

# Measuring the attainment gap in Glasgow schools through Sumdog data August 2017 to April 2018

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## ABSTRACT

The progress of pupils using Sumdog Maths between August 2017 and April 2018 in the most deprived schools in Glasgow was compared to the progress of pupils in the least deprived schools in order to investigate the role that Sumdog Maths can play in working towards the goals of closing the attainment gap for numeracy. For pupils overall, the data revealed an attainment gap between the pupils from the least and most deprived schools which was equivalent to 1.1 academic years, as measured by Sumdog. This gap was present both in August 2017 and April 2018.

When the same analysis was performed on a subset of pupils who used Sumdog for at least 30 minutes per week, this gap, although starting at 1.1 academic years in August 2017, had shrunk to only 0.8 by April 2018. This evidence suggests that regular use of Sumdog has the potential to narrow the attainment gap between pupils from the least and most deprived schools.

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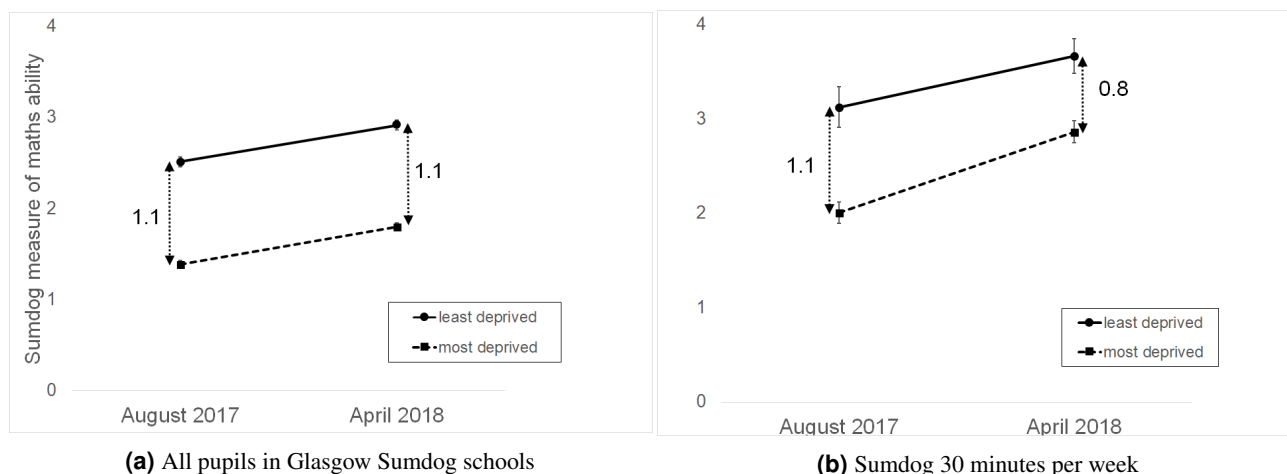
## Summary

### All students

Results confirmed an attainment gap between pupils from the most deprived schools (those with the highest proportions of pupils eligible for free school meals) and those from the least deprived schools at the start of the academic year 2017/18, equivalent to 1.1 of an academic year, as measured by Sumdog. Both the pupils from the least deprived schools, and those from the most deprived schools increased in their math ability from August 2017 to April 2018 by 0.40 of an academic year. This is evidence that the Sumdog metric provides a quantitative way of defining and measuring the achievement gap. Figure 1 (a) shows this data.

### Students using Sumdog at least 30 mins per week

A subset of the dataset described above was defined by limiting it to only those pupils who had used Sumdog for an average of at least 30 minutes per week between August 2017 and April 2018. For these pupils, the attainment gap at the start of the academic year was similar, at 1.1 of an academic year. Over the time period, the pupils from the least deprived schools progressed by 0.54 of an academic year, and the pupils from the most deprived schools progressed by 0.86 of an academic year. By April 2018, the gap had reduced to only 0.8 of an academic year; a reduction of 20%. Figure 1 (b) shows this data.



