Rapid evidence assessment on the impact of school closures
Protocol for a rapid evidence assessment
Principal investigators: Rob Coe, Ben Weidmann

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Background and rationale for the review

The Covid-19 pandemic has led to school closures across the UK and many countries across the world. This means that the majority of pupils in these systems are out of school, though supported and taught in various ways. Nevertheless, it is likely that school closures will lead to slower rates of learning, perhaps learning loss, and there is a risk that the negative impact will be worse for pupils who are economically disadvantaged.

In this context a number of researchers and policy organisations have produced quick analyses of the potential impact of the school closures (eg Sims, 2020; Burgess and Sievertsen, 2020; Kuhfeld, & Tarasawa, 2020). These are impressive in their speed and relevance for policy thinking, but they highlight the diversity and potentially contested nature of the evidence that may be relevant. A rapid evidence assessment seeks to address this heterogeneity by ensuring that, as far as possible, all relevant evidence has been captured and considered. We believe the most recent systematic review of the evidence on summer learning loss is Cooper et al's 1996 study, and have not found any systematic review that covers the impact of other types of school closure (eg due to epidemics, adverse weather, etc).

The urgency of the pandemic means that this review needs to be conducted quickly. The review aims to summarise the evidence on the impact of school closures to give policymakers an indication of the likely size of the learning loss due to Covid-19 closures, both in its overall effect and its effect on the attainment gap between disadvantaged learners and others. This may help policymakers to plan the scale and nature of both mitigation and compensation strategies.

Objectives

Our aim is to produce a policy-focused publication summarising the findings of the rapid evidence assessment (REA) within six weeks of starting the review.

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Original research questions:

1) What evidence currently exists about the impact of different kinds of school closure (eg due to summer holidays; adverse weather, natural disasters)?
   a) On overall academic attainment?
   b) On differential academic attainment for disadvantaged/others?
   c) On other outcomes related to education (eg impact on IQ or lifetime earnings)?
2) What evidence currently exists about the impact of missing vs attending periods of schooling for reasons other than closure (eg various kinds of absence; date of birth; policy change)?
3) What factors moderate the impact? (eg age of pupils; subject/content area; types of attainment measure/methodology; length of closure; timing/conditions of testing)?
4) What evidence and theory helps us to understand the mechanisms by which closure of or absence from school leads to learning loss and widening of attainment gaps (if it does)?

Modified research questions:

There were two significant changes to the aims of the review that happened after we had begun work.

The first is that, having separated the searches for RQ1 and RQ2, we found the search for RQ2 returned what we judged to be an unmanageably large number of hits (around 7000) for screening. At this point we decided to focus on RQ1 and abandon RQ2.

The second change is that after the initial search and screening was complete, we decided
- With the resource and time available, we would not be able to extract data from all 59 included studies
- Given our priority was to quantify how school closure impacts the disadvantage gap in attainment (rather than the overall impact on the whole population), we should prioritise studies that provide data on the gap

As a result, we removed RQ1a from our list.

The modified research questions therefore became:

1. What evidence currently exists about the impact of different kinds of school closure (eg due to summer holidays; adverse weather, natural disasters)?
   a. On differential academic attainment for disadvantaged/others?
   b. On other outcomes related to education (eg impact on IQ or lifetime earnings)?
2. What factors moderate the impact? (eg age of pupils; subject/content area; types of attainment measure/methodology; length of closure; timing/conditions of testing)?
3. What evidence and theory helps us to understand the mechanisms by which school closure leads to learning loss and widening of attainment gaps (if it does)?

