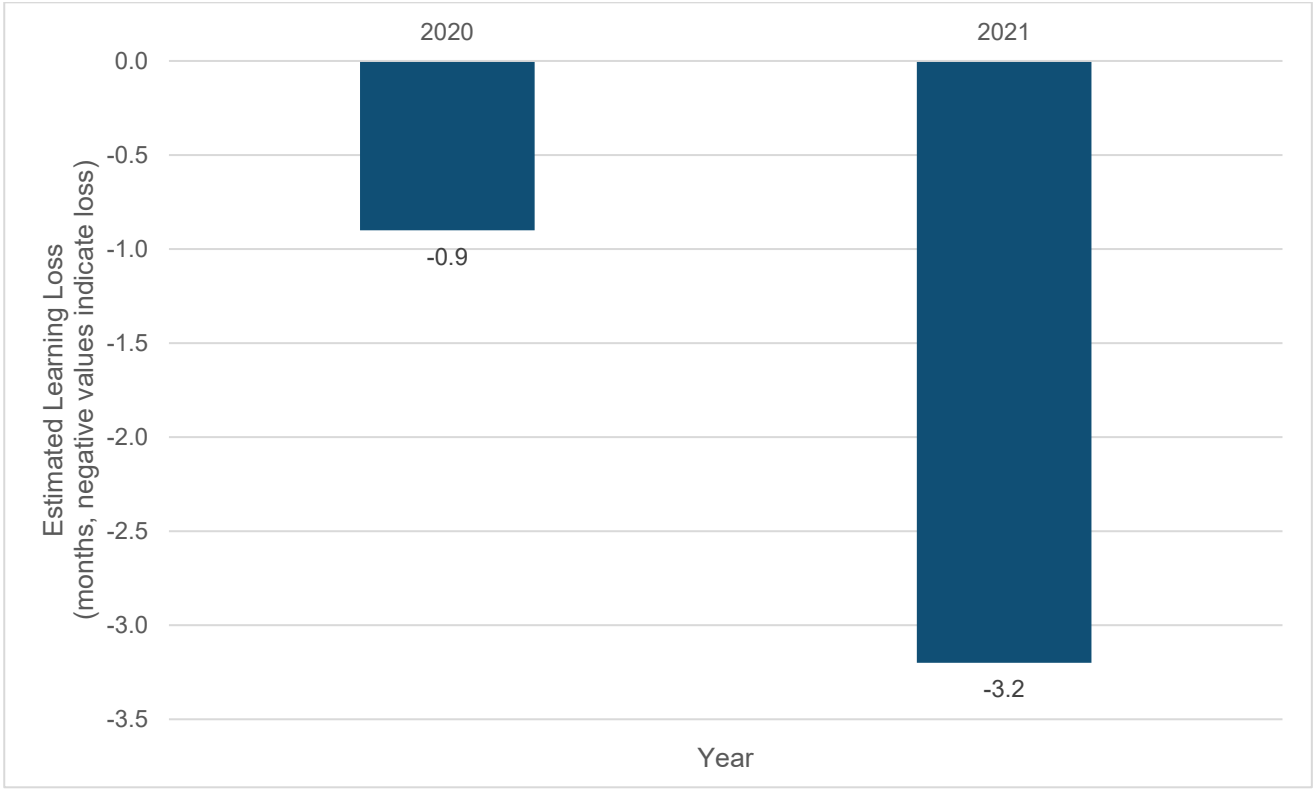
Unfortunately, we have concluded that the sample sizes in mathematics for secondary schools are simply too small to draw conclusions about learning loss in mathematics at this stage. The numbers mean that any estimate will be based on a very small number of schools and any results are likely to reflect the individual circumstances of those schools rather than being an estimate of the effect on the system. We will review this position as more data becomes available later in the autumn term.

