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Laura M. Crispin

lcrispin@sju.edu

Saint Joseph's University

Elizabeth Mitchell

City of Philadelphia

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Laura M. Crispin^{1*} and Elizabeth Mitchell²

^{1*}Department of Economics, St. Joseph's University, 5600 City Avenue,
Philadelphia, 19131, PA, USA.

²Office of the Director of Finance, City of Philadelphia, 1401 John F
Kennedy Blvd., Philadelphia, 19102, PA, USA.

*Corresponding author(s). E-mail(s): lcrispin@sju.edu;
Contributing authors: ebm.mitchell@gmail.com;

Abstract

Using data from the 2017 through 2022 American Time Use Survey, our paper is the first to analyze the time allocated to skill-building and leisure activities for high school and live-at-home college students by household income, just before and during the Covid-19 pandemic. We explore time allocated to educational activities (class time and homework) as well as work, leisure activities (socializing, exercise, screen time), and sleep, all of which may have changed substantially due to the pandemic and the move to virtual or hybrid schooling, with a comparison of students directly before (2017 to mid-March 2020) and during the pandemic (mid-May 2020 to December 2022). Our results show that students reduced educational time during the pandemic relative to the pre-pandemic period. This was largely a reduction in class time with limited change in homework time, with particularly large declines in class time for low-income students. Participation and

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time spent in other productive activities was largely unchanged. The likelihood of socialization decreased, while screen time increased substantially during the pandemic, especially for low-income students. These findings suggest that post-pandemic, schools may need to provide additional academic supports for students and may need to find ways to reduce screen time and increase opportunities for in-person interaction.

Keywords: time use, high school, college, Covid-19

JEL Classification: J22 , I24

1 Introduction

In the United States, the Covid-19 pandemic has had significant impacts on students' educational experiences, forcing many students to move to virtual/remote or hybrid learning abruptly in March 2020. A Gallup poll conducted in April 2020 showed that 83% of K-12 students were learning virtually, with 4-11% of students receiving no instruction ([Brenan 2020](#)). As the pandemic progressed, only four states mandated fully in-person learning for the 2020-2021 school year and 74% of the 100 largest school districts remained virtual ([Staff 2021a](#)). This is further documented in Figure 1, showing that in the 2020-21 school year, in-person learning by state-month averaged as low as 40%, with significant variation in each month and across the year, and did not return to normal levels until the 2021-22 school year.¹ This has likely changed the way that students allocate their time to educational activities (class and homework) and work – activities that are all associated with human capital accumulation – and potentially increased time towards leisure activities such as watching TV and playing computer games. Additionally, this has changed the amount of social interaction, with an increase in alone time for these different activities ([Kalenkoski and Pabilonia 2025](#)).

These changes are likely to be heterogeneous by income, given that many low-income students may not have had access to the internet or other essential technology to move to online schooling ([Wolfman-Arent 2020](#), [Staff 2021b](#), [Friedman et al. 2021](#), [McClain et al. 2021](#)). By understanding how students have re-allocated their time towards/away from skill-building activities during the pandemic, along with differences by household income, our findings may help policymakers and administrators combat Covid learning loss (which may be substantial [[Kuhfeld et al. 2020](#)]), on-the-job training gaps, and increased screentime to minimize any longer-run impacts of the pandemic on student outcomes.

¹Data for this graph is from [Burbio School Opening Tracker \(2024\)](#), representing the percentage of online, hybrid, and in-person learning across K-12 schools within a county, then aggregated to the state level using the appropriate weights.

Our paper is the first to use the American Time Use Survey (ATUS) to provide comprehensive estimates of the effect of the Covid-19 pandemic on students' time allocation, particularly disaggregating by household income. Prior to the pandemic, researchers found that only 29% of high school students engage in extracurriculars and only 11% of high school students engage in paid work (Crispin and Kofoed 2019), while for (live-at-home) college students, extracurricular participation is lower (12% of students) and paid work is more prevalent (33% of students) (Crispin and Nikolaou 2018). However, for both groups, when participating, the time spent working or in extracurriculars was significant (1.5 or more hours devoted to extracurriculars, and 5 or more hours spent working). Studies have also shown that (prior to the pandemic), students made significant time tradeoffs between various activities, including working and homework (Kalenkoski and Pabilonia 2012), and working and sleep (Kalenkoski and Pabilonia 2012), working and extracurriculars (Crispin and Kofoed 2019), and extracurriculars and educational time (specifically homework) (Crispin and Nikolaou 2018).