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Hypothesised mechanisms

Our aim is to translate the existing evidence on the impact of school closure on attainment gaps to the context of Covid-19 closures. As the parallel is far from perfect, it is important to understand the mechanisms by which closure has this impact. The evidence from this review should help us to develop and test theories about these mechanisms. As a starting point, we propose the following list:

Mechanisms: How might school closure/absence reduce learning?
1. Forgetting: lack of practice in and exposure to things already learnt causes decline in performance in those things
   a. Retrieval and processing of knowledge
   b. Fluency/facility in procedures (eg arithmetic, writing)
   c. Abstract and conceptual modes of thinking
2. Loss of new learning: lack of benefits of school learning, through
   a. Loss of classroom instruction time
   b. Loss of out-of-classroom learning (eg homework, extra-curricular activities/trips)
   c. Loss of exposure to specific content or topics (even holding learning time constant, lack of adequate mastery of specific curriculum content may leave gaps that undermine future learning)
   d. Loss of assessment preparation and generation effects (revising, practising and preparing for tests; being required to generate answers; inherent feedback from the testing process)
3. Adverse environment: school-free environment is less conducive to health and wellbeing, so reducing mental functioning
   a. Home life is more stressful, chaotic, emotionally disconnected: leads to anxiety (& trauma?)
   b. Nutrition: lack of school dinner/breakfast
   c. Reduced social contact with peers (& increased social media use may be dysfunctional?)
   d. Reduced physical activity (walking to school, games/sport, PE)
   e. Lack of routine: getting out of bed in the morning, having purpose & structure

Through the review, we will seek to find relevant evidence with which to test each of these potential mechanisms as mediators of the effect of school closure or school attendance on learning.

Methodology

The Cochrane Collaboration Rapid Reviews Methods Group has recently published interim guidance on producing rapid reviews, motivated by the Covid-19 pandemic and the need to provide answers to relevant time-sensitive questions (Garrity et al. 2020). We will draw on this methodological guidance for this REA, as well as the Civil Service REA methodological guidance (Government Social Research Service, 2009) and the Cochrane Collaboration's guidance on overviews of reviews (Pollock et al. 2020).

The review is limited to studies from 1995 or later. This allows us to complement the most recent systematic review we have found (Cooper et al, 1996), which included studies published up to 1994.

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Inclusion and exclusion criteria for the review

These are the final criteria used. As noted above, the original search included a wider set.

	Include	Exclude
Population	Primary or secondary aged pupils, including ages 4-18. Studies from any country will be included.	Post-secondary, vocational learning, professional development.
Reason for school closure (or variation in schooling)	Summer (or other planned) vacation. Natural disasters (eg flood, fire, hurricane, snow/ice, earthquake). Pandemic/epidemic, disease. Teacher strikes.	Drop out from school. Occasional or chronic absence due to sickness, other or unknown reasons Month of birth. Policy change in age of starting or finishing school. Length of school day or teaching time in specific subjects.
Outcome	Any measure of academic achievement in any school subject. IQ Subsequent life outcomes related to education (eg lifetime earnings). Studies must include a comparison of the impact of closure on high/low socioeconomic status groups. Studies must present enough information for an effect size and standard error to be calculated (or plausibly estimated)	Studies/reviews that only examine behaviour, attendance, or other non-cognitive outcomes. Studies that do not compare impact on high/low SES groups
Study design	Empirical studies, meta-analyses or systematic reviews that provide evidence about the impact of school closure. Causal estimates may be from experiments, or observational studies with adequate controls (eg quasi-experiments with strong predictors, IV, RRD, PSM, DID)	Narrative reviews. Studies that evaluate a summer or other intervention to address the gap.[1]
Other criteria	Published since 1995. Published in English. Reviews published in peer-reviewed journals or grey literature.	Published before 1995. Published in languages other than English.

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[1] Initially we had considered including estimates from the control group of randomly allocated studies that evaluated an intervention. Several of these were captured in the original searches. However, partly for reasons of resource/timing and partly because of the difficulty of identifying 'pure' control conditions, we excluded these.

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Search strategy for identification of studies

Searches will be conducted using a combination of search systems and bibliographic databases, including Web of Science, Microsoft Academic and ERIC, and hand searches of known sources of systematic reviews such as the Campbell Library.