In Figure 2.4 we showed that there was a substantial reduction in the overall attainment in mathematics in primary schools. In Figure 3.3 we present the modelled learning loss of pupils in Star Maths for these pupils.

The effects are larger than we saw for reading. Amongst primary-aged pupils (including pupils in year 7, since the learning loss was primarily experienced during year 6) we estimate that pupils lost just over three months of learning. We again present the results of what we would have found had we applied a similar methodology to last year's results. We find that pupils made just under one month less progress in 2019/20 than pupils in 2018/19. It is again difficult to determine the true counterfactual in this situation but, similarly to our argument for reading we find that:

- If the system had continued to decline at the same rate as between 2018/19 and 2019/20 then the degree of learning loss is potentially lower – around 1 month – than we present here.
- If 2019/20 was in fact a low point, then the learning loss is potentially high – again around 1 month.

Figure 3.3: Estimated learning loss in mathematics for primary-aged pupils in 2020/21 in comparison to estimates made in a similar way for outcomes in 2019/20



Estimates of learning loss by region and school-level disadvantage

We have carried out some initial analysis to examine whether there are different rates of learning loss in different regions of England (sample sizes mean it is not possible to use smaller geographies) and in schools with different characteristics. We present these results for learning loss in reading only as the sample sizes prohibit robust analysis in mathematics. In reading it has been necessary to combine year groups.

Figure 3.4 shows the mean learning loss in reading in 2020/21 by region for primary-aged pupils, and Figure 3.5 repeats this analysis for secondary-aged pupils. We present two sets of figures. The first is the simple mean of all individual pupil learning losses based on our modelling of outcomes in 2020/21 in comparison to 2019/20. However, this 'learning loss' estimate actually reflects two features of pupil outcomes. The first - the element we are interested in - is the amount of learning loss that is due to the coronavirus (COVID-19) pandemic. The second is the different rates of progress that pupils typically make in each region. To control for this, we calculate the mean progress pupils made in each region in 2019/20 and subtract this from our estimate of learning loss (in other words, we assume that in the absence of coronavirus (COVID-19), pupils in the region would have made the same progress as pupils in the region last year). This provides a better estimate of the effect of the pandemic on pupil outcomes.

We find that:

- In terms of raw 'learning loss', primary-aged pupils in the North East and Yorkshire and the Humber lost 2.8 months, pupils in London lost the least at 1.1 months.
- Once we adjust for historic differences in pupil progress, we find that in most regions (including London) primary-aged pupils have typically lost between 1.7 and 2 months. However, pupils in the North East and Yorkshire and the Humber have still lost slightly more – 2.4 months and 2.2 months respectively.
- In terms of raw 'learning loss', secondary-aged pupils in the North East and Yorkshire and the Humber lost 3.3 and 2.8 months respectively, pupils in London lost the least at just 0.6 months.
- Once we adjust for historic differences in pupil progress, we find that all regions have experienced a loss of at least a month. Pupils in the North East and Yorkshire and the Humber appear to have experienced the greatest learning loss (2.3 and 2.4 months respectively). Learning losses were smallest in the South East, the East of England, and the North West.