Related to the pandemic's effect on student time use, there is relatively little research. Wray-Lake et al. (2022) study a sample of 555 high school students during the summer of 2020 to understand their time allocated to educational activities, work, and media (including TV, video games, social media). They find that teens spent the most time watching TV and on social media, and that those who engaged in more educational activities spent less time online with friends and social media. Kalenkoski and Pabilonia (2025) use the ATUS to study teens' time use during the pandemic with a focus on alone time and well-being. They find large increases in leisure time spent alone, and large decreases in education time, with notable differences for girls and boys.

At the college level, Aucejo et al. (2020) find that there are significant heterogeneous effects of the pandemic on time use, with one quarter of students significantly

increasing their study time (+4 hours per week) and one quarter significantly decreasing their study time (-5 hours per week). [Jaeger et al. \(2021\)](#) also find that students have reduced study time during the pandemic.

Recent research more commonly studies other pandemic-related impacts on student outcomes, with some particularly focused on lower-income students. For instance, at the college-level, [Aucejo et al. \(2020\)](#) find significant declines in academic performance, delays in college graduation, job/internship losses, and reductions in earnings, and that students from lower socioeconomic backgrounds are more likely to have been affected. [Kofoed et al. \(2024\)](#) finds causal evidence of the effects of online classes on student outcomes, where online college students had lower academic performance than those randomly assigned to in-person classes. International evidence shows similar negative effects during the pandemic, with many students' internships being canceled, students withdrawing from classes or leaving university altogether, which are again shown to be disproportionately affecting lower income students ([Jaeger et al. 2021](#)).

For K-12 students, there is also a growing body of research. [Wright et al. \(2025\)](#) studies a sample of low-income early elementary students in Oklahoma before and after the pandemic and finds significant learning loss in both math and reading, though once back in school post-pandemic, their learning growth returned to normal.² [Strunk et al. \(2025\)](#) finds similar learning loss for middle school students, with larger effects for lower-income students. [Kuhfeld et al. \(2020\)](#) estimates projections of possible learning loss among third to eighth graders due to the early stage of the pandemic, predicting that students may have begun Fall 2020 with only 63% to 68% in reading gains and 37% to 50% of math gains relative to a typical year, with more variability than usual. [Goldhaber et al. \(2022\)](#) find similar effects, and also note the larger gaps for lower-income school districts. [Halloran et al. \(2021\)](#) focus on learning modality across school

²See [Wright et al. \(2025\)](#) for a more detailed review of the literature on learning loss among K-12 students, particularly lower-income students.

districts during the pandemic, finding that pass rates of state standardized math tests were lower during the pandemic, but more so for districts with less in-person learning.³

To contribute to the literature, our analysis uses a sample of high school and live-at-home college students from the 2017-2022 ATUS, focusing on time allocated to educational activities, work, leisure activities (socialization, screen time, and exercise), and sleep. We first provide descriptive analyses of time allocated to these activities pre-pandemic (2017 to mid-March 2020) and during the pandemic (mid-May 2020 to December 2022) to identify changes in time use that may be due to the pandemic. Given that time allocation may differ by a number of demographic and background characteristics, we estimate two types of models: first, we estimate probit models to predict the likelihood of engaging in the activity during the pandemic versus the pre-pandemic period, conditional on observable characteristics (extensive margin); second, we estimate linear models using OLS to predict the changes in time allocated to each activity for those who engaged in the activity on their diary day in the pandemic versus pre-pandemic periods, conditional on observables (intensive margin). We also include interactions with a low-income indicator to test for differences by socioeconomic status. To further understand time spent in educational activities, we also exploit the hierarchical nature of the data available in the ATUS to study the location of educational activities and whether done with household members (particularly parents) present versus alone.

This paper proceeds as follows: In Section 2, we describe the empirical framework for our main analysis, followed by a discussion of our data in Section 3. Then, in Section 4 we discuss our descriptive and regression results, along with the subsample analysis and hierarchical results. We end with conclusions and discussion in Section 5.

³In related research, [Bacher-Hicks et al. \(2021\)](#) document the growing digital divide during the pandemic, showing that search intensity for online learning resources was significantly higher in higher-income areas during the pandemic.

2 Framework and Empirical Strategy

2.1 Framework

Regardless of the pandemic, students choose to allocate their time to various productive and leisure activities based on their own tastes and preferences, which are influenced by individual and household characteristics, as well as external factors such as length of the school day, job availability, and the cost of activities (e.g. tuition, room and board, fees for extracurriculars and sports).