Search Systems and databases to be searched:

- Web of Science
- ERIC
- Google Scholar[2]

Once we have screened the search results from the databases above and have a set of included studies, we will also use Microsoft Academic to identify similar studies that might have been missed by the main search. Microsoft Academic is a large open access repository containing more than 228 million records. We will access it through the EPPI-Reviewer 4 software and use the EPPI Reviewer user guide[3]. This process is conceptually similar to forward and backwards citation tracking.

Search terms:

Where it is possible to refine searches using filters such as categories on web of science, we will exclude categories that are not related to education. Where filters on sites correspond to inclusion criteria we will also filter during the search – for example, only searching studies published since 1995.

We divide the search into two: one to capture the impact of school closure (RQ1), the other on the impact of attending/missing school (RQ2). Because of the character limit in a Google Scholar search string, we further reduce the terms searched and also split the school closure search into two, one aimed at summer learning loss, the other at unplanned closures (natural disasters, pandemics, etc).

Main string for school closure (WoS, ERIC):

("summer learning" OR "summer learning loss" OR "seasonal learning" OR "school vacation" OR "seasonal loss" OR "summer reading loss" OR "summer reading setback" OR "summer learning gap" OR "summer recess" OR "school disruption" OR "class dismissal" OR "adverse weather" OR "extreme weather" OR "closure" OR "pandemic" OR "snow" OR "community traumatic events" OR						
	AND	("school" OR "schooling")	AND	("learning" OR "attainment" OR "achievement" OR "disadvantage gap" OR "test scores" OR "attainment gap" OR "achievement gap" OR "equity" OR "outcomes")	AND	("effects" OR "effect" OR "impact" OR "implications" OR "reduce" OR "increase" OR "reduction")

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[2] Google scholar has a 256 character limit and does not automatically searches for truncations. A more limited search string will be used for the google scholar search. The search will then be filtered to limit the results to studies that are published since 2005. We will look at the first 200 results in Google Scholar, in line with the recommendation of Haddaway et al. 2015.

[3] More information is available at: http://eppi.ioe.ac.uk/CMS/Portals/35/MAG%20Browser%20v_1_0_User%20Guide.pdf

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"natural disaster" OR "teacher strike" OR "earthquake" OR "hurricane")					

(("summer learning" OR "summer learning loss" OR "seasonal learning" OR "school vacation" OR "seasonal loss" OR "summer reading loss" OR "summer reading setback" OR "summer learning gap" OR "summer recess" OR "school disruption" OR "class dismissal" OR "adverse weather" OR "extreme weather" OR "closure" OR "pandemic" OR "snow" OR "community traumatic events" OR "natural disaster" OR "teacher strike" OR "earthquake" OR "hurricane") AND ("school" OR "schooling") AND ("learning" OR "attainment" OR "achievement" OR "disadvantage gap" OR "test scores" OR "attainment gap" OR "achievement gap" OR "equity" OR "outcomes") AND ("effects" OR "effect" OR "impact" OR "implications" OR "reduce" OR "increase" OR "reduction"))

Main string for attending/missing school (WoS, ERIC: (NB: this was part of the original search, later excluded)

("attendance" OR "month of birth" OR "season of birth" OR "leaving age" OR "starting age" OR "absence" OR "summer born" OR "length of schooling" OR "instructional time")	AND	("impact" OR "effect" OR "effects" OR "reduce" OR "increase")	AND	("attainment" OR "learning" OR "achievement" OR "outcomes")	AND	("school" OR "schooling")

(("attendance" OR "month of birth" OR "season of birth" OR "leaving age" OR "starting age" OR "absence" OR "summer born" OR "length of schooling" OR "instructional time") AND ("impact" OR "effect" OR "effects" OR "reduce" OR "increase") AND ("attainment" OR "learning" OR "achievement" OR "outcomes") AND ("school" OR "schooling"))

String for summer school closure (Google Scholar):