Figure 3.4: Mean learning loss in reading for primary-aged pupils by region

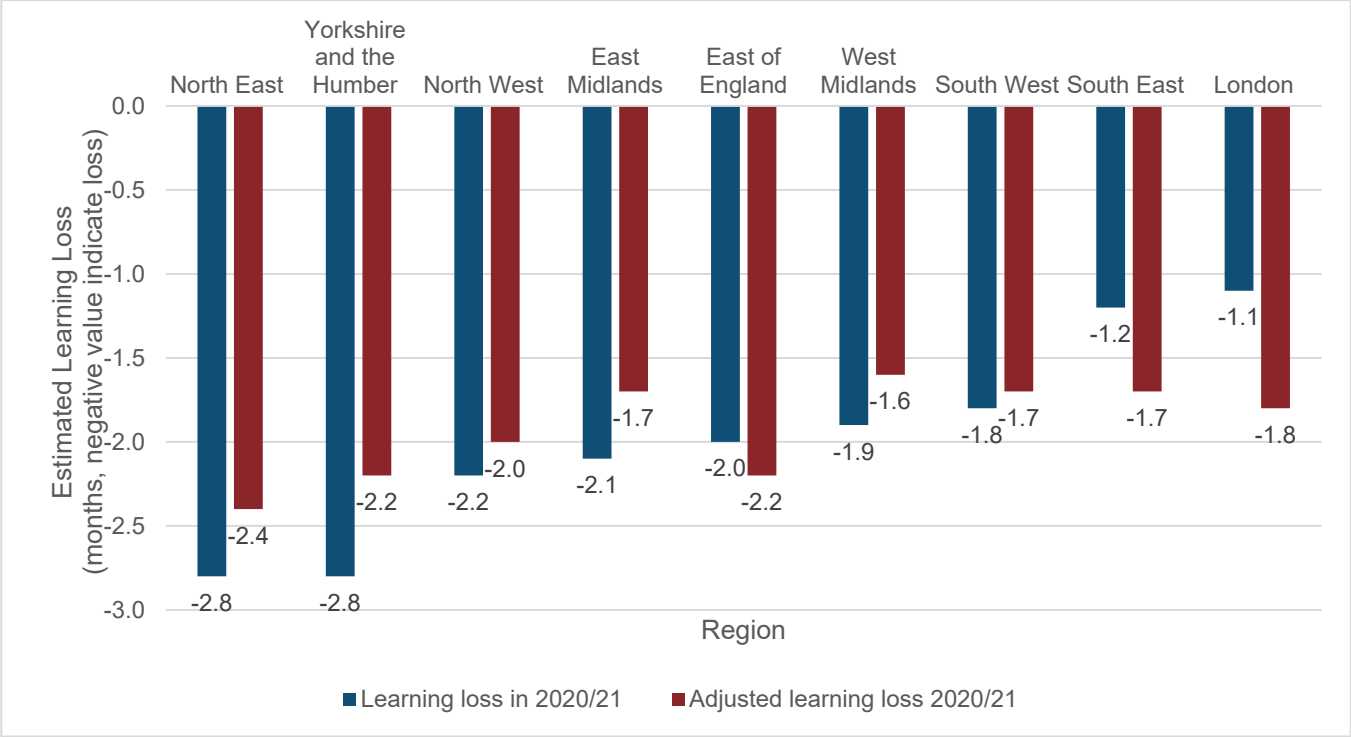
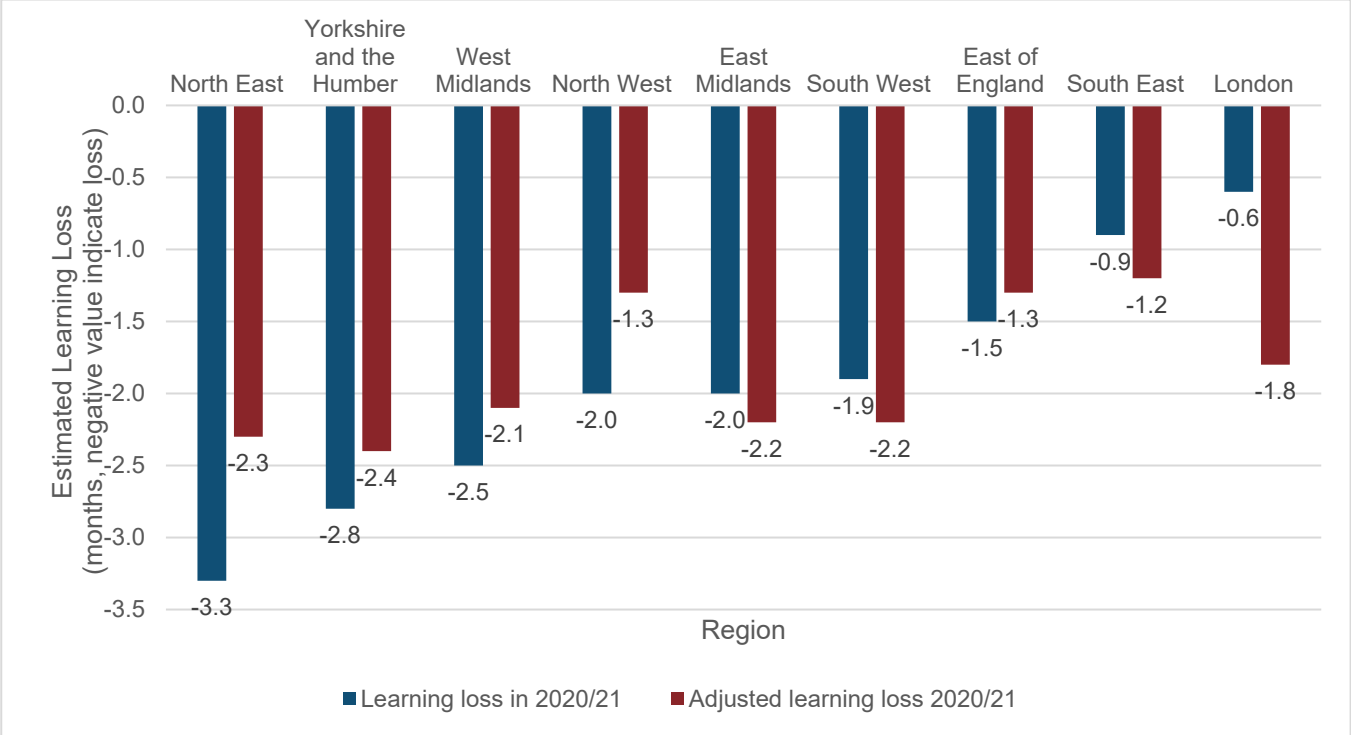