The pandemic has created additional considerations and constraints. Students may be attending courses virtually or in a hybrid setting (see Fig. 1), which may reduce some of the costs associated with education (e.g., transportation), but may also change the psychic costs of education, depending on their preference for and comfortability with their new learning style. Some students may have to put in additional effort to focus on virtual/hybrid learning and/or minimize distractions in their learning environment, and may need to complete more assignments asynchronously outside of class time. Other students, who had previously not experienced virtual learning, may thrive in an online or hybrid setting with more opportunities to work at their own pace at their chosen time. Therefore, it is unclear what the net effect of the pandemic will be on educational time, and there may be differences in class time and homework time. It is important to note that this ebbed and flowed, varying across states and over time. This also may have affected high school and college students differently as college students tend to have had more flexibility in their class schedule than high school students.

As the labor market conditions deteriorated in the early stages of the pandemic, many workers were unemployed, and many quit due to other obligations or due to the risks or uncertainty of the virus itself ([Petrosky-Nadeau and Valletta 2020](#); [Faberman et al. 2022](#); [Gittleman 2022](#)). Conversely, those who were previously not working may

have entered the labor force in order to support themselves or their families (added worker effect) (Lundberg 1985; Baldini et al. 2018). Thus, the effect of the pandemic on working and work time for students must be determined empirically.

Finally, as students may have had their extracurriculars and sports cancelled due to restrictions on gatherings and events (National Federation of State High School Associations 2020; Moody 2020), students may have reduced their time in these skill-building out-of-school activities and replaced this time with more online or on-screen activities like social media activity and watching TV. Conversely, with additional time spent at the computer for virtual classes or homework, some may have chosen to counteract screen time with additional time in athletic and extracurricular activities. Again, the effect of the pandemic on sports and extracurricular activities, as well as leisure activities, is an empirical question.

The effect of the pandemic on each aspect of time use may differ by household income. As discussed earlier, students in lower-income households may have had less access to needed technology (Bacher-Hicks et al. 2021, Wolfman-Arent 2020, Staff 2021b, Friedman et al. 2021, McClain et al. 2021), which could affect their ability to attend class online or complete online assignments, or their ability to work remotely.

2.2 Empirical Strategy for Regression Analysis

To estimate the participation in and time allocated to various skill-building activities prior to and during the pandemic, we estimate two different types of models. First, to estimate changes in the extensive margin due to the pandemic, we estimate a series of probit models:

$$P(A_{ijt} = 1) = \beta_0 + \beta_1 Covid_t + \beta_2 X_{it} + \beta_3 H_{it} + \beta_4 L_{it} + \epsilon_{it} \quad (1)$$

Where the probability of student i participating in activity j at time t , A_{ijt} , is a function of whether it is during the pandemic ($Covid_t$), the student’s characteristics (X_{it}) and household characteristics (H_{it}) that may influence their tastes and preferences, and location characteristics that may proxy for local labor market conditions as well as pandemic-related factors such as positivity rates and local restrictions (L_{it}). The error term includes all unobserved factors that may affect a student’s decision to participate in activity j .

Second, to estimate the change in the intensive margin due to the pandemic, we estimate a series of OLS models only for those who participated in activity j :

$$MinA_{ijt} = \delta_0 + \delta_1 Covid_t + \delta_2 X_{it} + \delta_3 H_{it} + \delta_4 L_{it} + v_{it} \text{ if } MinA_{ijt} > 0 \quad (2)$$

where time use for student i in activity j at time t is measured in minutes ($MinA_{ijt}$) and all other terms are defined above.

We estimate these models for the activities and samples described below in Section 3 using the appropriate sample weights with standard errors clustered at the state level.⁴ We also test the dynamics of the effect of Covid by considering the early pandemic period and later pandemic period separately. Since high school students may be subject to more mandatory educational hours with less flexibility in their schedules, among other differences, we also test each of these models separately for the high school and college subsamples. Additionally, we test for differences in the effect of the pandemic on time use by socioeconomic status using an interaction between the Covid indicator and an indicator for whether the student is in a low-income household. Finally, we extend these basic models to then analyze specific time use by location and who was present for education, class, and homework.

⁴Documentation ([ATUS 2025](#)) that all analysis should use person-level weights (WT06 for all years other than 2020 and WT20 for 2020), which we use for our main analysis. Other documentation ([CPS 2025](#)) indicates that replicate weights are more appropriate for estimating standard errors due to the survey design. We estimate our main results using replicate weights and find no substantive differences between results with survey weights and replicate weights. We provide the main analysis with replicate weights for comparison in the appendix.

3 Data

We use data from the American Time Use Survey (ATUS) from 2017 through 2022.⁵ This provides several years of pre-pandemic data to compare with the pandemic period. ATUS respondents are selected from the outgoing rotation groups of the Current Population Survey, completing a 24-hour time diary beginning at 4 a.m. on their diary day. In addition to documenting the activities that they engaged in and the time spent in these activities, respondents also provide information on where they were located, who they were with, and when appropriate, secondary activities such as childcare. To construct our sample, we include high school and college students only, regardless of their full-time or part-time status.⁶ We exclude anyone who is older than 25 to isolate traditional college-aged students, for a final sample size of 2,495. This includes 1,368 high school students and 1,127 college students, which we pool for the main analysis and use separately for subsample analysis.