("summer learning" OR "seasonal" OR "summer recess" OR "summer reading" OR "vacation")	AND	("learning" OR "gap" OR "loss" OR "slide" OR "setback")	AND	("school")	AND	("learning" OR "attainment" OR "achievement" OR "disadvantage")	AND	("effect" OR "impact")

("summer learning" OR "seasonal" OR "summer recess" OR "summer reading" OR "vacation") AND ("learning" OR "gap" OR "loss" OR "slide" OR "setback") AND ("school") AND ("learning" OR "attainment" OR "achievement" OR "disadvantage") AND ("effect" OR "impact")

String for unplanned school closure (Google Scholar):

("adverse weather" OR "pandemic" OR "snow" OR "natural disaster" OR "teacher strike" OR "earthquake" OR "hurricane" OR "flood")	AND	("school closure")	AND	("learning" OR "attainment" OR "achievement" OR "disadvantage")	AND	("effect" OR "impact")

("adverse weather" OR "pandemic" OR "snow" OR "natural disaster" OR "teacher strike" OR "earthquake" OR "hurricane" OR "flood") AND ("school closure") AND ("learning" OR "attainment" OR "achievement" OR "disadvantage") AND ("effect" OR "impact")

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String for attending/missing school (Google Scholar): (NB: this was part of the original search, later excluded)

("attendance" OR "month of birth" OR "season of birth" OR "leaving age" OR "starting age" OR "absence" OR "length of schooling" OR "instructional time")	AND	("impact" OR "effect")	AND	("attainment" OR "learning" OR "achievement")	AND	("school")

("attendance" OR "month of birth" OR "season of birth" OR "leaving age" OR "starting age" OR "absence" OR "length of schooling" OR "instructional time") AND ("impact" OR "effect") AND ("attainment" OR "learning" OR "achievement") AND ("school")

Where databases allow, Boolean operators will be used to exclude any studies with: "medical" or "health" included.

Selection of studies
The results of the search will be imported into EPPI reviewer and duplicates removed. Search results will be screened twice, first on abstract and title only, then on the full text. After initial calibration, each screening stage will be completed by one reviewer only due to the timeline for this project. However, we will take a "safety first" approach at both screening stages (Shemilt et al., 2016); that is, the reviewer will have the option of marking a search result as unclear for review by a second reviewer.

At the title and abstract stage, every reviewer will begin by screening the same 30 search results. The results of this screening will be compared to ensure that the inclusion and exclusion criteria are being interpreted and applied in the same way. The priority screening tool within EPPI-reviewer (Thomas et al., 2010) will be used for title and abstract screening to order results by probability of inclusion and stop screening once we reach a certain point when relevant studies are no longer being identified. The priority screening function orders the results based on the words in the title and abstract of the included and excluded papers from a training set of screening. It does this using machine learning text mining technology. We will screen a random set of 10 percent of the search results as the training set. Reviewers will stop screening after 100 studies are rejected in a row using the tool. As a check on this approach, we will randomly sample a number of the unscreened titles to see if this approach has missed any relevant studies.

The results of this process will be documented using a flow chart generated from EPPI-reviewer.

Data extraction and management
We will systematically extract data in Microsoft Excel using the templates included in appendix A. A larger team will be responsible for extracting information from the included studies using the data extraction tool. The core team will do double data extraction on 10% of studies (randomly selected).

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Appraisal of included studies

We will undertake a critical appraisal of each of the included studies in the REA, to make a judgement about the quality of each.

[How to judge quality of studies?]

Each study will receive an overall assessment of low, medium or high confidence, []

The critical appraisal of each included study will be completed by one reviewer and checked by another. The full final REA report will include a table that provides a breakdown of how each study was rated on each question of the tool and the overall confidence rating.

Data synthesis/analysis

Where possible, effect size estimates from each study will be calculated using Cohen's d: the difference between pre-closure and post-closure mean test scores, divided by a pooled estimate of the population test standard deviation.