Figure 3.5: Mean learning loss in reading for secondary-aged pupils by region



Finally, we repeat this analysis by levels of disadvantage. In Figure 3.6 we split the mean learning loss in primary and secondary schools by the level of disadvantage in the school

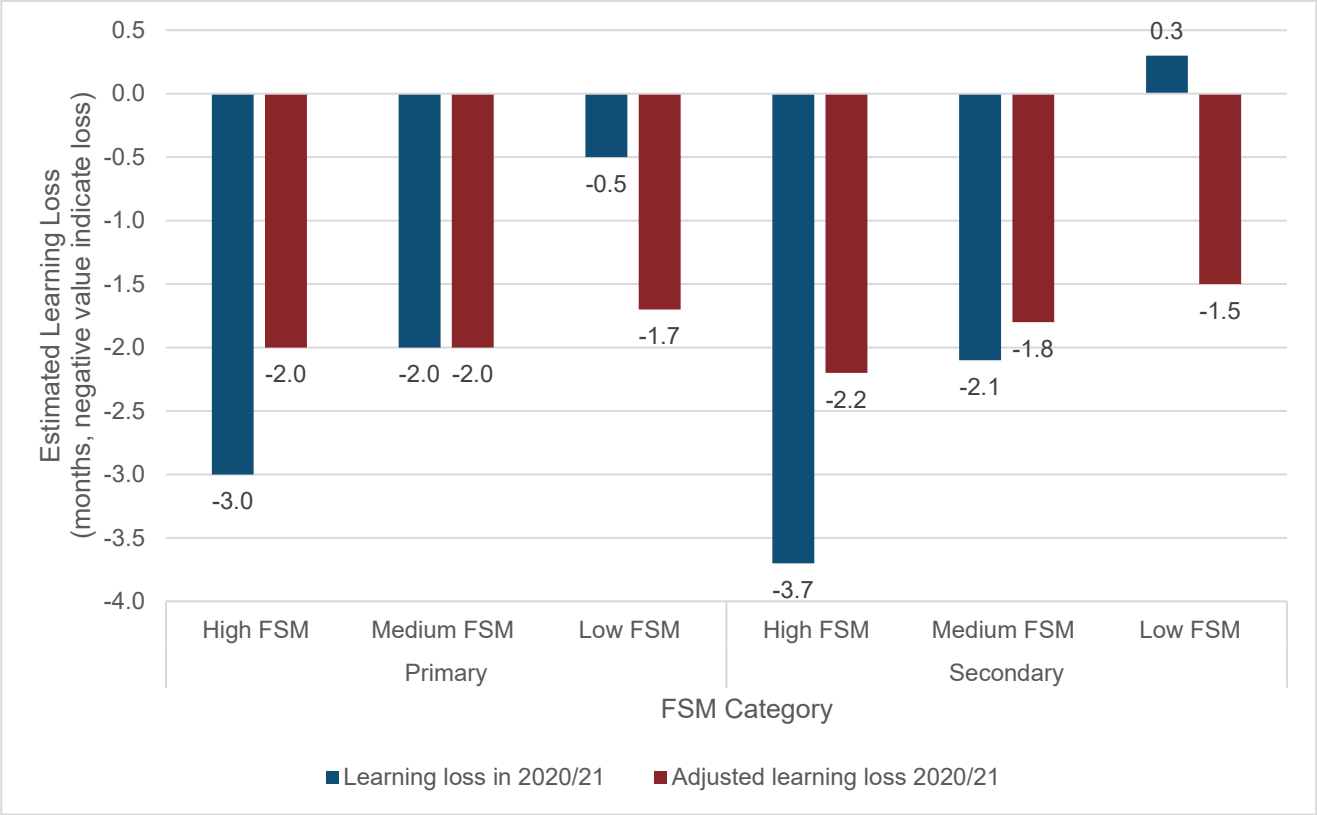
attended - into high, medium and low rates of free school meal eligibility.[13] Again, we present a raw learning loss estimate (the outcomes of pupils in comparison to all pupils in 2019/20) and a learning loss estimate adjusted for historic rates of progress for pupils in these types of schools.

We find that:

- In terms of raw 'learning loss' primary-aged pupils in high-FSM schools experienced the greatest loss of 3.0 months and those in low-FSM schools experienced an apparent loss of 0.5 months.
- Once we control for historic rates of progress for pupils in different school types, we find that primary-aged pupils in low-FSM schools still experienced a learning loss (1.7 months) but this was lower than in medium and high-FSM schools (2.0 months).
- In terms of raw 'learning loss' secondary aged pupils in high-FSM schools experienced the greatest loss of 3.7 months and those in low-FSM schools experienced no loss (achieving around 0.3 months higher than pupils with similar prior attainment in 2019/20).
- Once we control for historic rates of progress for pupils in different school types we find that secondary aged pupils in low-FSM schools did experience a learning loss (1.5 months) but this was lower than in medium and high FSM schools (2.2 and 1.8 months respectively).

[13] For this analysis high means more than 25 per cent of pupils are eligible for free school meals, low means less than 10 per cent of pupils are eligible for free school meals.

Figure 3.6: Mean learning loss in reading for primary and secondary aged pupils by level of disadvantage in the school



These results suggest that pupils in regions and schools that typically achieve greater rates of progress have still experienced a learning loss. But we also find that there are some areas of the country that have experienced larger losses than elsewhere, and pupils in schools with high levels of disadvantage have lost the most. This may mean that there will be widening of the attainment gap between disadvantaged pupils and their peers. At this stage we cannot estimate the effect specifically on pupils from disadvantaged backgrounds and it is likely that we underestimate the effect for them because most pupils in high-FSM schools are not eligible for free school meals.