Our key time use variables fall into two broad categories: skill-building activities (educational time, including class and homework, paid work), leisure activities (all leisure, socialization and communication, screen time, exercise and sports), and sleep.⁷ The focus of this paper is on educational time, which we define broadly as time allocated to educational activities or travel related to educational activities (BLS_EDUC). We also decompose educational time into class time (BLS_EDUC_CLASS) and homework time (including research; BLS_EDUC_HWORK) because the nature of the pandemic may have affected each component differently.⁸

We construct binary variables for each of these time use categories equal to one if the student engaged in that activity for any amount of time on their diary day, and equal to zero otherwise. We refer to this as the “extensive margin.” We also use the

⁵Data are downloaded from IPUMS (Flood et al. 2023).

⁶Students are typically only interviewed if they are living in the household, so the sample of college students primarily captures college students living at home with their parents.

⁷Though extracurricular activities and art-related activities are also important skill-building activities, the sample size of the number of participants was small, leading to limited variation to use for analysis.

⁸For further details on the construction of each time use variable, see the appendix. For summary statistics of each time use variable and all other variables, see Appendix Table 1.

continuous measure of each of the time use variables for those who participated, all in minutes, referred to as the “intensive margin.”

To test for differences in the pre-pandemic versus pandemic periods, we create a Covid indicator equal to one if the year is 2020 and the month is greater than March. It is important to note that the ATUS staff did not conduct interviews from March 18, 2020 to May 9, 2020, so we were unable to include the very early phase of the pandemic in our analysis.⁹ Our sample consists of 1,468 students in the pre-pandemic period and 1,027 in the pandemic period.¹⁰ We also test for differences across the pandemic by changing the Covid indicator to allow for differences in the early pandemic period (May 2020 to March 2021; N=453) and later pandemic period when vaccines became more widely available (April 2021 to December 2022; N=574).¹¹

We include a range of demographic characteristics and location controls in our regression analysis. For demographics, we include age (in years), race and Hispanic ethnicity, sex, household income, and school status (level and full-time or part-time status). To test for heterogeneity across household income, we define low income as those in households earning at or below \$34,999, which corresponds to approximately the 25th percentile of the income distribution. For location, we include Census region and metro fixed effects. We also include a month indicator to account for monthly variation in education, and a holiday indicator equal to one if the diary day is a holiday. Summary statistics for the full sample are provided in Appendix Table 1.

To exploit the hierarchical nature of the data, we also use the “who with” and “where” data associated with the individual time-use records. For our analysis, we are most interested in the location of educational activities (school, home, or elsewhere)

⁹For more information about the effect of the pandemic on the ATUS data collection and methods, see <https://www.bls.gov/tus/covid19tech.htm>.

¹⁰We find no notable differences across demographics of the sample from the pre- to pandemic period. There is a small increase in the share of the sample in the “other race/ethnicity” category and in the highest income category, but there were no other statistically significant differences at the 5% level in the sample. See Appendix Table 2 for this comparison.

¹¹In robustness checks, we eliminate mid-March through mid-May for all years to test whether this inclusion affects results. We also exclude summer months (June through August) and January to test whether the inclusion of summer and winter break affects the results.

and for those at home, who was present (parent, other adult, other children/students). High school students were not asked about who they were with during class time, so this analysis is restricted to college students only.

4 Results

4.1 Descriptive Analysis

The results of the descriptive statistics are provided in Table 1. For each of the activities listed, we provide the share of students participating in that activity on their diary day, then the minutes of time spent in the activity for those who participated, separated by time period. As shown, the share of students engaged in education-related activities does not differ substantially over the pre- and during Covid periods, but the minutes of education decrease significantly during Covid by 33 minutes. When we separate out class and homework time, specifically, we find that the share attending class declines by 3 percentage points (pp.) and the minutes of class time for those attending classes decline by 23 minutes, but we find no statistically significant difference for homework participation or time for those participating. We also find no statistically significant difference in work participation nor time. With regards to leisure activities, we find significant increases in time spent in leisure, generally, and specifically screen time, with respective increases of 25 minutes and 40 minutes. We also find that students were less likely to socialize during the pandemic (-11pp.). These patterns suggest that students were largely impacted in reduced class taking and class time, but not in other skill-building time uses. Students may have used time gained from educational reductions to increase leisure activities, though further analysis is required to test this hypothesis.

