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**Working Paper**

## Inequalities in children's experiences of home learning during the COVID-19 lockdown in England

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# Inequalities in children's experiences of home learning during the COVID-19 lockdown in England

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## Abstract

This paper combines novel data on the time use, home learning practices and economic circumstances of families with children during the COVID-19 lockdown with pre-lockdown data from the UK Time User Survey to characterise the time use of children and how it changed during lockdown, and to gauge the extent to which changes in time use and learning practices during this period are likely to reinforce the already large gaps in education attainment between children from poorer and better-off families. We find considerable heterogeneity in children's learning experiences - amount of time spent learning, activities undertaken during this time and availability of resources to support learning. Concerningly, but perhaps unsurprisingly, this heterogeneity is strongly associated with family income and in some instances more so than before lockdown. Furthermore, our analysis suggests that any impacts of inequalities in time spent learning between poorer and richer children are likely to be compounded by inequalities not only in learning resources available at home, but also those provided by schools.

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# 1 Introduction

The school closures that have been imposed around the world to reduce the spread of the coronavirus are one of the most defining features of the COVID-19 crisis. On 20 March 2020, UK schools closed their gates to all but the children of essential workers and those deemed most vulnerable; during this period of lockdown, under 3% of pupils in England continued to attend school in person. The majority of children then spent more than a full term out of school.

Months out of school risk setting back children's learning and development. This is particularly concerning for children from disadvantaged backgrounds, who already achieve less well on average than their better-off classmates (Hutchinson et al., 2016; Burgess and Sievertsen, 2020; Education Endowment Foundation, 2020). By bringing home all education investments, the pandemic is reducing the equalising role of the time that children normally spend in school may have for their learning. Combined with the disproportionate effect of the crisis on the finances and employment of poorer households, the COVID-19 crisis could have disastrous consequences for inequalities in children's educational attainment (Blundell et al., 2020).

In this paper, we use newly collected real-time data on the time use, home learning practices and financial circumstances of families in England to study the learning experiences of children during lockdown. Specifically, we focus on education investments that have long-term impacts on educational attainment, such as instructional time, doing school work and studying with a tutor. We also analyse the home learning resources provided by families and schools to support students' learning during the lockdown. We document substantial inequalities by pre-pandemic family income in the time that children spend on home learning, the types of educational activities they undertake, and their access to resources such as technology and study space. To explore whether these inequalities have worsened during the lockdown, we combine this detailed data with pre-lockdown information from the 2014-15 UK Time Use Survey.

Characterising these experiences of home learning and how they differ from regular school-based learning is crucial to understand how children have lived through this period and to anticipate the long-lasting consequences this disruption may have for their educational attainment. Our aim will be to characterise inequalities in home learning and how they relate to pre-existing inequalities in ways that may reinforce or attenuate differences in the educational attainment of children. Understanding the formation of learning inequalities during lockdown is crucial to inform policy aimed at supporting families with children and schools during and after this period, and this paper provides a first step in that direction.

Existing evidence offers some important insights into the mechanisms through which lockdown may have affected children's learning and the inequalities between children. First, and perhaps most obviously, school closures have removed most children from their physical school environment for over a term – around 40% of a regular school year. Several studies suggest that the loss of instructional time – delivered by teachers working to the national curriculum on which children will eventually be

examined – is likely to create substantial learning losses. For example, Lavy (2015) looks across 50 countries and finds that an extra hour of instructional time each week in the main subjects increases test scores by around 6% of a standard deviation. Other studies find that even a handful of missed school days due to inclement weather lower test results measurably (Marcotte and Hansen, 2010; Marcotte and Hemelt, 2008).

The impact of foregone instructional time appears to remain even when schools and families face a predictable, relatively long-lasting shock to the school year. Pischke (2007) finds that West German students who, due to a reform, had two school years with approximately 40% less instructional time than normal were more likely to be held back a grade and less likely to enter academic tracks in secondary school (though long-run earnings were unaffected). There is also a substantial literature on learning loss over the summer holidays, which concludes that long periods away from school can have detrimental impacts on educational outcomes, particularly among children in lower-income families (see Steward et al, 2018 for an overview).

The loss of the school environment might have particularly large impacts on children from disadvantaged families. By some calculations, accumulated disadvantage from the summer holiday period may account for two-thirds of the attainment gap between richest and poorest children by the time they reach 14 (Slates et al, 2012; Alexander et al, 2016). While inequalities between schools are well documented (Hutchinson, 2016), disadvantaged schoolchildren in England attract extra funding (Belfield, Goll and Sibieta, 2018) and recent research suggests that the marginal benefit of school funding is higher for disadvantaged children (Jackson et al., 2016; Jackson, 2018). Disadvantaged children in schools are also eligible for a variety of means-tested programmes, most notably free school meals. Losing access to these programmes can increase financial pressure and food insecurity in households (Rai, 2015) and have impacts on children's health (Holford and Rabe, 2020).

The extent to which the loss of school-based instructional time and other school-based programmes will harm students' outcomes and inequalities between them depends on how home learning is implemented in each school and in each family. Existing studies suggest that additional time spent with parents can have positive effects on child development, especially among younger children (e.g. Carneiro and Rodrigues, 2009; Attanasio et al, 2018; 2020). Evidence across several contexts including the UK, the US and Australia show that this effect is driven by time spent on educationally oriented and structured activities rather than unstructured and passive time with parents (Hsin and Felfe, 2014; Fiorini and Keane, 2014; Del Bono et al, 2016). What parents do with the large amount of extra time with their children during this crisis is, therefore, likely to have significant effects on their development.

Even if more time with parents will counterbalance some of the adverse effects of loss of instructional time, it is unlikely to do so equally for all children. There is some evidence that the positive effects of time spent with parents are stronger for children of more educated parents (Del Bono et al, 2016).

The developmental benefits of parental time might also have changed during the lockdown, potentially differentially between families. There is a large literature that links parental wellbeing and stress to children's outcomes. These impacts can be felt from mothers who are stressed while pregnant (e.g. Aizer et al., 2016; Persson and Rossin-Slater, 2018), in childhood (Crnic et al., 1986) and in adolescence (e.g. Gutman et al., 2005; Oreopoulos et al., 2008). This is sobering evidence in light of the current situation; families, particularly low-income families, are facing adverse economic and health shocks. Indeed, several studies have found that the lockdown has had a particularly negative impact on the mental health and wellbeing of women of childbearing age (Banks and Xu, 2020; Henderson et al., 2020). At the same time, children are spending so much more time with their parents and have little access to their wider social and support networks, which in "normal" times might play a protective role.

In this paper, we document the levels of and inequalities in many of these investments, including time spent on educational activities at home; resources provided by schools to replace lost instructional time and social interactions; parental engagement in and ability to support children's learning at home; and the learning environments and resources that children have access to. We also compare these inequalities to the already-large pre-crisis inequalities in how parents and children spend their time.

We are not able to study causal impacts of lockdown on children's learning or test any of these possible mechanisms. However, the evidence we present in this paper suggests that children are at considerable risk of suffering from significant long-term adverse consequences of lockdown, especially those from low income families. In the absence of significant policy intervention in the short-term, these risks may become a reality.

Our results show, predictably, the shift of learning time from school to home, with considerable heterogeneity in the amount of time children spent learning, what activities they did during this time and what resources they had to support their learning. We find that this heterogeneity is strongly associated with family income; in some instances, these socio-economic gradients have increased during the crisis. Furthermore, our analysis suggests that the adverse effects of inequalities in time spent learning between poorer and richer children are likely to be compounded by inequalities not only in resources available at home that children need to make the most of their learning time, but also those provided by schools.

In what follows we start by describing the data that we collected in the next section and how our study sample compares to a nationally representative sample. Section 3 then presents a snapshot of children's time use before and during lockdown on the weekday preceding the day in which the survey was completed, as well as a breakdown of time spent learning into different types of learning activities. We then focus on differences in learning time across children from lower and higher income families in Section 4. Section 5 extends this analysis to also look at differences in the home learning resources available to children by family income and the degree to which these mediate any income gradients in learning time during lockdown. Section 6 concludes.

## 2 Data

To analyse how the lockdown is affecting the time use of children and their learning activities, we use two main sources of data. The first is unique real-time data that we collected through an online survey of families of school-age children living in England in the first two months of the lockdown. The second one is the 2014-15 UK Time Use Survey (Gershuny and Sullivan, 2017).

### 2.1 Real-time survey of time use during the lockdown

We surveyed 5,582 parents living in England with at least one child aged 4 to 15 either entering Reception and in year groups Reception, 1, 4, 5, 8, 9 or 10.<sup>9</sup> These are year groups that will, in the next few years, take one of the standardised national assessments. Our sample was constructed to allow us to link in that information from administrative data sources in the future, once it becomes available, to study the longer-term impact of this crisis on children's learning. However, it also provides important insights into how lockdown and school closures affected what children of different ages and from different families were doing during the summer term, which is the focus of this paper.

Data collection ran over the period of 29 April to 20 June 2020.<sup>10</sup> The survey gathers detailed information on how children spent their time on a term-time weekday. One parent per family was asked to fill an online time diary for one of their (randomly selected) school-aged children, telling us what activities they did during each hour of the previous day and who they were with. Interviews were conducted on Tuesdays to Saturdays (excluding the days after public holidays) to ensure that the information refers to "school" days. We also collected rich information about the types of home learning activities children were doing and the resources they had available for supporting their learning, including those provided by the school and the facilities at home. These data are complemented with detailed demographic and socio-economic information about the family, including on the working status and income of the parents before and during the crisis.

To ensure the representativeness of our sample, we imposed sampling quotas based on a number of characteristics, including the gender, education and pre-lockdown employment status of the respondent parent, and the region of residence of the family. We worked with a reputable online survey company to stratify the sample and ensure it represents diversity in the population along these dimensions.

Predictably this procedure did not produce a balanced sample along additional important characteristics relative to the population of families with children in England. The first and third column of Table A1 in Appendix A show how the distributions of some socio-economic characteristics in our sample compare with those found in the Labour Force Survey (LFS) for 2019, implemented on a representative large sample of the population. The comparison reveals that our sample tends to be

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<sup>9</sup> In England, parents are statutorily obliged to send their child to school from the school term that begins after the child's fifth birthday. However, schools have the discretion to admit children earlier than this, and almost all children in England are in Reception class from September of the year in which they turn four.