We will be able to present results by pupil characteristics in our second report.

Conclusion

This report represents our first assessment of the learning loss experienced by pupils in England as a result of the coronavirus (COVID-19) pandemic.

Whilst there have already been several studies that have attempted to estimate learning loss in England the key strength of the Renaissance assessment data is that it allows us link outcomes in the first half of the autumn term 2020/21 with outcomes at the same point in 2019/20 at pupil level, and compare their progress with similar pupils in earlier academic years. The samples are also sufficiently large enough to allow us to see whether these results are consistent across different year groups. We present a method for estimating learning loss that is based on the expected progress for pupils based on their prior attainment and historic rates of progress for similar pupils.

The degree of learning loss identified in this report is lower than has been reported by some other studies of pupils in England but is of a similar magnitude to those found by the EEF in an assessment of pupils in Year 2 and is of a similar magnitude to those found using Renaissance assessments in the United States. We find that all year groups have experienced a learning loss in reading, ranging from 1.6 months to 2.0 months. The learning losses in mathematics were greater, in primary schools learning losses averaged just over 3 months. It has not been possible to provide an estimate for secondary schools due to small sample sizes.[14] All regions have, on average, experienced learning losses in reading, though the differences between regions are relatively small. We also find schools with high levels of disadvantage have experienced higher levels of loss than other schools particularly in secondary (2.2 months in schools with high free school meal eligibility and 1.5 months in schools with low free school meal eligibility).

At this stage it is not possible to break down results by pupil characteristics, or to model the progress typically made in Star Assessments by different pupil groups, but this will be possible when the data is matched with information held in the National Pupil Database and will be included in our second report. We will develop our models to account for these different rates of progress made by different pupil groups.

That data will also enable us to assess the impact of the coronavirus (COVID-19) pandemic on the gap in attainment between disadvantaged pupils and their peers. Consistent with other studies, the initial analysis presented in this report suggests that that gap may have widened as a result of the pandemic.

[14] All of these estimates are based on an assumption that, in the absence of the coronavirus (COVID-19) pandemic, pupils would progress at the same rate as pupils in the past. It is of course possible that pupils this year would have progressed at a different rate, so we illustrate this in the report by applying the same approach to predicting last year's results and find smaller fluctuations than the losses estimated here.

Annex

Data

Renaissance Learning provided a dataset to the Education Policy Institute that comprised all assessments undertaken in schools in England between 1st August 2017 and 25th October 2021. A total of 11,685,315 records were provided (one per assessment). The data consisted of the following variables:

- a 'meaningless' pupil identifier[15]
- a school URN where available
- subject (reading and mathematics)
- academic year
- year group of pupil
- date of test
- scaled score
- percentile rank

The school region and percentage of pupils eligible for free school meals was taken from an extract from Get Information About Schools taken on 16 November 2020. This was linked to the pupil data using the school URN. Note that the URN data was complete for around 90 per cent of pupils.

Number of assessments

Table A1: The number of assessments undertaken in Star Reading and Star Maths by half-term 2017/18

Half-term	Reading	Mathematics
Autumn 1	807,000	32,000
Autumn 2	496,000	33,000
Spring 1	519,000	24,000
Spring 2	442,000	30,000
Summer 1	447,000	22,000
Summer 2	619,000	35,000

[15] The identifier was consistent within the dataset to allow linking of different assessment records but has no real world meaning

Table A2: The number of assessments undertaken in Star Reading and Star Maths by half-term 2018/19

Half-term	Reading	Mathematics
Autumn 1	937,000	45,000
Autumn 2	578,000	44,000
Spring 1	615,000	31,000
Spring 2	561,000	41,000
Summer 1	423,000	22,000
Summer 2	717,000	44,000

Table A3: The number of assessments undertaken in Star Reading and Star Maths by half-term 2019/20