To explore the dynamics of these changes in time use since 2017, we provide graphs of the mean time use for education time (Fig. 2), class time (Fig. 3), and homework

time (Fig. 4).¹² For education and class time, there is a notable decline in average time use in the immediate pandemic months and the 2020-21 school year, in general. For homework time, we see a slight increasing trend in the 2020-21 school year, but in the following year, is similar to pre-pandemic trends.

Because of the changes to education due to pandemic restrictions and precautions, we further explore aspects of these specific activities. For education, we analyze where the educational activity took place: school, home, or elsewhere. In Figures 5, 6, and 7, we show the mean of educational time on the diary day averaged by month-year at school, home, and elsewhere, respectively. Several notable patterns emerge relative to Figure 2. First, while the aggregated graph of education time shows small changes in time during the early phase of the pandemic, the graphs by location show substantial differences in educational time. As expected, educational time at school declined dramatically during the entire 2020-21 school year and into the 2021-22 school year relative to the pre-pandemic years. Next, we see the opposite pattern in education time at home, with significant increases during the 2020-21 school year and persisting beyond into the next school year. Additionally, we also observe relatively low averages of educational time elsewhere during the 2020-21 year, but notable increases (and seemingly more volatility) in educational time elsewhere in 2022, indicating a potential shift. These figures show patterns consistent with expectations: during the pandemic, restrictions closed schools and students traded learning at school with learning at home, while educational time at other locations began to increase in the later pandemic.

While it is important to consider the sample as a whole, as discussed earlier, the pandemic had a particularly large impact on lower-income students relative to their peers. Therefore, in Table 2, we consider descriptive statistics by income, specifically

¹²The mean by month-year is calculated using the entire sample, which includes those who participated in an activity on their diary day and those who did not.

focusing on educational time. We find that for students in mid-to-high income households (\$35K+), time spent in educational activities declined during the pandemic by 20 minutes, while for low-income students(<\$35K), a decline of 75 minutes. This suggests that for low-income students, education was particularly affected at the intensive margin during the pandemic. For class time, we see especially large declines for low-income students. For mid-to-high income students, class time fell by 10 minutes, while for lower income students, the decline was 75 minutes, resulting in a difference of more than an hour per day. For homework, time actually increased by 10 minutes for mid-to-high income students, but fell by 13 minutes for low-income students. If we consider the early pandemic period specifically, these disparities are even larger. For leisure activities, lower income students spend notably more time socializing during the pandemic, but significantly less time exercising, relative to their peers (+43 minutes and -48 minutes, respectively). Taken together, these findings suggest disparities in skill- and health-building activities for lower income students during the pandemic. The results from these descriptive statistics, however, are based on relatively small sample sizes for the low-income group during the pandemic period, and should therefore be interpreted with caution.

We provide graphical analysis to demonstrate the time trends of educational time for low-income relative to higher-income students in Figures 8 through 10. While low-income students had an overall decline in educational time relative to their peers, these graphs show that education time at school was especially low during the pandemic, while education time at home was higher. Education time elsewhere is also relatively lower for low-income students, but there are several sharp spikes during and after the pandemic, suggesting that lower-income students may have needed to rely on libraries and other locations for their education at specific times. However, we again caution about drawing strong conclusions from this disaggregation as it is based on relatively small samples, and is only provided to show suggestive patterns in the data. That said,

these suggestive patterns do indicate more substantive difference in education beyond changes in time use, including time learning online, parental oversight, and whether there were other distractions or childcare expectations for those learning at home.

4.2 Regression Results

Next, we estimate probit models of the extensive margin with marginal effects provided in Table 3 and on the intensive margin for those who participate on their diary day in Table 4. Conditional on observables, we find that the patterns suggested by descriptive statistics hold. As shown in Table 3, all else equal, the pandemic does not seem to have affected the likelihood of participation in any of these activities except socialization. We test the robustness of these results by eliminating summer months (June, July, and August) and then also eliminating January, and the results are largely unchanged.¹³

However, as shown in Table 4, after conditioning on observables, those engaged in educational activities reduced education time by 34 minutes, largely stemming from an 18 minute reduction in class time. If we assume students take classes five days per week, this would imply a reduction in class time by 1.5 hours per week. Conversely, students increased their leisure and screen time on the intensive margin by 19 minutes and 37 minutes (or 4.3 additional hours of screen time in a seven-day week), respectively. Neither homework, work, socialization, exercise, nor sleep had statistically or economically significant differences during the pandemic on the intensive margin, all else equal. These findings suggest that there may be significant learning loss due to less class time, which does not seem to be replaced by increases in homework (or out of class educational activities) nor other productive activities like working or exercise, but instead replaced with leisure activities (generally) and screen time. Eliminating summer months and January resulted in slightly larger reductions

¹³Results available upon request.