<sup>10</sup> 90% of the sample was collected before the 15<sup>th</sup> of May 2020.

better educated and from higher economic strata than the population, which is likely to reflect the fact that the survey was voluntary and conducted online.

To correct for sampling bias, we constructed a subsample from the LFS on criteria similar to our selection rules for surveying families. We used that sample to construct balancing weights for our sample on many characteristics, including parental education, their pre-lockdown working status and income and the types of industry and occupations they worked for, as well as region of residence. The second column of Table A1 shows the means of these variables in our now weighted survey sample and confirms that our re-weighted sample reproduces closely the distribution of these characteristics in the LFS for 2019.

## **2.2. UK Time Use Survey**

In this paper we also use the most recent (2014-15) round of the UK Time Use Survey (UKTUS) as a second source of data in order to compare time use during and before lockdown. The UKTUS is a diary-based time use survey of a representative sample of 4,238 households across all 4 nations of the UK. The survey captures diary information for two randomly selected days of the week, one on a weekday and one on a weekend, for all household members aged 8 and above. Each respondent recorded what they were doing in each 10-minute slot of the day, as well as where they were and with whom. In this paper we utilise data on time use of children aged between 8 and 15 on school days, alongside family composition, number and age of children, and family earnings. More information on the UKTUS can be found in Gershuny and Sullivan (2017). We use weights provided by the survey to ensure the representativeness of the survey.

In order to maximise comparability between the sample in our survey and UKTUS, we exclude children under the age of 8 from our sample for all of the analysis presented in this paper. We now describe the main measures that we use in the analysis for this paper.

## **2.3 Socio-economic Status**

A big focus in this paper is on the differences in children's experiences during the lockdown across families in different socio-economic groups. In our survey, we measure socio-economic background using the family's pre-tax annual earnings in 2019. We equalise this measure to best reflect the amount of resources available to household members, accounting for the fact that bigger families need higher earnings to enjoy the same standard of living and that adults typically require more resources than children.<sup>11</sup> We construct a comparable measure for the UKTUS sample by equalizing reported household income in 2014/15 to account for household size.

## **2.4 Time use of children**

In order to capture time use we asked respondents to fill in information about what the selected school-aged child in the household was doing in each one-hour slot in the previous 24 hours.

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<sup>11</sup> We use standard procedures to equalise earnings and count the first adult as one member, subsequent adults and children 14 and over for half an equivalent member, and younger children for 0.3 of an equivalent member.



Respondents could choose from the following activities: sleeping, personal care, learning, time in school, reading, playing outdoors, playing indoors, socialising, on-screen time, other hobbies and housework. For each, we provided brief explanations and examples of what falls in that group. For adolescents, we also allowed the parent respondent to say they didn't know what the child was doing during a particular hour. Since children may spend less than an hour on a given activity, we allowed respondents to report that a child was doing more than one activity within each one-hour time-slot. Our data thus capture *the number of one-hour slots* during which children reported doing a particular activity. They do not allow us to determine precisely *how long* children spent on a particular activity. While these two measures will be correlated, they will obviously not be equal and the number of one-hour slots is likely to over-estimate the exact time spent on a given activity.

This is a more basic approach to collection of time use data than the one adopted in specialised time use surveys such as the UKTUS, which ask respondents to report what they are doing over the course of 24 hours against a more detailed list of activities and much more frequently. However, this was the best that could be done as part of a 20 minute, online, *recall* time use survey. Time diaries were further complemented with questions on the number of hours a week children spent on four specific learning-related tasks over the course of a typical week during the lockdown. These tasks included online classes provided by the school, any other work set by the school (e.g. home learning packs), time with paid private tutors, and other educational activities. These data allow for more in-depth analysis of the amount of time children spent on key home-learning activities.

In the UKTUS, we aggregate time use categories to construct measures that align with those in our survey. When comparing our time use data to that from 2014-15, we use the 10 minute slots in the UKTUS to construct indicators for whether the child spent any time doing this activity in a particular hour and add up these indicators to measure the number of hourly time slots in which a given activity was recorded. We only include information from surveys conducted on school or college days. When comparing our data on learning-time (based on parental report of total hours spent on specific learning activities over a typical week) to UKTUS data, we aggregate the information from the 10 minutes slots in the UKTUS to measure the number of minutes spent on that learning activity per day.<sup>12</sup>

### 3 Children's time use before and during lockdown

We start by providing an overview of how children were spending their time in lockdown and compare these patterns to those observed a few years before the lockdown, in 2014/15. Figure 1 presents sequences of activities in which children were engaged in each hour over the course of the day; Panel A shows results for the lockdown period and Panel B for before lockdown. For

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<sup>12</sup> We treat outliers in the following way: we set to missing any observations reporting weekly hours above the 95<sup>th</sup> percentile of the distribution of each of the four measures. We divide the weekly information in our survey by 5 to measure time spent on those activities per day so that the measure for our survey is comparable to the measure from the UKTUS. To construct total learning time, we add the time spent on each of the four activities daily. We set any observation reporting more than 12 hours of learning per day to 12.

comparability, we use information aggregated in hourly time slots in both panels. Figures based on the more detailed 10-minute slots available for the UKTUS are shown in Appendix B; they show patterns that are very similar to (although predictably more granular than) those plotted in Panel B of Figure 1. In both panels, we present all of the results separately for primary and secondary school aged children.

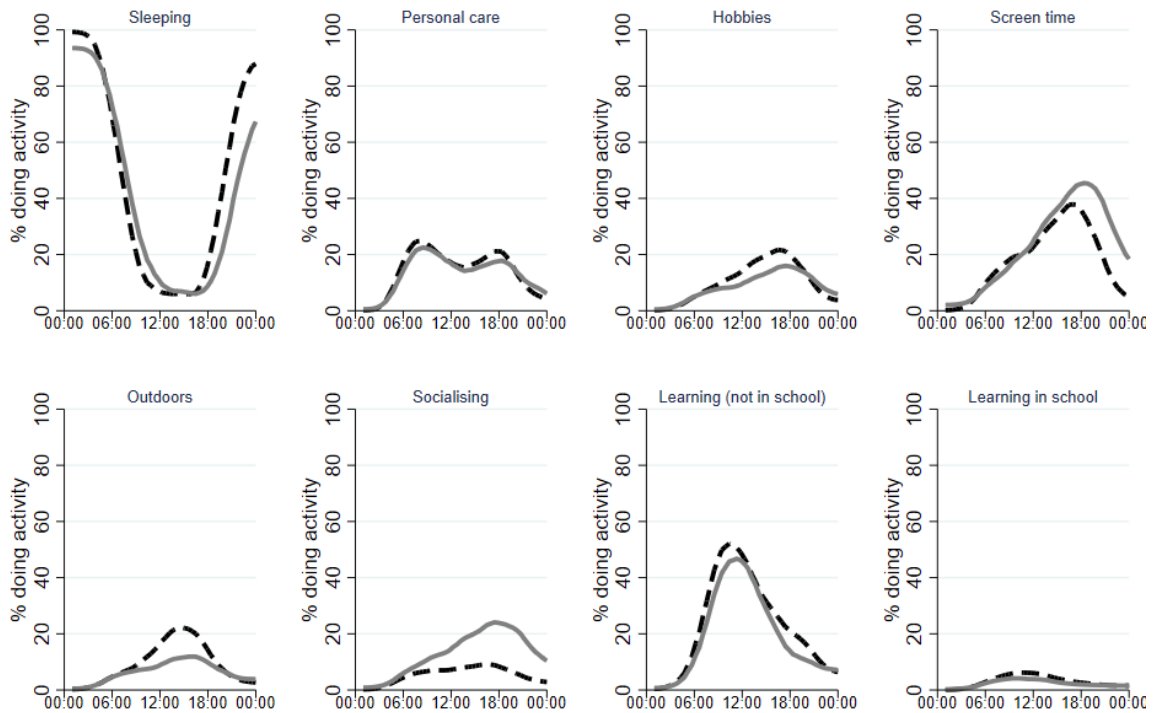
Figure 1 shows some predictable patterns. For instance, sleeping time was broadly unaffected by lockdown: school-aged children sleep throughout the night, with secondary school children going to sleep later (especially during the lockdown) and waking up later than primary school children. Before and during lockdown other personal care is most likely to take place after waking up and before going to bed. These patterns are sensible suggesting that our data are capturing daily activities in ways that are consistent with those in state-of-the-art time use surveys like the UKTUS.

The rest of the children's day is filled with learning and leisure activities. While before lockdown, primary and secondary school children spent roughly the same amount of time socialising, there was a big drop in socialising for primary school age children in May and June 2020. This is likely a direct result of the social-distance measures, which closed down playgrounds and ruled out play dates. Interestingly, older children are socializing just as much as they used to, most likely reflecting the importance of virtual social connections for this age group. In contrast, there was a noticeable decline in proportion of secondary school age children spending time outside throughout the day which is not there for primary school age children. Screen time increased for primary school age children at all points in the day, less so for secondary school age children who were already spending more time on screens than primary school age children before lockdown.