Half-term	Reading	Mathematics
Autumn 1	1,119,000	55,000
Autumn 2	631,000	51,000
Spring 1	697,000	33,000
Spring 2	325,000	27,000
Summer 1	32,000	1,000
Summer 2	49,000	4,000

Table A4: The number of assessments undertaken in Star Reading and Star Maths by half-term 2020/21

Half-term	Reading	Mathematics
Autumn 1	1,039,000	58,000

Regression analysis[16]

Table A5: Regression coefficients and R-squared value for the estimated learning loss in 2020/21 (modelled on 2019/20 data) – reading

Year	Constant	Coefficient – prior attainment	R-squared
Year 3	147.885	0.957	0.475
Year 4	140.224	0.925	0.563
Year 5	131.479	0.948	0.590
Year 6	110.491	1.006	0.600
Year 7	133.272	0.946	0.566
Year 8	110.471	0.982	0.576
Year 9	146.774	0.919	0.610

Table A6: Regression coefficients and R-squared value for the estimated learning loss in 2020/21 (modelled on 2019/20 data) – mathematics

Year	Constant	Coefficient – prior attainment	R-squared
Years 3-7	172.183	0.835	0.637

Table A7: Regression coefficients and R-squared value for the estimated learning loss in 2019/20 (modelled on 2018/19 data) – reading

Year	Constant	Coefficient – prior attainment	R-squared
Year 3	138.936	0.962	0.485
Year 4	132.543	0.927	0.568
Year 5	124.094	0.959	0.600
Year 6	98.516	1.024	0.605
Year 7	108.566	0.980	0.601
Year 8	100.921	0.989	0.582
Year 9	123.805	0.941	0.621

Table A8: Regression coefficients and R-squared value for the estimated learning loss in 2019/20 (modelled on 2018/19 data) – mathematics

[16] Note that year 7 is grouped with primary since we are primarily interested in learning loss that occurred in the summer term when this group were in year 6.

Year	Constant	Coefficient – prior attainment	R-squared
Years 3-7	161.530	0.866	0.670

Days between assessments

Table A9: Percentiles of the number of days between tests taken in the first half of the autumn term for reading – 2018/19 to 2019/20

Year	5th percentile	25th percentile	50th percentile	75th percentile	95th percentile
Year 3	328	355	364	372	408
Year 4	328	357	364	373	410
Year 5	328	358	364	372	409
Year 6	330	358	364	371	407
Year 7	333	358	366	375	395
Year 8	341	356	363	371	390
Year 9	344	359	365	374	393

Table A10: Percentiles of the number of days between tests taken in the first half of the autumn term for reading – 2019/20 to 2020/21

Year	5th percentile	25th percentile	50th percentile	75th percentile	95th percentile
Year 3	322	349	364	373	402
Year 4	320	351	365	373	400
Year 5	319	353	365	373	399
Year 6	319	353	365	373	401
Year 7	330	359	369	378	397
Year 8	342	361	371	380	395
Year 9	342	362	371	383	399

Table A11: Percentiles of the number of days between tests taken in the first half of the autumn term for mathematics – 2018/19 to 2019/20

Year	5th percentile	25th percentile	50th percentile	75th percentile	95th percentile
Year 3	332	349	363	371	384
Year 4	332	356	364	371	403

Year 5	331	353	364	372	401
Year 6	329	347	362	371	403
Year 7	334	337	343	358	392
Year 8	336	356	360	371	393
Year 9	345	361	376	379	386

Table A12: Percentiles of the number of days between tests taken in the first half of the autumn term for mathematics – 2019/20 to 2020/21

Year	5th percentile	25th percentile	50th percentile	75th percentile	95th percentile
Year 3	334	361	367	373	390
Year 4	333	354	365	373	391
Year 5	335	358	367	375	398
Year 6	330	358	365	373	393
Year 7	356	359	363	365	378
Year 8	340	359	363	368	389
Year 9	343	364	367	393	398

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