in educational time (-40 minutes) and class time (-21 minutes), and slightly larger increases in leisure (+28 minutes) and screen time (+40 minutes).¹⁴

When we separate the earlier and later Covid periods, we find patterns similar to the descriptive statistics. As shown in Table 5, Panel A, students were only affected on the extensive margin for class during the early Covid period (-5.5pp.) and in both periods for socialization (-16.9pp. and -9.4pp., respectively), but as Panel B shows, they were much more significantly affected on the intensive margin in the early Covid period. Students reduced their educational time by -62 minutes per day during the early Covid period, with significant reductions in class time of -31 minutes. Conversely, they increased their leisure time by +43 minutes, their screen time by +61 minutes, and their sleep by +14 minutes. Screen time increases persisted into the later Covid period, with an increase on the intensive margin by +24 minutes. These findings suggest much more extreme changes in time use during the early Covid period away from skill-building activities and toward leisure activities, but that time use returned to pre-pandemic levels during the pandemic recovery phase with the exception of screen time. If we restrict our sample to exclude summer months and January, we find statistically and economically significant reductions in educational time in both the early and later Covid periods (-67 minutes and -27 minutes, respectively), with larger reductions in class time in the early Covid period (-37 minutes), and larger increases in leisure and screen time in the early Covid period (+60 minutes and +70 minutes, respectively).

These results indicate that educational time was significantly impacted, particularly during the early phase of the pandemic, and largely reduced class time with no evidence of an increase in asynchronous work (i.e. homework or research) to compensate. The increases in leisure time, and specifically screen time (for leisure, not schoolwork) observed particularly in the early Covid period, suggest that educational

¹⁴Results available upon request. Estimates using replicate weights instead of survey weights are provided in the appendix. The results are largely unchanged.

time may have been replaced with screen time, persisting beyond the early pandemic phase. Finally, the results on the extensive margin suggest that while students did not seem to reduce their likelihood of participating in most activities during the pandemic, socialization was affected, persisting into the later Covid period, and may have implications for students' social-emotional development and mental health.

Next, we show the results separately for high school and college students in Tables 6 and 7, respectively. For high school students, on the extensive margin (Panel A), we find similar results as those for the full sample: the only change is a -12.8pp. reduction in the likelihood of socialization. On the intensive margin (Panel B), again similar to earlier results: high school students reduce their education and class time by -33 minutes and -22 minutes, respectively, increase their leisure by +29 minutes, increase their screen time by +41 minutes, and increase their sleep by +18 minutes. For separate Covid periods, Panel C shows that there was an initial reduction in the likelihood of attending class by -7.5pp., and a persistent reduction in the likelihood of socializing by -17.4pp and -10.1pp in the early and later periods, respectively. On the intensive margin (Panel D), similar to the earlier results, these findings show that for high school students, the changes in time use were largely in the early Covid period, with reductions in education time (-76 minutes), class time (-62 minutes), and work time (-57 minutes), and increases in homework time (+29 minutes), leisure time (+72 minutes), socializing time (+46 minutes), screen time (+77 minutes) and sleep time (+21 minutes). Time use for high school students seems to have returned to pre-pandemic norms in the later Covid period.

For college students, Table 7 Panel A shows similar results as those above: only a reduction in the likelihood of socializing by -10.6pp. In Panel B, we find that education time decreased by -43 minutes, while screen time increased by +39 minutes. Separating out the early and later Covid periods, Panel C shows again the persistent effects of the pandemic on the likelihood of socializing (-17.4pp. in the early period, -10.1pp.

in the later period), while Panel D shows that on the intensive margin, there is a persistent decline in education time (-58 minutes, and -34 minutes, respectively), and a persistent increase in screen time (+51 minutes and +32 minutes, respectively). This is a much smaller sample relative to the high school subsample, however, so it is possible that with small sample sizes for certain activities, it is difficult to estimate precise changes. That said, the findings comparing these two subsamples suggest that high school students were particularly affected by the pandemic in both reductions in skill-building activities and increases in leisure activities.