Our main focus is to estimate the impact of school closure on the gap between disadvantaged and others. We aim to calculate this 'rate of gap change effect' in standard deviation units per month as

$$\Delta = \frac{\left(\overline{X_2^{hi}} - \overline{X_1^{hi}}\right) - \left(\overline{X_2^{lo}} - \overline{X_1^{lo}}\right)}{SD(X) \cdot t}$$

where $\overline{X_2^{hi}}$ is the mean attainment score for the high SES group on occasion 2 (ie post-closure), and similarly; SD(X) is an estimate of the population standard deviation for attainment, X; t is the time in months of the closure. Positive values of Δ denote gap-widening effects.

If samples have estimated effect sizes using a restricted range sample, we will adjust estimates of population standard deviation accordingly, where possible.

Where studies use different thresholds for defining low and high SES groups this will affect the value of Δ. Hence, we will estimate an equivalent Δ_{pp}, the rate of gap change effect we would expect for the difference between Pupil Premium and others.

We will present information on the effect sizes found. If effect sizes are homogeneous enough and comparable enough to conduct quantitative meta-analysis we will do so.

Reporting

The technical report will use the EEF review reporting template for evidence reviews. A policy facing publication will summarise the evidence.

Peer review

Due to the limited timeframe of this REA, this protocol was not formally peer reviewed.

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Personnel

Core team:

- Rob Coe, Ben Weidmann – EEF - search strategy and quality assessment leads
- Jonathan Kay – EEF - screening and retrieval lead
- Amy Ellis Thompson, Robbie Coleman – EEF - publication leads
- Mohammad Zaman – EEF - project manager

Data extraction and screening team:

EEF:

- Amy Clark
- Trent Grassian
- Christine Kelly
- Harry Madgwick
- Sue Morgan
- Shelby Roberts
- Sarah Tillotson

Grattan Institute

- Julie Sonnemann
- Kirsten Sadler

DfE

- Alexander Gnanapragasam

Conflicts of interest

No conflicts of interest

Planned timeline

	Task	Deadline
Protocol development	Protocol finalised	Tue 21 Apr
	Report template finalised	Fri 8 May
	Data extraction tool finalised	Fri 24 Apr
Search	Academic search	Wed 22 Apr
	Search grey literature and organisational websites	Fri 24 Apr
	Citation tracking and other checks on search results	Fri 24 Apr
Screening	Screening on title and abstract	Mon 27 Apr
	Full text retrieval	Tue 28 Apr
	Full text screening	Wed 29 Apr
Data Extraction	Data extraction	Wed 6 May
	Check data extraction	Thu 7 May
	Quality appraisal of studies	Fri 8 May
	Narrative synthesis	Wed 13 May

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	Write up of new synthesis	Fri 15 May
	Compilation of policy relevant findings	Mon 18 May
Synthesis and write-up	Internal EEF review of findings document	Tue 19 May
	Policy briefings	Thu 21 May
	Publish on EEF website	Mon 25 May
	Write up draft technical report using REA template	TBC

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Appendix: Data extraction tool

Data will be extracted from included studies using the following template

Q#	Question	Response codes
1	Data extractor	open response Name of person recording the information
2	Study unique ID	open response
3	First author	open response
4	Publication year	Year (eg 2004)
5	Publication type	1=peer reviewed 2=other
6	Reason for school closure	1=summer vacation 2=weather/short (snow - closed for up to a week) 3=natural disaster/long (fire, flood, hurricane, earthquake - closed for more than a week) 4=disease (pandemic, epidemic) 5=strike/other (teacher strikes, or any other reasons)
7	Details of reason for closure	More detail, information about exact reason for school closure
8	Date of closure	Year (eg 2004)
9	Country	open response
10	Age of students	Open response (eg median age in years; school grade; age range)
11	Number of students in affected group	numeric (also give page number in document where recorded)
12	Other characteristics of students or context	Open response eg: urban/rural; socioeconomic context; EAL, SEN; ethnicity
13	Main subject or curriculum area tested	1=maths (or some part of maths, eg arithmetic) 2=reading 3=first language (eg English) wider than just reading 4=other/unclear
14	Details of subject/curriculum area tested	Open response (eg maths computation; maths problem solving; reading comprehension; reading fluency; fluid intelligence (IQ))
15	Length of closure	number of weeks/days (also give page number in document where recorded)
16	Timing of pre-closure test	number of weeks/months/years before closure (or NA if unknown)