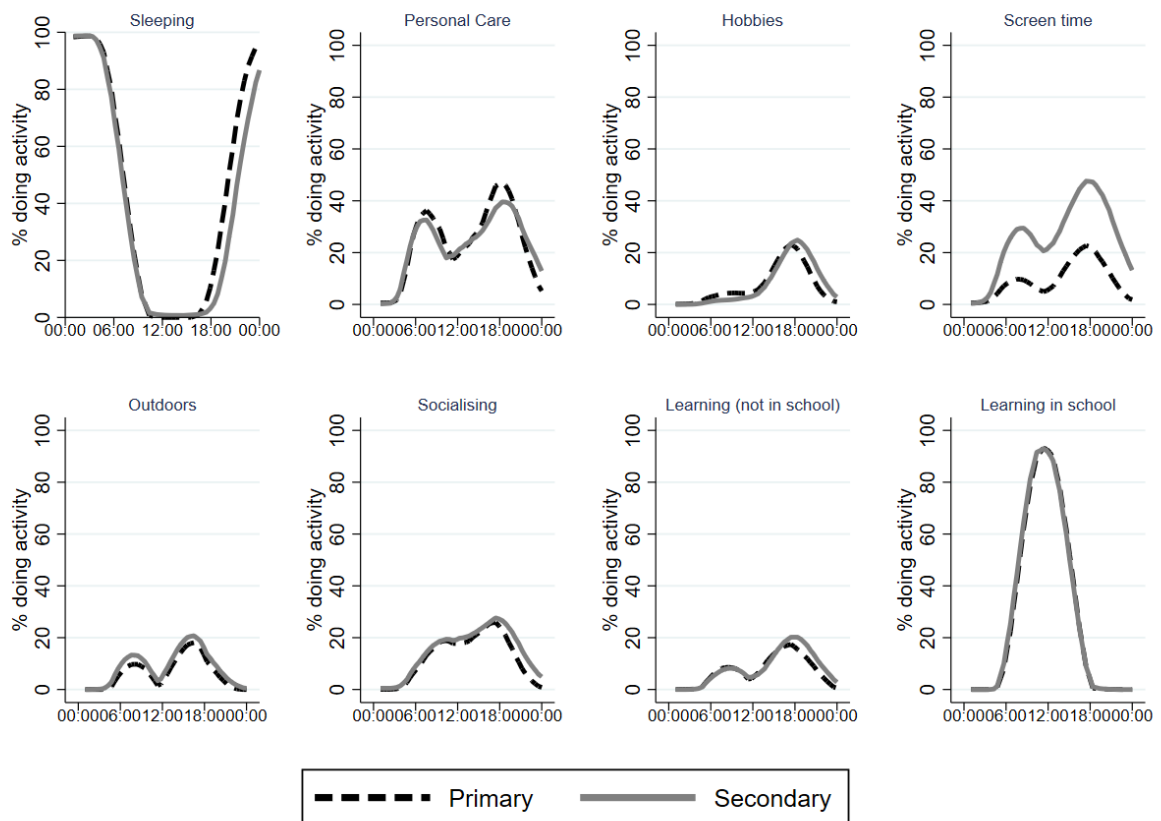
Figure 1 shows that education time shifted from school to being fully concentrated at home for children of all ages. It also shows a decline in the proportion of children engaged in learning related activities at the times of the day when they used to be most prevalent pre-lockdown. A maximum of 50% of children engaging in learning activities in a given hour during lockdown; pre-lockdown the maximum was over 90%. Together this amounts to children spending less time overall in learning activities during lockdown than they used to.

**Figure 1. Children and adolescents' activities over the course of the day during the lockdown**

*Panel A: During the lockdown (May 2020)*



*Panel B: Before the lockdown (2014-15)*



Indeed, this is what we find when we look at data on mean hours spent on learning activities during and before lockdown. Here we move away from learning time reported in time-use diaries and instead use an alternative measure, based on parental report of hours spent in a typical week on different home learning activities, which is more comparable to pre-lockdown measures in UKTUS.<sup>13</sup> Table 1 shows that, in line with Figure 1, average total time in which some learning took place (at school and outside school) decreased from 6.3 hours before lockdown to 4.47 hours during lockdown. The drop was even bigger for secondary school pupils from 6.59 to 4.46 hours.

**Table 1: Average total learning time in weekdays before and during lockdown**

	Primary	Secondary	Total
During lockdown: recall questions	4.49	4.46	4.47
Before lockdown	5.99	6.59	6.3

Note: Recall question measure of learning time during lockdown (Row 1) is calculated by dividing by 5 total time reported in recall questions about time spent on educational activities in a typical lockdown week. The before lockdown measure of learning time is calculated by summing up 10-minute slots in which children report learning in UKTUS 2014/15 data. For comparability with recall lockdown measures we only include children in the UKTUS sample who report attending school for at least some of the time.

While the evidence we have shown so far clearly points to the fact that children were, on average, spending less time engaging in learning activities during lockdown, it does not tell us about differences in the experiences of learning during lockdown. Before lockdown, the vast majority (90%) of all learning activities were carried out in school, in close contact with teachers. During lockdown, however, the time children dedicate to different learning activities is likely to be much more varied and dependent on the resources available to support their learning.

To investigate this, we turn to examining what children were doing during *learning* time in lockdown, using parental report on time spent on online classes, other school work, time with a paid tutor or other educational activities, during a typical lockdown week, and how much variation there was in this across children. First, Figure 2 shows that there were substantial differences in how much time children were spending on any type of learning during lockdown: around a third of children of all ages spent between 2 and 4 hours per day on learning activities and a half did more than 4 hours. There is, however, a non-negligible minority of around 20% of secondary school children and slightly fewer primary school children who did less than 2 hours per day.

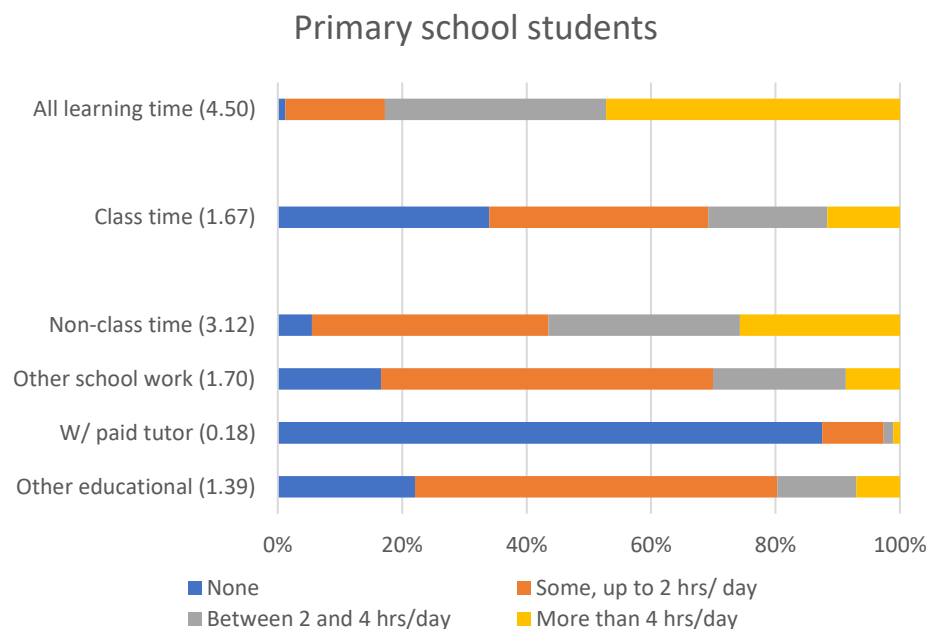
Beyond total learning time, the types of activities conducted is important – some activities are more conducive to learning than others (Hsin and Felfe, 2014; Fiorini and Keane, 2014; Del Bono et al,

<sup>13</sup> There may be a concern that these data would be noisier than the time-diary data we have presented so far as they are collected in a much more aggregated way. However, Appendix Table B.1 shows that the average amount of time spent on learning activities per day based on our time diary data is remarkably similar to that based on the weekly recall data.

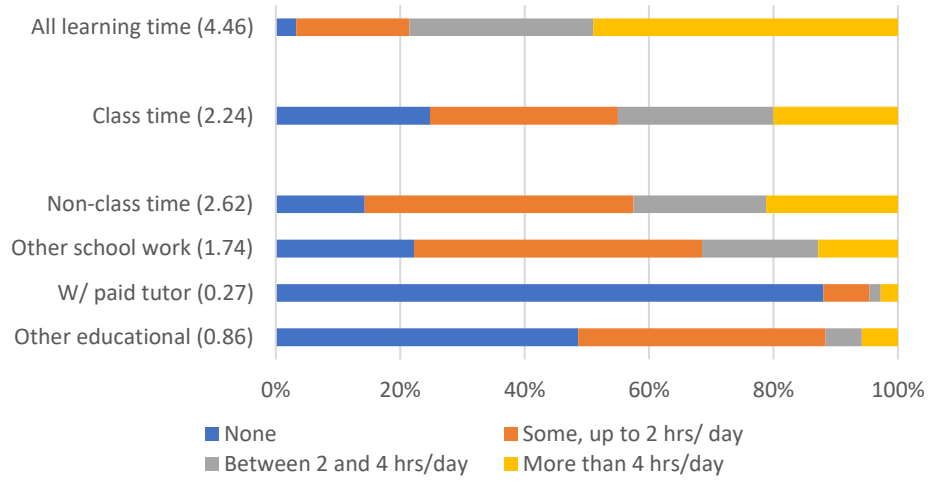
2016). Online classes are likely the closest substitute to a regular class structure that children would have experienced pre-lockdown. On average, online classes account for 1.67 and 2.24 hours of the school days of children in primary and secondary schools, which is a much shorter time than the time taken by regular classes in a normal school day. However, these averages mask large variation; while 34% and 25% of primary and secondary school students report spending 0 hours doing online classes respectively, over 30% of primary school children and over 40% of secondary school children do more than 2 hours.

Outside of online classes, primary and secondary school age children spend another 1.7 hours on school work. Once again, there is large variation in this dimension of time use, but more than 60% of secondary school children and 70% of primary school children do 2 or fewer hours. Only about 7% of children were doing time with a paid tutor during the week, but among those who did, the average time spent with a tutor was less than 20 minutes per day. There is also a large majority of primary school children spending some time on other educational activities outside those for school and tutoring; in contrast around half of secondary school children do not report any time on this category. While it is difficult to interpret these patterns without further information on what the activities include, these patterns could potentially reflect the fact that the work set by primary schools takes less time to do than the work set by secondary schools, leading the parents of primary school children to feel the need to keep their children busy with additional learning activities.

**Figure 2. Distribution of time spent on educational activities on a weekday (from recall questions)**



## Secondary school students



Note: These statistics are computed for a sample of children including those who did not attend school the day before their parents answered the survey, who have valid time diary responses and non-missing answers to the recall questions.