**Figure 1.** Sumdog levels in August 2017 and April 2018 for pupils in the least and most deprived schools

## Data sources

### Eligible pupils

Sumdog data for all active<sup>1</sup> pupils in state-funded primary schools in Glasgow were obtained. The data resulted in 2,985 pupils in 70 schools who had a Sumdog level in both August 2017 and April 2018.

### Classification of 'deprived' schools

The 70 schools were split into four quartile groups based on the proportion of pupils within the school who were eligible for free school meals (FSM)<sup>2</sup>. The pupils in schools within the first quartile, with the lowest proportion of pupils eligible for FSM, were labeled as "least deprived", and the pupils from the schools within the bottom quartile, with the highest proportion of pupils eligible for FSM, were labeled as "most deprived". This resulted in a subset of 35 schools, with 737 pupils in the least deprived, and 684 students in the most deprived schools.

### Sumdog levels

When a pupil first uses the Sumdog website, they are given an initial diagnostic test, in the format of the Sumdog games. This test is adaptive to each individual pupil, and results in a "Sumdog level" being allocated per pupil.

A pupil's Sumdog level is calculated from the proportion of the Sumdog skills (mapped to the Curriculum for Excellence (CfE)), that the pupil has mastered (achieving at least 80% accuracy on related questions). If a pupil has mastered no skills at all, they will have a score of zero. Figure 2 below illustrates the mapping of Sumdog levels to CfE Levels.

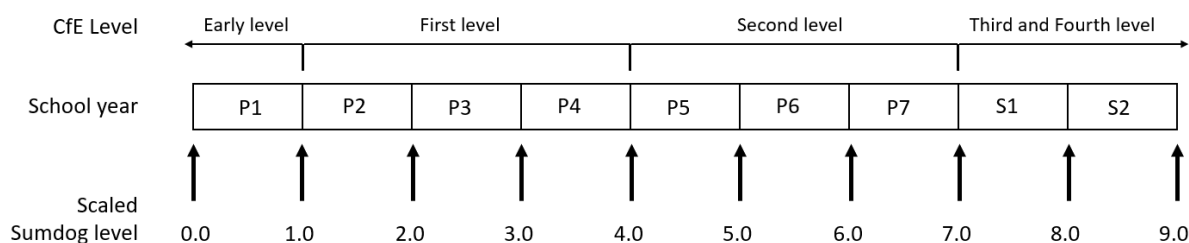


Figure 2. Sumdog level mapped to CfE Levels

If a pupil has mastered all of the skills mapped to Early level, they will have a Sumdog level of 1.0. If they have mastered a third of First level (as might be expected at the end of P2) they will have a Sumdog level of 2.0. When they have mastered all of the Sumdog skills mapped to CfE First level, they will have a Sumdog level of 4.0. The highest score that a student could have is 9.0, which would represent the case in which they has completed all of the Sumdog skills that are mapped to CfE Third and Fourth level. The Sumdog level for each pupil was recorded for two time points: August 2017 and April 2018.

<sup>1</sup> A pupil is defined as 'active' if they answered at least one question in the four weeks prior to the time point that the data was taken from.

<sup>2</sup> A pupil is eligible for FSM if if they or their parents are in receipt of benefits

## Analysis and results

### Analysis 1 — all students using Sumdog

At the start of this study, in August 2017, the overall cohort of pupils had an average Sumdog level of 1.87. In April 2018, this average had increased to 2.25, which represents the average pupil having mastered 0.38 of a Sumdog level (one academic year is represented by 1 Sumdog level, so this is equivalent to around 0.4 academic years). Pupils spent an average of around 16 minutes a week using Sumdog.

Table 1 compares the changes in Sumdog levels for pupils from the least and most deprived schools.