4.3 Heterogeneity by Household Income

Regression results for the extensive margin including the interaction between the low-income and Covid indicators are provided in Table 8.¹⁵ In Panel A, the results show that for most categories, there is not a statistically significant difference for the Covid period by income on the extensive margin.¹⁶ The exception is for socialization, where students in mid-to-high income households are less likely to engage in socializing (-12.7pp.) than lower income students (-9.4pp.). In Panel B, the results are somewhat different by Covid period. In the early Covid period, we find that low-income students are less likely to participate in class during the early pandemic period (-10.3pp.), with no statistically significant change for mid-to-high income students. Low-income students also increased their likelihood of leisure during the early pandemic period (+6.7pp.), again with no statistically significant change for mid-to-high income students. Mid-to-high income students did have a notably lower likelihood of socializing during the early pandemic period (-19.9pp.), with no change for low-income students,

¹⁵Estimates that use replicate weights instead of sample weights are included in the appendix. The results are largely unchanged. Robustness checks that eliminate summer months and January lead to similar conclusions, though are less precisely estimated likely due to smaller sample size. These results are available upon request. We also tested the sensitivity of our results to the missing data due to Covid. To do this, we eliminated March 18 through May 9 for all years and re-estimated these regressions. Again, we find that our main results still hold and are somewhat larger in magnitude (for instance, the reduction in class time for low-income students was -59 min during the pandemic, but only -25 min for higher-income students), but overall, the main patterns and general magnitudes of our results still hold.

¹⁶Regression results of the extensive margin available upon request.

while in the later period, low-income students reduced their likelihood of socializing (-13.2pp.) more than higher-income students (-8.6pp.).

On the intensive margin, however, results in Table 9, Panel A show that for low-income students, there are significant differences in time use during the pandemic compared to those in mid-to-high income households. For education, there is a reduction in education time by -63 minutes during Covid, while for higher-income students, the reduction is only -29 minutes, for a difference of 34 minutes per day. For class time, low-income students reduced class time during the pandemic by -50 minutes, with no statically significant difference for higher-income students across the pre-pandemic and pandemic periods. Similarly, low-income students increased their screen time significantly during the pandemic (+53 minutes) relative to mid-to-high income students (+36 minutes), while lower-income students decreased their exercise (-35 minutes), with no significant difference for higher-income students. For both groups, there are no significant differences for work, socialization, or sleep time on the intensive margin, and leisure time is only marginally increased for higher-income students (+20 minutes).

When separating by pandemic period (Panel B), the differences are dramatically larger between income groups in the early pandemic period. In the early period, lower-income students decreased education time and class time by -105 minutes and -86 minutes, respectively, and these reductions persisted into the later period (-44 minutes and -37 minutes, respectively). Their exercise time was also lower during the pandemic (-49 minutes). However, for higher-income students, there was an initial reduction in education time by -46 minutes, but no significant reduction in class time and no lasting difference in the later period, and no reduction in exercise time. For leisure activities, we find large increases for lower-income students during the early pandemic: +96 minutes of leisure, +80 minutes of screen time. In contrast, mid-to-high income

students only increased leisure time by +29 minutes and increased screen time by +55 minutes, which did persist into the later Covid period (+26 minutes).

Taken together, these findings suggest that among those who participated, higher-income students had more time in skill-building and health-related activities during the pandemic than low-income students, particularly for educational activities including class. For class time, specifically, the difference in 50 minutes per day would amount to 4.2 hours per week. These findings also suggest that low-income students may be substituting away from skill-building activities and toward screen time, which could result in significant skill gaps post-pandemic.

4.4 Regression Results using Hierarchical Data

Earlier descriptive analysis showed that during the pandemic, time use for education varied by location (particularly for low-income students) and by who was present. To quantify the magnitude of these changes, we estimate the same regression models as above, but focus on the time use variables that reflect education time by location (school, home, elsewhere), and by who was present (alone, parent, other adult, siblings or other children). The “where” results are provided in Table 10, Panel A for the full sample and Panel B for the interaction model by household income, and the “who with” results are for live-at-home college students are discussed below.

For the “where” results on the extensive margin in Panel A, we find that students are +6.1pp more likely to participate in education at home, but -15.7pp and -13.7pp less likely to participate in education at school or other location (respectively) during the Covid period. Similarly, for class, students are +12.1pp more likely to engage in class at home and -15.1pp less likely to engage in class at school during Covid. For homework, however, we find that the likelihood of participating in homework at school declines by -4.3pp during Covid, but there is no offsetting increase in homework participation at home or other location.

On the intensive margin, for those who participated in education on their diary day, we find a significantly large increase in the minutes of education time at home (+62 min) and at other locations (+29 min), but no offsetting decline in minutes of education at school. For class time, specifically, for those who attended class, there was also an economically significant increase in class time at home (+166 min), but only a small decline in class time at school (-14 min). Homework time was not significantly different during the pandemic, regardless of location.

In Panel B, the extensive margin results show that lower income students were less likely to participate in education at school during Covid than higher income students (-17.6pp vs. -16.4pp). For class, lower-income students had a nearly identical offset in the reduction in the likelihood of attending class at school (-15.6pp) and the increase in attending class at home (+15.4pp), while for mid-to-high income students, the decrease in education at school (-16.2pp) was not offset by the increase in education at home (+10.9pp). For homework, both groups saw a significant decrease in the likelihood of participating in homework at school (-5.2pp and -4.0pp, respectively), with no significant increase in homework at home.