## 4 Socio-economic differences in home learning

Having provided a broad overview of children's time use during lockdown, we now spend the rest of this paper considering the questions of what these patterns may mean for evolution of future educational inequalities between children from higher and lower income families. There is mounting evidence that large socio-economic gaps in education investments are key drivers of the also large socio-economic gaps in education attainment (Attanasio, 2015). There is the real risk that this crisis widens gaps in attainment further by reducing the equalizing role that the time that children spend learning at school rather than at home is likely to play. To investigate this, we start by looking at whether there was a change in the socio-economic gradient in time spent learning as a result of the lockdown. We then study inequalities in the resources that children have available to support their learning at home in the next section.

We quantify the impact of the lockdown on the economic gradient in time spent learning by combining our data with UKTUS data to estimate the following simple two period difference-in-differences regression model:

$$Y_{it} = \alpha + \beta Post_{it} + \gamma Income_{it} + \delta Income_{it} \times Post_{it} + \eta X_i + \epsilon_i \quad (1)$$

where the subscripts  $i$  and  $t$  identify the child and the time period (before and during lockdown), respectively.  $Y_{it}$  is time spent learning, which is computed from the 10-minute slot records in the UKTUS and compared with the recall measures of our survey. The regression includes the variable  $Post_{it}$ , which is a dummy that equals 1 if the observation is from the pre-lockdown (2014-15) and 0 if the observation is from the lockdown period; the variable  $Income_{it}$ , which denotes the family's

rank in the distribution of equivalised gross parental earnings in the pooled sample;  $Income_{it} \times Post_{it}$ , which is the interaction between the two. The parameter  $\gamma$  measures the relation between family income rank and learning time before the lockdown, and the coefficient  $\delta$  measures the change in that relationship between the lockdown. Finally, we also control for a vector of other covariates  $X_i$ , which include age (in years) dummies, number of siblings, and indicators for whether the child lives in a lone parent household and whether he/she is the oldest.<sup>14</sup> Note that we divide the family's income rank variable by 100 so coefficients associated with the variable refer to the effect associated with going up from the very bottom to the very top of the income distribution.

For comparability with UKTUS, as well as expositional clarity we combine the learning time use categories presented in Figure 2 into “Class time”, “Non-class time” and “Total time”. Class time includes time spent in online classes in our survey, and time spent in classes at school/college (including short breaks but not lunch breaks and free periods) in UKTUS.<sup>15</sup> “Non-class time” includes time spent with paid tutor, on other school work and other educational activities in our survey, and time spent on homework and other free time study (including extracurricular activities such as art and music) in UKTUS. “Total time” combines Class and Non-class time.

Table 3 shows estimates of the income gradient separately for primary and secondary school children for each of these three groups of activities. Columns (1)-(3) suggest that the learning time of primary school children was not associated with family income prior to lockdown. That holds for all learning in Column 1 and both class and non-class learning time in columns 2 and 3. This might not be surprising given that most learning activities of young children happen in school, and the length of school days in primary school varies little from school to school. However, the third row of the table shows that family income matters much more during lockdown, with differences in total learning time of nearly 1.5 hours a day between a child at the bottom and at a top of the income distribution. For instance, the estimates in column 1 means that a child in the 10<sup>th</sup> quantile of the family income distribution does about 35 minutes less of learning time per day than her peer in the median income family, and 1 hour 10 minutes less than her peer in quantile 90. Moreover, family income has a larger impact on time spent in (online) classes (Column 2) than on other “Non-class” learning activities (Column 3).

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<sup>14</sup> We also ran the analysis unconditional on this vector of child and household characteristics and the results are very similar. The results are not included in the paper, but available upon request.

<sup>15</sup> Specifically, in UKTUS, we categorise activities referring to “classes and lectures” (activity code 2110) and “Unspecified study”, defined as “Studies at primary, secondary and tertiary education institutions as part of the formal education system, including general and vocational training” (activity code 2000).

**Table 3. Effect of lockdown on inequalities in learning time by income**

	(1)	(2)	(3)	(4)	(5)	(6)
	Primary school students			Secondary school students		
	Total learning time	Class time	Non-class time	Total learning time	Class time	Non-class time
Lockdown	-2.233*** (0.307)	-4.639*** (0.253)	2.616*** (0.169)	-2.070*** (0.259)	-3.680*** (0.198)	1.785*** (0.196)
Income rank	0.124 (0.145)	0.135 (0.121)	-0.00963 (0.0806)	1.221*** (0.152)	0.852*** (0.118)	0.379*** (0.117)
Income rank X Lockdown	1.468*** (0.507)	1.142*** (0.416)	0.500* (0.280)	0.162 (0.436)	0.0145 (0.333)	0.635* (0.330)
Constant	5.733*** (0.149)	5.488*** (0.125)	0.249*** (0.0828)	5.727*** (0.147)	5.276*** (0.114)	0.439*** (0.112)
Observations	1,256	1,298	1,265	1,794	1,863	1,826
R-squared	0.077	0.389	0.405	0.140	0.358	0.165

Note: These coefficients are OLS estimates of Equation (1), which also controls for child's age (in years) dummies, the number of siblings living in the household, and indicators for lone parent household and for whether the child is in the oldest. All regressions are weighted using the weighted we constructed using the procedure described in Section 2. Standard errors are in parenthesis. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The results for secondary school children show a different pattern. For secondary school students there is a much clearer association between income and time spent on class and non-class learning activities before lockdown. The income-class time association could, in part, be due to the possibility that some parents report extra-curricular activities performed at school after core school hours as “classes and lectures” in UKTUS (which would mean that these are included in the “Class time” category) and that better-off children are more likely to engage in these than their less affluent counterparts.

Lockdown did little to change these inequalities. Overall time in class decreased by more than the increase in non-class learning time so that total learning time went down. However, these changes, especially those in overall learning time and class-time, were similar for children from more and less well-off families.

Where we do see a marginally significant increase in inequality is learning time outside of class time. The estimate in column (6) suggests that a secondary school child from 90<sup>th</sup> family income quantile was engaging in about 30 minutes more learning (outside of online class time) than one from the 10<sup>th</sup> quantile by family income.



In all, among secondary school students, there is no significant *worsening* in inequality in total learning time during lockdown, although children from better off households (as before lockdown) continued to spend significantly more time on learning activities than children from worse off households.

## 5 Home learning resources and environment

The quality of home learning resources (provided by schools) as well as the quality of the home learning environment (study space, computer or tablet to access school resources) are likely to play an important role in determining how productive the time that children spend learning is for the accumulation of human capital. Moreover, better learning resources and environment may also make learning more interesting and enjoyable, possibly motivating children to do more of it. Complementarities between learning time and resources could create inequalities in human capital between those who do and those who do not have access to good learning support at home. Their role in determining inequalities may be especially important during the lockdown due to the rapid transition from learning mostly at school to learning exclusively at home; there is likely to be much larger heterogeneity in the degree of preparedness and availability of adequate support across families than across schools.

In this section we describe inequalities in various key dimensions of home learning environments during lockdown. We consider the activities and resources that schools provided to replace school learning, access to digital technology that children can use to contact their teachers and complete their school work, and availability of a quiet dedicated space for learning at home. We then show suggestive evidence of complementarities between learning time and material investments, and we examine whether access to resources can, at least partly, explain the socio-economic gradient of time spent learning during lockdown.

### 5.1 Variability in availability of home-learning resources

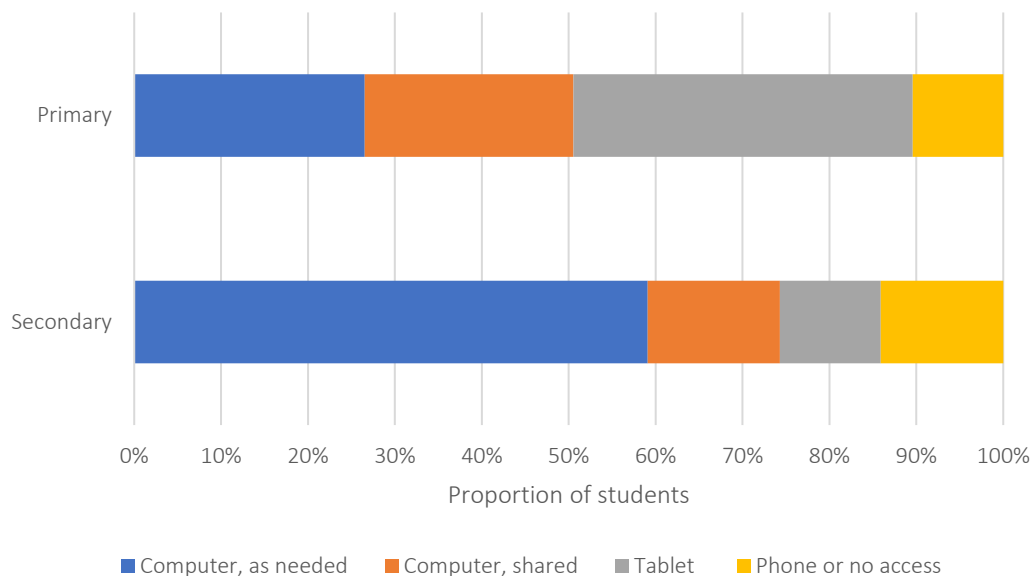
We start by examining the dispersion in learning resources across pupils in Figure 3 in order to show the degree to which different pupils were facing different learning environments at home during lockdown.

Among primary school pupils, only around half had access to a computer for school (either their own or shared with someone else in the family). The most widely reported device was a tablet, used by 39% of primary school students. One in ten students in primary school relied on a phone or had no device at all with which to access school work.