	Least deprived (N=737)	Most deprived (N=684)	Total
Av. mins on Sumdog	12.20 (12.04)	18.34 (17.87)	16.17 (16.95)
August 2017	2.51 (1.57)	1.39 (1.31)	1.87 (1.46)
April 2018	2.91 (1.72)	1.80 (1.46)	2.25 (1.57)

**Table 1.** Means and (standard deviations) of Sumdog levels for all pupils

### ANOVA

A 2×2 repeated measures ANOVA was conducted on the data. This measures three things:

1. The strength of the effect of time (August 2018 to April 2018) on pupils' Sumdog level;
2. The strength of the effect of deprivation status on pupils' Sumdog level; and
3. The interaction between the effect of time, and the effect of deprivation status

Results of the ANOVA showed that:

1. There was a statistically significant effect of time ( $F(1,1419)=268.4, p < .001, \eta_p^2 = 0.16$ ), with pupils having higher Sumdog levels in April 2018 than in August 2017. This finding is a positive indication that, overall, all pupils improved in their Sumdog maths skills over the period of the school year that the study covered. This will have been combination of an effect of Sumdog practice, and of their regular classroom activities.
2. There was also a statistically significant effect of deprivation status ( $F(1,1419) = 207.9, p < .001, \eta_p^2 = 0.13$ ), with pupils from the most deprived schools having lower Sumdog levels than the pupils from the least deprived schools. This is unsurprising, given the documented attainment gap between these groups, and highlights the importance of finding interventions to address this discrepancy successfully.
3. There was no interaction between time and deprivation status ( $p = .206$ ), suggesting that there was no particular advantage for either the pupils from the least deprived schools, or those from the most deprived schools. The pupils from the most deprived schools did not progress through the Sumdog skills any faster than the pupils from the least deprived schools.

### Analysis 2 — only pupils using Sumdog at least 30 minutes a week

For the second part of this study, the same analysis was repeated, but with a subset of the pupils; those who had used Sumdog for an average of at least 30 minutes per week during the period of August 2017 to April 2018. This analysis allowed an investigation of whether the recommended 30 min a week regular use of Sumdog would have a significant effect on pupils' maths progression.

This subset was made up of 240 pupils from 17 schools. Overall, these pupils had an average Sumdog level of 2.31 in August 2017, and 3.09 in April 2018, which represents progress of 0.78 of a Sumdog level, or of an academic year. These pupils spent a average of around 47 minutes a week using Sumdog. Table 2 shows the data from this subset.

	Least deprived (N=70)	Most deprived (N=170)	Total
Av. mins on Sumdog	45.34 (18.55)	47.62 (21.58)	47.01 (20.81)
August 2017	3.12 (1.80)	2.01 (1.55)	2.31 (1.69)
April 2018	3.66 (1.70)	2.86 (1.73)	3.09 (1.76)

**Table 2.** Means and (standard deviations) of Sumdog levels for only pupils who used Sumdog for at least an average of 30 minutes per week during the time period

## **ANOVA**

The same ANOVA analysis was performed for this subset of pupils with the following findings:

1. There was a statistically significant effect of time ( $F(1,238)=89.9$ ,  $p < .001$ ,  $\eta_p^2=0.27$ ), again with pupils scoring better in April 2018 than in August 2017.
2. There was a significant effect of deprivation status ( $F(1,238)=16.70$ ,  $p < .001$ ,  $\eta_p^2=0.07$ ), with pupils from the most deprived schools having lower Sumdog levels than those from the least deprived schools.
3. There was a marginally significant interaction effect ( $F(1,238)=3.57$ ,  $p = .060$ ,  $\eta_p^2=0.02$ ), meaning, again, that there was a particular advantage in progression through Sumdog levels over the period August 2017 to April 2018 for pupils from the most deprived schools.

## **Conclusions**

The aim of this research was to investigate the attainment gap between pupils in the least and most deprived schools, and their use of Sumdog. Looking at all pupils, the data conclusively confirmed the presence of an attainment gap between the groups, representing approximately one academic year (as measured by Sumdog). When the Sumdog data for the groups was compared over time, there was no change in this attainment gap between the period August 2017 to April 2018.

In order to establish what role the use of Sumdog has in terms of closing the attainment gap, a subset of pupils were investigated: those who used Sumdog for at least an average of 30 minutes per week during the time period. The results for this subset of pupils reflected the patterns already seen for the overall cohort, with an achievement gap of around one academic year in August 2017, and a marginally significant closing of the gap over the year. For these students who were very regular users of Sumdog, the achievement gap shrunk by around 20%.