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		(also give page number in document where recorded)
17	Timing of post-closure test	number of weeks/months/years after return (or NA if unknown) (also give page number in document where recorded)
18	Interval between pre- and post-closure tests	number of weeks/months/years (also give page number in document where recorded)
19	What happened to affected students during closure?	open response (eg: distance learning; transferred to other schools; no provision)
20	Comparison or counterfactual. What is their attainment compared with?	open response (eg: same test used twice; learning rate during the rest of the year; comparable students not affected; national norms; performance in previous years)
21	Test: name of test used	Open response: give name of test or assessment used
22	Test: type of test	1=standardised (ie has norms and standard procedures) 2=researcher made 3=other/unclear
23	Test: same test before and after?	1=exact same test 2=equated/parallel versions of same test 3=different test 4=other/unclear
24	Test validity: any evidence of validity cited?	1=yes (eg: reliability; predictive validity; bias) 2=no
25	Test validity: issues considered/reported	Open response (eg: validity study cited; reliability/Cronbach's alpha coefficient; test-retest correlation; ceiling or floor effects mentioned; evidence of lack of bias, esp re SES; interval scale - are test score units equal?)
26	Type of calibration/standardisation of learning loss	1=relative to population standard deviation 2=relative to typical/expected months of learning 3=none/other
27	Size of overall effect size change in attainment.	numeric response Ideally this is the difference between rate of learning (in population SD units, per month) during closure and during normal schooling ClosureES = (learning gain during closure/months between tests/popn SD) - (learning gain during

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		normal schooling/months between tests/popn SD) Comment if unclear, problematic, etc (also give page number in document where recorded)
28	Explanation for ES calculation (give values and page numbers)	
29	Does the sample contain the full population range?	1=yes: study explicitly shows that sample is representative 2=probably: representativeness is implied or seems plausible 3=quantified: sample SD reported as a proportion of population SD 4=slightly reduced: sample probably has narrower spread than population 5=substantially reduced: sample probably has much narrower spread than population (eg high poverty sample) 6=unknown
30	Standard error for overall change	open/numeric response Report lower/upper confidence intervals if given (assume 95%CI, or specify) (also give page number in document where recorded)
31	Change in variance/spread of attainment between pre/post closure	open/numeric response (also give page number in document where recorded)
32	SES comparison: Did study compare change for low/high socioeconomic status?	1=yes 2=no
33	Details of SES measure and thresholds	open response (if yes to prev) How was SES/disadvantage defined and captured? Descriptives and cut-offs for SES comparison groups
34	Size of SES interaction/gap	Difference in school closure effect size for high and low SES groups, or standardised coefficient ie difference in impact of closure (as in Q27) between low and high SES groups (as defined in Q33) Calculate this as: low SES effect - high SES effect (ie is negative if low SES closure effect is worse)

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35	Explanation for SES gap estimate	open response details of values, where taken from, how calculated
36	Standard error of gap estimate	numeric Estimate of the standard error of the gap estimate from Q35
37	Explanation for calculation of SE of gap	open response details of values, where taken from, how calculated
38	Other moderators analysed: How did 'learning loss' vary for different subgroups?	Open response Describe the subgroup and the results. eg: high/low attainers; high/low IQ; ethnicity/race; gender; EAL/ELL
39	Analysis models used	Open response eg: OLS regression; multilevel/hierarchical/mixed models; IRT models for test scaling; school-level vs individual pupil-level data
40	Other comments	Any other comments relevant to quality of study or confidence in the estimate (eg about methods, results, context)