Secondary school students were more likely to have access to computers, especially their own computers. However, one in seven relied on a phone or had no device to access school work. As we

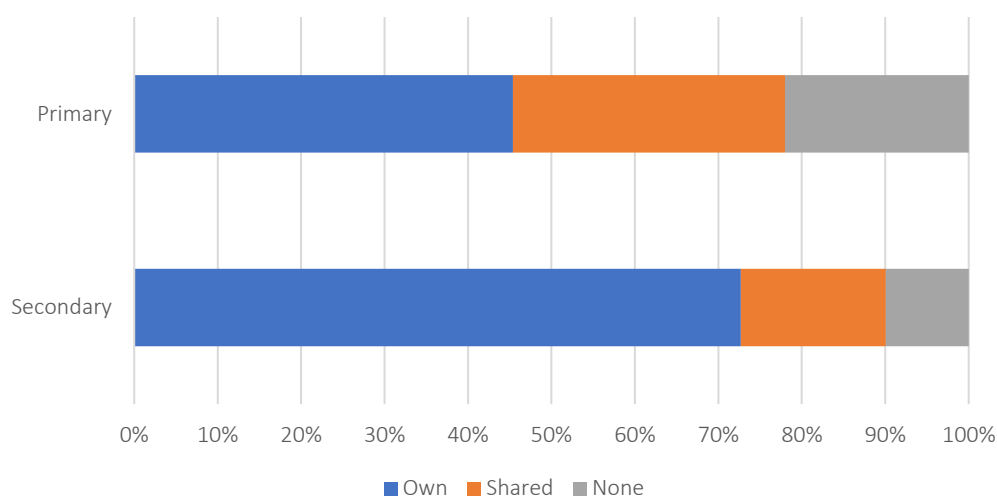
show below this may have been an especially binding constraint since online activities were more widespread in secondary schools (Figure 5).

**Figure 3. Distribution of access to technology among primary and secondary school students**



While access to technology and internet has received a lot of media and policy attention as a potential barrier to productive home learning, much less has been said about availability of appropriate study space at home. We define having a dedicated study space as having one's own desk. Figure 4 shows that fewer than half of primary school students had their own dedicated space to study at home during lockdown and more than 20% did not have access to any study space. At secondary school, this proportion is substantially smaller; one in ten secondary school age children did not have access to a dedicated study space during lockdown.

**Figure 4. Distribution of access to a designated study space**



While home resources can help students make more effective use of their learning time, they are unlikely to substitute effectively for the professional teaching that children receive at school. One of the most striking features of school support for home learning during lockdown was how suddenly it was implemented, but the urgency to deliver led to a fragmented and unequal provision. National guidance was thin on the ground, and largely left it to schools and even individual teachers to determine the aims of and resources for home learning among their students. Early studies from surveys of teachers such as TeacherTapp<sup>16</sup> documented especially large differences between the resources provided by schools for older and younger children, and for those in the state and private sectors.

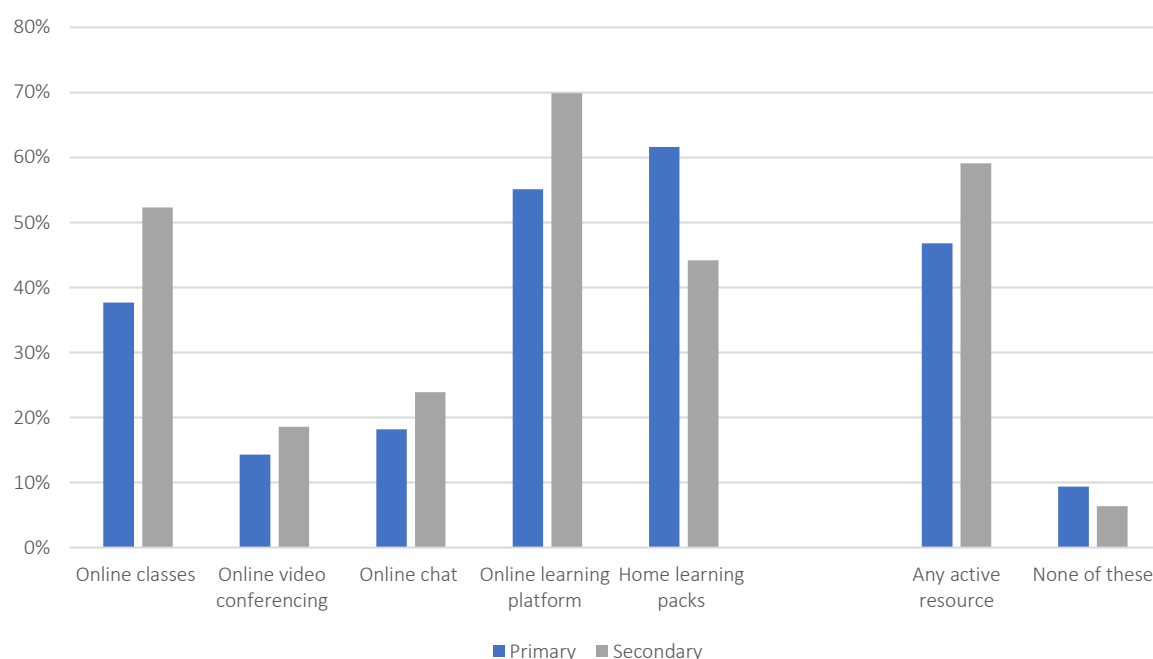
To examine inequalities in school support, we asked parents about the resources that their child's school was providing, regardless of whether they were able to make use of these. Figure 5 shows the dispersion in school resource provision across students. Overall, 9% and 6% of primary and secondary school children, respectively, were not being offered any support through online classes, video or text chat, online learning platforms to set and collect work, or home learning packs at the time we administered the survey (i.e. 1 to 1.5 months after school closures). While this is a relatively small group of students, these children are likely to be significantly disadvantaged from their time in lockdown, without access to school resources to support their learning or maintain ties to their school.

On the other hand, just over half of students – 59% of secondary and 47% of primary students – were being offered some form of active learning (which includes online classes video conferences, or chats). Relatively few students were offered real-time video conferencing or chatting with teachers.

<sup>16</sup> For example, see <https://teachertapp.co.uk/what-does-distance-learning-look-like-in-england-and-where-will-teachers-kids-be-today/>.

These resources can facilitate learning; they may also be helpful for students' social and emotional well-being by helping to preserve connections with school, classmates and teachers.

Figure 5. Home learning resources provided by schools



## 5.2 Inequalities in home-learning resources

A key question is whether the heterogeneity in school responses and home learning environments will widen inequalities between children from higher and lower income families. To assess the likelihood of this we first estimate the association between home learning resources and household income, regressing home learning resources on family income rank, controlling for the same set of covariates as in Eq (1). For conciseness and to highlight the main margins of heterogeneity, we combine similar categories from Figures 3, 4 and 5 to construct the 5 outcome measures for this analysis, presented in Table 4. For the resources provided by the school, we distinguish between “Active Resources” in column 1 (which include online classes, online video conferencing and online chat), “Other Resources” in column 2 (including online learning platforms, home learning packs and emails), and “None” in column 3 (children received no support from school). The outcome variable in column 4 is an indicator for whether the child has access as needed to a computer or tablet for home learning, hence leaving out those who only occasionally have access to these. Finally, the outcome in column 5 is an indicator for whether the child has a dedicated study space, excluding those who share or have no space for learning activities.

**Table 4. Socio-economic gradient in school and home resources for learning**

	(1)	(2)	(3)	(4)	(5)
	School resources			Computer or tablet as needed	Dedicated study space
	Active resources	Other resources	None		
<b>Panel A - Primary school students</b>					
Earnings rank	0.285*** (0.0505)	-0.0917*** (0.0296)	-0.0470*** (0.0176)	0.0766** (0.0299)	0.186*** (0.0521)
Constant	0.407*** (0.0508)	0.882*** (0.0298)	0.0688*** (0.0177)	0.922*** (0.0300)	0.681*** (0.0534)
Observations	1,143	1,143	1,143	1,043	812
<b>Panel B - Secondary school students</b>					
Earnings rank	0.126*** (0.0417)	-0.0218 (0.0261)	-0.0231 (0.0153)	0.0656** (0.0305)	0.0907*** (0.0302)
Constant	0.541*** (0.0460)	0.844*** (0.0288)	0.0647*** (0.0169)	0.846*** (0.0337)	0.801*** (0.0337)
Observations	1,722	1,722	1,722	1,661	1,420

Note: "Active resources" provided by schools include online classes, video conferencing and online chat. "Other resources" include online platforms, home learning packs, emails with information and other resources. "Computer or tablet as needed" is an indicator that takes the value 1 if the child's main device to access schoolwork is a computer or tablet that is always available or available most of the time, and the value 0 if the child's main device to access schoolwork is a phone or no device. "Dedicated study space" is an indicator that takes the value 1 if the child has a desk or dedicated space for studying for him/herself and 0 if the child has no desk or dedicated space for studying. All regressions are weighted using the weighted we constructed using the procedure described in Section 2. Standard errors are in parenthesis. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Estimates in Table 4 shows that income is strongly associated with the home learning resources that we measure in most cases. The income gradients are especially large for active resources provided by schools which we would expect to be most productive for children's learning, and stronger for primary than for secondary school children. For example, a primary school child in the 10<sup>th</sup> income quantile is 23 percentage points (or nearly 50% relative to the overall mean) less likely to receive active school resources than a child in the 90<sup>th</sup> income quantile; the equivalent parameter for secondary school children is 10 percentage points. In turn, better off children in primary school are less likely to receive other resources for learning from schools, or to attend schools that provide no resources at all, than their worse off peers. Moreover, better off families are significantly more likely to provide their children with the home resources needed for learning, including computer/tablet as needed and a desk of their own.

Our results in Section 4 exposed significant levels of inequality in learning time by family income, which increased after lockdown for primary (but not for secondary) school children. The confinement of learning to the home and the inequalities in learning resources that we documented above may have compounded these inequalities. We now investigate this question further by asking whether, as we hypothesised above, there is a link between home learning resources and learning time and, if so, how much of the association between time spent learning and family income is explained by the fact that children from better off families have better resources to support their learning.

Tables 5 and 6 show the results for primary and secondary school students respectively. For each of the three learning time categories studied before (total learning time, class time and non-class time) we present estimates of their association with home learning resources provided by the school and available at home (first column), family income during lockdown (second column),<sup>17</sup> both set of covariates (third column).

Columns 1, 4 and 7 in both tables show the relationship between learning resources and each category of learning time. Most of the home learning resources discussed above are positively associated with our measures of learning time. The provision of online classes or other active learning resources by the school is strongly positively correlated with class learning time for students in primary and secondary schools, but does not explain time spent in other learning activities. Having one's own desk is strongly positively correlated with both types of learning time for primary school students and non-class time for secondary school students. Finally, for both primary and secondary school students having access to a computer/tablet all or most of the time is important for class time but not for non-class time. Combined with evidence of an income gradient in time spent learning presented in Table 3 and in availability of home learning resources presented in Table 4, this evidence suggests that indeed the association between home learning time and income inequality is partly explained by the availability of home learning resources.

Results in the second and third columns for each outcome allow us to quantify the magnitude of the mediating power of the different home learning resources. At the primary school level, we see that adding controls for home learning resources reduces the size of the income rank coefficient by nearly a third for total learning time, with similar reductions in specifications with class and non-class time as outcomes. At the secondary school level, home learning resources appear to be a less powerful mediator of the relationship between family income and learning time, explaining about one tenth of the association between total learning time and family income. It is possible that learning attitudes may be more crystalized among older children, making their efforts less reliant on the resources they have available during this exceptional period. It may also be that we do not do as

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<sup>17</sup> This coefficient on family income in this column can also be computed from Table 3 by adding the second and third row coefficients. The coefficients could be slightly different because while the two regressions condition on the same covariates (child's age, dummy for lone parent household, dummy for the child being oldest, and the number of siblings in the household), we do not include interactions between these covariates and the "Post" dummy in Eq. (1) whose estimates are reported in Table 3.

well at capturing the types of home-learning support that are important at secondary school level as at primary school level; for instance, ability of parents to help with school work. Nevertheless, up to a quarter of the association between family income and *class* time is mediated by differences in learning resources for them, but almost none of the association between family income and *non-class* time.

To gauge the importance of the home learning resources in mediating the relationship between family income and learning time during lockdown, we implement the decomposition proposed by Gelbach (2016). This decomposition allows us to quantify the portions of the gap in learning time between poorer and better off children during lockdown that can be explained by availability of different home learning resources.

For reference, the first row in Panel A of Table 7 reproduces the coefficients on earnings rank presented in columns 2, 5 and 8 of Table 5. Its exact interpretation is the change in hours spent on home learning associated with movement from the 1st to 100<sup>th</sup> family income quantile, or the learning time gap between the poorest and richest primary school age children. The coefficients below show how much of that gap is explained by active support with home learning from the school, availability of home study space and availability of computer/tablet. In total these coefficients add up to the difference in the earnings rank coefficients in the second and third columns under each outcome in Table 5.

The coefficient of 0.294 for active school resources shows that the availability of active school resources explains about 14% ( $0.294/2.063$ ) of the lockdown learning time gap between the poorest and richest primary school students. We see that home-study space explains a similar proportion, while availability of computers only about half of that. Combined variation in home resources explains only marginally (4 percentage points) more of the gap in total learning time between poorer and richer children than variation in support provided by schools. This suggests that decisions made by schools may have had an important role to play in determining home learning activities and inequalities therein during lockdown, of a similar order of magnitude as physical resources available at home. This evidence is reinforced by results for class-time in columns 2 and 3. There, we see that variation in the provision of active school resources explains over a quarter of the gap, more than twice as much as home study space or computer/tablet availability. But although its effect is smaller, having access to digital technology is also a significant driver of time spent learning in online classes for primary school children.

**Table 5: Mediation analysis of learning time during the lockdown among primary school students (Conditional)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total learning time			Class time			Non-class time		
Earnings rank		2.063*** (0.290)	1.391*** (0.285)		1.588*** (0.191)	0.989*** (0.178)		0.751** (0.291)	0.533* (0.296)
Active school resources	1.072*** (0.163)		0.964*** (0.163)	1.463*** (0.103)		1.383*** (0.103)	-0.00686 (0.170)		-0.0468 (0.171)
<i>Home study space (ref: No desk or dedicated study space)</i>									
Own desk/study space	1.447*** (0.220)		1.365*** (0.218)	0.412*** (0.139)		0.357*** (0.138)	1.314*** (0.229)		1.284*** (0.229)
Shared desk/study space	0.569** (0.238)		0.630*** (0.236)	-0.146 (0.151)		-0.106 (0.149)	0.810*** (0.247)		0.834*** (0.247)
<i>Computer or tablet available for studying (ref: no computer or tablet)</i>									
All or most of the time	0.895*** (0.299)		0.775*** (0.297)	0.709*** (0.188)		0.640*** (0.186)	0.214 (0.311)		0.167 (0.312)
Rarely or some of the time	0.116 (0.387)		0.0687 (0.383)	0.338 (0.243)		0.325 (0.240)	-0.250 (0.403)		-0.270 (0.403)
Constant	2.524*** (0.398)	3.733*** (0.292)	1.928*** (0.412)	0.439* (0.249)	1.221*** (0.193)	-0.0125 (0.259)	2.106*** (0.412)	2.797*** (0.291)	1.883*** (0.429)
Observations	1,056	1,057	1,056	1,097	1,099	1,097	1,065	1,066	1,065
R-squared	0.128	0.054	0.147	0.224	0.070	0.245	0.041	0.012	0.044

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1



Table 6: Mediation analysis of learning time during the lockdown among secondary school students (Conditional)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total learning time			Class time			Non-class time		
Earnings rank		1.790*** (0.259)	1.627*** (0.252)		0.948*** (0.189)	0.702*** (0.174)		1.489*** (0.275)	1.465*** (0.273)
Active school resources	1.359*** (0.146)		1.307*** (0.144)	1.718*** (0.0997)		1.696*** (0.0994)	0.0338 (0.159)		-0.00900 (0.158)
<i>Home study space (ref: No desk or dedicated study space)</i>									
Own desk/study space	0.667*** (0.253)		0.596** (0.250)	0.220 (0.170)		0.186 (0.170)	0.674** (0.276)		0.610** (0.274)
Shared desk/study space	0.566** (0.288)		0.432 (0.285)	0.255 (0.194)		0.195 (0.194)	0.681** (0.315)		0.560* (0.313)
<i>Computer or tablet available for studying (ref: no computer or tablet)</i>									
All or most of the time	-0.0202 (0.212)		-0.0787 (0.210)	0.396*** (0.144)		0.371*** (0.143)	-0.235 (0.233)		-0.288 (0.231)
Rarely or some of the time	0.614 (0.490)		0.711 (0.484)	0.0853 (0.339)		0.127 (0.337)	0.425 (0.534)		0.510 (0.530)
Constant	2.709*** (0.349)	3.018*** (0.284)	1.959*** (0.364)	0.937*** (0.237)	1.934*** (0.207)	0.612** (0.249)	1.608*** (0.382)	1.132*** (0.303)	0.944** (0.398)
Observations	1,562	1,563	1,562	1,631	1,632	1,631	1,594	1,595	1,594
R-squared	0.072	0.040	0.096	0.176	0.025	0.184	0.010	0.025	0.028

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

This is an important finding in light of anecdotal evidence that schools were hesitant to provide online support during lockdown in order to not disadvantage poorer children who do not have the home resources needed to access such support; for this reason home learning packs were seen as potentially a more equitable home learning support tool. Our results give some support to this concern, but, since most children have access at least to a shared computer or tablet, they also show that choices made by the schools presented a more significant barrier to access to online learning (class time) for children from poorer backgrounds than lack of home resources.

As noted above, observed home learning resources are less good at explaining learning time gaps at secondary school level. Moreover, they only explain some of the family income gap in *class* (but not in non-class) learning time among these children. Panel B of Table 7 shows that variation in provision of active school resources explains about a fifth of the gap in class learning time between the poorest and richest pupils, while the availability of a computer or tablet to support learning can only explain a modest 3% of that gap. While still important, these figures suggest that learning attitudes and how they vary with the income of the family may already be crystalized among older children in ways that they are not among younger children, so that externally provided resources are less capable of influencing the learning behaviour of secondary school children.

**Table 7: Gelbach decomposition of learning time gaps between children from lower and higher income families**

	(1) Total learning time	(2) Class time	(3) Non-class time
<i>Panel A - Primary school students</i>			
Earnings rank	2.063*** (0.290)	1.588*** (0.191)	0.751** (0.291)
Active school resources	0.294*** (0.0716)	0.431*** (0.0789)	-0.0135 (0.0496)
Home study space	0.272*** (0.0762)	0.124*** (0.0373)	0.191*** (0.0717)
Computer or tablet availability	0.107** (0.0433)	0.0663** (0.0272)	0.0380 (0.0350)
<i>Panel B - Secondary school students</i>			
Earnings rank	1.790*** (0.259)	0.948*** (0.189)	1.489*** (0.275)
Active school resources	0.144** (0.0603)	0.189** (0.0747)	-0.000898 (0.0157)
Home study space	0.0331 (0.0267)	0.0159 (0.0159)	0.0407 (0.0278)
Computer or tablet availability	-0.0257 (0.0222)	0.0326* (0.0178)	-0.0389 (0.0245)

## 6 Conclusions

The closure of schools in spring of 2020 in response to the COVID-19 pandemic disrupted the daily lives and learning experiences of children. The transition period might have been particularly unsettling as families and schools had little time to prepare for new ways of delivering childcare and education activities to homebound children. The different choices made by families about home schooling and childcare provision and by schools about support for home learning during this time may have long-lasting consequences for children's development and inequalities therein.

In this paper we have examined children's time use during lockdown, focusing especially on learning time, with the aim of characterising children's learning experiences during lockdown and inferring, to the extent possible at this early stage, whether educational inequalities are likely to worsen in the longer run as the result of lockdown.

We have used a combination of existing data and novel data that we collected between 29<sup>th</sup> of April and 20<sup>th</sup> of June, 2020, on 5,582 parents living in England with at least one school-age child aged 4 to 15 and in year groups Reception, 1, 4, 5, 8, 9 or 10. A key feature of our data is that it contains information on time use in one hour intervals over the course of the 24 hour period preceding the survey. Although not collected using the same methodology as in specialised time use surveys due to logistical constraints, we show that it compares well to such surveys, alleviating to a considerable degree concerns about excessive measurement error.

Our results offer compelling evidence to suggest that indeed inequalities may have worsened over the course of lockdown, especially for primary school students. We see that a considerable gap in learning time emerges between primary school age children from poorer and better off families, which is not there prior to lockdown. In contrast, for secondary school pupils inequalities in learning time persist over the course of lockdown but do not worsen relative to the pre-lockdown period. Unsurprisingly we find that poorer children live in homes where they are significantly less likely to have access to resources that are positively associated with learning time, including computers/tablets and dedicated study space. Perhaps less predictably, we also find that they had less access to active school support with home learning because their schools were less likely to provide them with support such as online classes, online video conferencing and online chat and more likely to support home learning through more passive means, such as assignment of learning packs.

Anecdotally, at least in part, the justification for this was a concern about inequity if poorer students would be less able to access "active" learning support than richer students due to constraints in resources available at home, such as computers and internet access. However, decompositions of the learning time gap between poorer and richer pupils at primary school level show that variation in provision of active support by schools explains as much of the gap in home learning between poorer and richer students as variation in availability of the home resources for learning that we

measure, suggesting that school choices and/or constraints may have constituted an important driver of inequalities in learning during lockdown.

For primary school students we are able to explain more of the gap between poorer and richer students with differences in physical resources available for home learning (both home and school provided) than for secondary school students (at 33% and 9% respectively). Combined with evidence of little overall change in the income gradient of learning time for secondary school students, this suggests that circumstances during lockdown may have played a more important role in the home learning experience of primary than secondary school students. We cannot rule out the possibility that, in fact, this is because the forms of support that we capture in the survey are more relevant for younger than older children and that other features of the home environment matter more for the latter group, such as parents' ability to help them with their work. However, it could also be that learning attitudes are more crystalized among older children, making their efforts less reliant on the resources available to them during this exceptional period.

We end on a note of caution. While the analysis presented is suggestive of increasing educational inequalities, more needs to be done before firmer conclusions can be made. Future work will link the survey data used in the analysis here to administrative data on children's school attainment before and after lockdown. This will allow us to study directly how lockdown will affect levels of attainment and inequalities therein, controlling for pre-lockdown differences in school attainment and delinquency. The evidence presented so far, however, suggests that there is an urgent need for policies that do not only support catch up at school among pupils who have fallen behind, but also streamline provision of school support over the course of what is likely to be a disrupted school year in 2020/2021.

## 7 References

- Aizer, A., L. Stroud and S. Buka (2016) "Maternal stress and child outcomes: Evidence from siblings", *Journal of Human Resources* 51(3):523-55
- Alexander, K, Pitcock, S, Boulay, M (2016) "The Summer Slide: What We Know and Can Do about Summer Learning Loss". *New York: Teachers College Press.*
- Andrew, A., S. Cattan, M. Costa Dias, C. Farquharson, L. Kraftman, S. Krutikova, A. Phimister and A. Sevilla (2020a). "Learning during the lockdown: real-time data on children's experiences during home learning." *IFS Briefing Note* BN288.
- Attanasio, O. (2015) "The Determinants of Human Capital Formation During the Early Years of Life: Theory, Measurement, and Policies" *Journal of the European Economic Association*, Volume 13, Issue 6, 1 December 2015, Pages 949–997, <https://doi.org/10.1111/jeea.12159>
- Attanasio, O. A, Andrew, E, Fitzsimons, S, Grantham McGregor, C Meghir, M Rubio-Codina (2018). "Impacts 2 years after a scalable early childhood development intervention to increase psychosocial stimulation in the home: A follow-up of a cluster randomised controlled trial in Colombia." *PLOS Medicine* 15(4): e1002556.
- Attanasio, O. S Cattan, E Fitzsimons, C Meghir, M Rubio-Codina, (2020). "Estimating the Production Function for Human Capital: Results from a Randomized Controlled Trial in Colombia," *American Economic Review*, vol 110(1), pages 48-85.
- Belfield, C., D. Goll and L. Sibieta (2018). "Socio-economic differences in total education spending in England: middle-class welfare no more." IFS Briefing Note BN242. Accessed online: <https://www.ifs.org.uk/publications/13662>.
- Blundell, R., M. Costa Dias, R. Joyce and X. XU (2020). "covid-19 AND Inequalities", *Fiscal Studies*, Vol. 41(2): 291-319.
- Burgess, S. and A. Vignoles (2020). "The Covid-19 crisis and educational inequality." Campaign for Social Science. Accessed online: <https://campaignforsocialscience.org.uk/news/the-covid-19-crisis-and-educational-inequality/>.
- Carneiro, P., M. Rodriques (2009) "Evaluating the effect of maternal time on child development using the generalized propensity score. 12<sup>th</sup> IZA European Summer School in Labour Economics
- Crini, K. M Greenberg, N Slough (1986) "Early stress and social support influences on mothers' and high-risk infants' functioning in late infancy". *Infant Mental Health Journal*. 7(1):19–33.

Del Bono, E. M Francesconi, Y Kelly, A Sacker (2016) "Early Maternal Time Investment and Early Child Outcomes" *The Economic Journal* vol 126, Issue 596, p96-135

Education Endowment Foundation (2020). "Impact of school closures on the attainment gap: Rapid evidence assessment". London: Education Endowment Foundation. Accessed online at: <https://educationendowmentfoundation.org.uk/covid-19-resources/best-evidence-on-impact-of-school-closures-on-the-attainment-gap/>.

Eyles, A., S. Gibbons and P. Montebruno (2020). "Covid-19 school shutdowns: What will they do to our children's education?" *CEP Covid-19 analysis* Briefing note No. 001. Accessed online: <http://cep.lse.ac.uk/pubs/download/cepcovid-19-001.pdf>.

Fiorini, M. and Keane, M.P. (2014). "How the allocation of children's time affects cognitive and non - cognitive development", *Journal of Labor Economics*, vol. 32(4), pp. 787–836.

Gelbach, J. (2016). "When do covariates matter? And which ones, and how much?" *Journal of Labor Economics*, University of Chicago Press, vol. 34(2): 509-543

Gershuny, J. and Sullivan, O. (2017). United Kingdom Time Use Survey, 2014-2015. Centre for Time Use Research, University of Oxford. [data collection]. UK Data Service. SN: 8128, <http://doi.org/10.5255/UKDA-SN-8128-1>

Gutman Leslie Morrison, McLoyd Vonnie, Tokoyawa Teru (2005) "Financial strain, neighborhood stress, parenting behaviors and adolescent adjustment in urban African American families." *Journal of Research on Adolescence*. 15(4):425–449.

Hsin, A. and Felfe, C. (2014). "When does time matter? Maternal employment, children's time with parents, and child development", *Demography*, vol. 51(4), pp. 1867–94.

Hutchinson, J. (2016) "School inspection in England: is there room to improve?", Education Policy Institute Report, <https://epi.org.uk/wp-content/uploads/2018/01/school-inspection-in-england-web.pdf>

Jackson, C. K., R. C. Johnson, and C. Persico (2016). "The Effects of School Spending on Educational and Economic Outcomes: Evidence from School Finance Reforms." *Quarterly Journal of Economics*, vol. 131(1), 157–218.

Jackson, C. K. (2018). "Does School Spending Matter? The New Literature on an Old Question." Working Paper 25368, National Bureau of Economic Research.

Lavy, V. (2015), "Do Differences in Schools' Instruction Time Explain International Achievement Gaps? Evidence from Developed and Developing Countries". *Economic Journal* 125(588): F397-F424.

Marcotte, Dave E. and Steven Hemelt. (2008). "Unscheduled Closings and Student Performance," *Education Finance and Policy*, vol. 3, pp. 316-38.

Marcotte, Dave E and B Hansen (2010) "Time for School?" *Education Next*, Vol. 10, No. 1

Oreopoulos, Philip, Marianne E. Page, and Ann Huff Stevens (2008) "The Intergenerational Effects of Worker Displacement," *Journal of Labor Economics* 26:455-483.

Persson, Petra, and Maya Rossin-Slater. 2018. "Family Ruptures, Stress, and the Mental Health of the Next Generation." *American Economic Review*, 108 (4-5): 1214-52.

Pischke, Jörn-Steffen. (2007). "The Impact of Length of the School Year on Student Performance and Earnings: Evidence from the German Short School Years," *Economic Journal*, vol. 117: 1216-42.

Rai, S (2015) "Food Poverty: School Holidays and Wider Impact" (Report). *Northern Housing Consortium*. Available at: <http://neytco.co.uk/food-poverty-school-holidays-and-wider-impact/> (accessed 22 May 2015).

Slates, SL, Alexander, KL, Entwisle, DR. (2012) "Counteracting summer slide: Social capital resources within socioeconomically disadvantaged families". *Journal of Education for Students Placed at Risk* 17(3): 165–185.

Steward, H., N Watson, M Campbell (2018) "The cost of school holidays for children from low income families" *Childhood*, Volume: 25 issue: 4, page(s): 516-529

## Appendix A: Data

Table A1. Means for our survey sample (weighted and unweighted) compared with nationally representative LFS sample



Characteristics reweighted on	IFS-IoE survey, unweighted	IFS-IoE survey, reweighted	Comparable LFS sample
<b><i>Family structure</i></b>			
Single mother	0.184	0.244	0.222
Single father	0.079	0.022	0.017
Couple	0.737	0.734	0.761
<b><i>Women's education</i></b>			
GCSEs or less	0.265	0.339	0.367
A levels	0.310	0.262	0.249
University degree	0.425	0.398	0.384
<b><i>Men's education</i></b>			
GCSEs or less	0.306	0.376	0.416
A levels	0.259	0.230	0.229
University degree	0.435	0.393	0.354
<b><i>Single Mum's education</i></b>			
GCSEs or less	0.358	0.441	0.495
A levels	0.423	0.308	0.272
University degree	0.219	0.251	0.233
<b><i>Prior employment</i></b>			
Women's pre-crisis employment	0.728	0.752	0.745
Men's pre-crisis employment	0.877	0.919	0.935
Single mum's	0.732	0.700	0.678
<b><i>Women's pre-crisis earnings</i></b>			
£0–£9,999	0.306	0.455	0.476
£10,000–£24,999	0.427	0.290	0.285
£25,000–£39,999	0.128	0.153	0.151
£40,000+	0.139	0.102	0.089
<b><i>Men's pre-crisis earnings</i></b>			
£0–£9,999	0.095	0.135	0.131
£10,000–£24,999	0.338	0.211	0.206
£25,000–£39,999	0.251	0.305	0.301
£40,000–£59,999	0.163	0.187	0.188
£60,000+	0.153	0.162	0.174
<b><i>Single mum's pre-crisis earnings</i></b>			
£0–£9,999	0.300	0.556	0.594
£10,000–£24,999	0.521	0.283	0.256
£25,000–£39,999	0.084	0.122	0.115
£40,000+	0.094	0.039	0.035
Pre-crisis industry			
<b><i>Proportion working in industry where 50%+ of jobs have been locked down</i></b>			

Women	0.330	0.255	0.231
Men	0.331	0.287	0.264
Single mums	0.394	0.323	0.282
<b><i>Proportion working in occupation where home working is possible in 0–15% of jobs</i></b>			
Women	0.314	0.327	0.327
Men	0.347	0.351	0.362
Single mums	0.351	0.379	0.392
<b><i>Proportion working in occupation where home working is possible in 15.1–75% of jobs</i></b>			
Women	0.211	0.217	0.237
Men	0.271	0.212	0.192
Single mums	0.228	0.272	0.300
<b><i>Proportion working in occupation where home working is possible in 75.1–100% of jobs</i></b>			
Women	0.474	0.456	0.436
Men	0.382	0.437	0.445
Single mums	0.421	0.349	0.309
<b><i>Region</i></b>			
Greater London	0.184	0.125	0.118
South East	0.148	0.211	0.235
South West	0.102	0.104	0.097
West Midlands	0.109	0.111	0.107
North West	0.145	0.143	0.136
North East	0.072	0.065	0.061
Yorkshire and the Humber	0.091	0.105	0.113
East Midlands	0.079	0.087	0.092
East of England	0.071	0.050	0.041

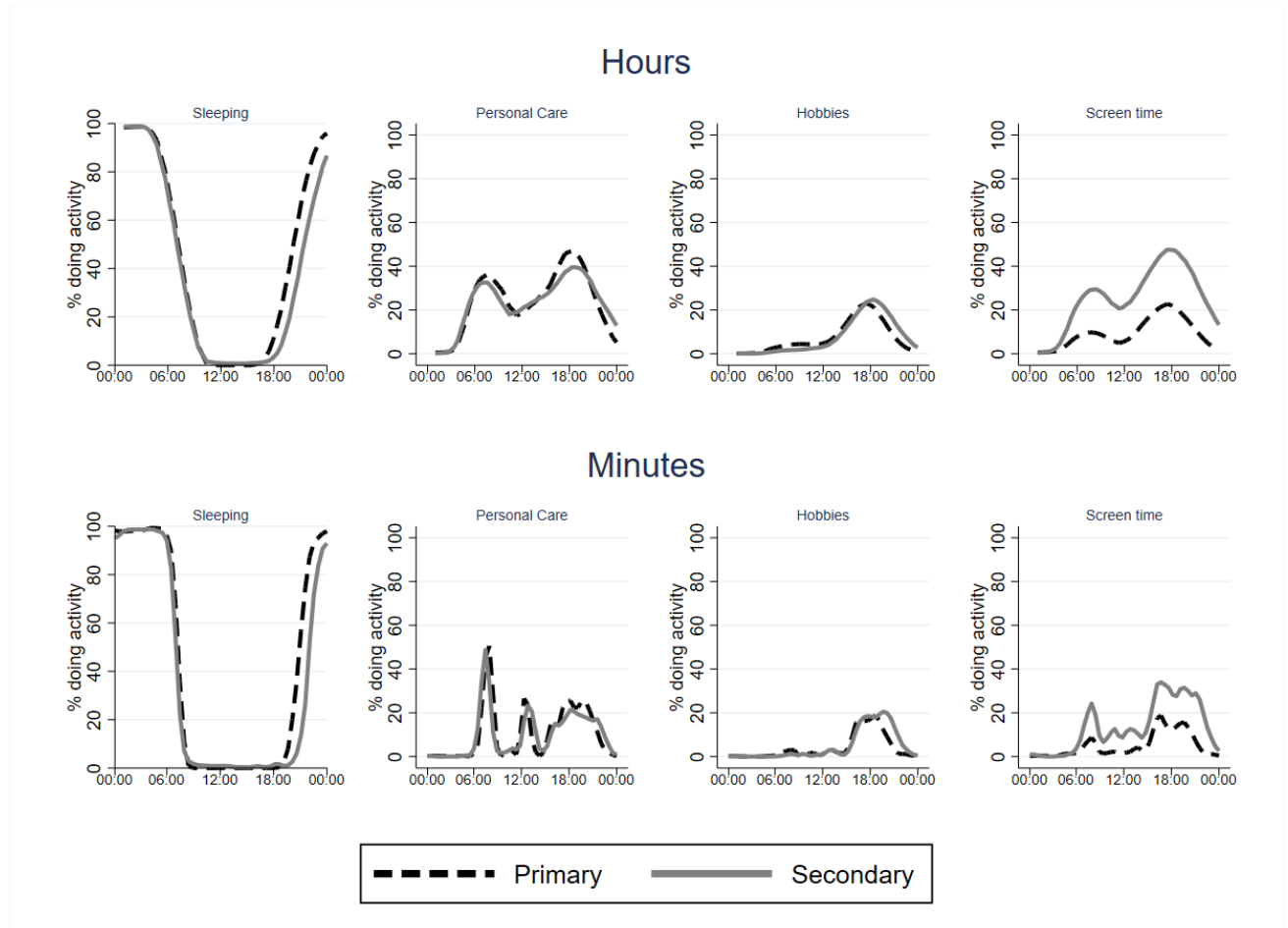
Note: This table reports the means of the variables in the LFS comparable sample (N = ) and in our survey sample, before and after being weighted.

Source: LFS 2019 and Covid-19 Online Survey of Families with Children.

## Appendix B: Extra table and figures

**Figure B.1 Children and adolescents' activities over the course of the day 2014/15 – 1 Hour compared to 10 Minute Intervals**

PANEL A:



PANEL B

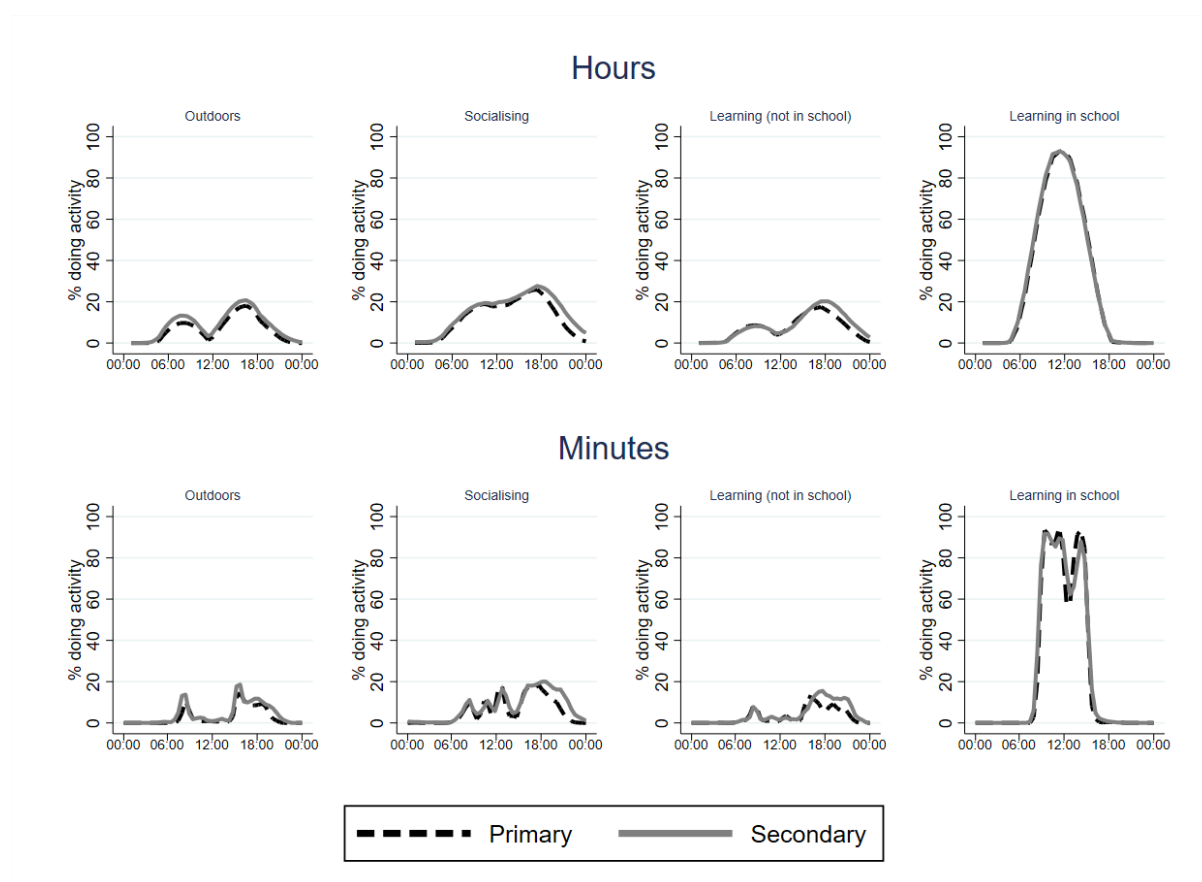


Table B.1: Different ways of measuring time spent on learning activities in a day during lockdown

	Primary	Secondary	Total
One-hour slots (time-diary data)	4.91	4.58	4.77
Parental recall of learning time in a typical lockdown week	4.495	4.46	4.472