On the intensive margin, we find that lower-income students increase their education time at home by only +48 minutes during the pandemic, compared to higher income students with an increase of +62 minutes. Higher income students also had an increase in education time in other locations of +28 minutes, with no significant difference for lower-income students. For class time, specifically, higher-income students had a sizable increase in class time at home during the pandemic (+168 minutes), but lower-income students did not have a significant difference. Neither group had a significant difference in homework time in any location.

For the “who with” analysis, we find minimal effects of the pandemic on education at home with either adults or children.¹⁷ However, for education at home, we find that

¹⁷This analysis is only for live-at-home college students due how the data was collected. Results not shown for brevity, but available upon request.

the likelihood of engaging in education at home alone increases by +11.6pp. during the pandemic, and for those engaged in education, the time spent in education at home alone increases by +65 minutes relative to the pre-pandemic period. This indicates that college students are learning online, but in isolation during the pandemic, which again has implications for social-emotional skills and mental health.

5 Discussion and Conclusion

Using data from the American Time Use Survey, our analysis is the first to explore the time use of high school and live-at-home college students during the Covid pandemic to determine how time use toward educational activities, other productive time uses, and leisure activities may have changed. The results from both the descriptive and regression analyses above show that indeed, parents, administrators, and policy makers may be concerned about reduced participation in educational activities and educational time, particularly class time, for students during Covid at both the high school and college level. This is particularly concerning for students in low-income households, who had much larger reductions in educational time relative to their higher-income peers.

Our main results show that during the Covid period, class time declined by 17.6 minutes per day, which would equate to a decline of 1.5 hours across a 5-day school week. For low-income students, the class time reduction was 50.3 minutes per day, equating to a loss of 4.2 hours across the school week. We do not find that there were any notable increases in homework time during the pandemic to offset these class time declines, which explains a possible mechanism for learning loss during the pandemic. The results that separate out the early and later pandemic periods show that most of the changes in time use happened during the early phase of the pandemic, but that some changes (specifically reduction in class time for lower-income students) were sustained over the entire pandemic period. Furthermore, the reductions in educational

time do not seem to coincide with increases in other productive time uses such as paid work, exercise, or sleep. Instead, results show that screen time during the pandemic increased by 37 minutes per day (3 hours/week) and more so for lower-income students. Furthermore, our findings show that for education, particularly class, there was a shift to learning from home (increased likelihood by 12.p.p. and increased time by 166 minutes), and for college students, online learning was likely done alone.

Throughout the pandemic, as educational time declined overall and transitioned to online learning, the likelihood of socialization decreased, and overall screen time increased, our findings suggest that there may be significant concern about students' learning loss, isolation and mental-health, and general concerns about students' human capital accumulation and overall well-being. However, based on this analysis, there are a number of avenues that policymakers and administrators could pursue to support students post-pandemic. Within school, these may include reducing the amount of online/asynchronous assignments in favor of in-person learning, along with increasing opportunities for in-person interactions among students. Outside of school, parents may consider limiting teens' screen time, while schools and local organizations may consider offering more opportunities for in-person extracurriculars, exercise, and socialization. Such policies and offerings may be particularly impactful for lower-income students, whose time use during the later Covid period did not return to pre-Covid norms, and may be facing longer-lasting effects of the pandemic on their human capital accumulation and overall well-being.

Finally, there are several related topics that may be of interest to future researchers using the ATUS. For brevity, we did not expand our analysis of paid work. There are emerging patterns in the overall labor market recovery post-Covid and it would be interesting to see whether the labor market recovery of high school and college students followed the same patterns as working-age adults. Additionally, we did not estimate time substitution models, but it may be useful to estimate whether reductions in class

time were associated with increases in other productive and leisure time uses, which may also provide additional policy insights for school administrators. Lastly, given the range of news and research documenting the challenges that lower-income students faced during the pandemic, we focused exclusively on this demographic comparison. However, there may be location-based, gender, or racial differences, among others, that would be helpful to explore to obtain a deeper understanding of time allocation during the pandemic and create targeted policies for stronger pandemic recovery. A limitation of the ATUS, however, is that it does not include students' outcomes, and for high school students, does not include the "who with" data for educational activities. With a different dataset, another important avenue for research would be the presences of parents during online learning, and whether this impacts educational time or outcomes.

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Table 1 Descriptive Statistics and Difference in Means Tests for Pre- and During Covid Periods

	Pre-Covid (N=1468)			Covid (N=1027)			Diff in Means
	N	Mean	SD	N	Mean	SD	
Education							
Participated		0.64			0.63		-0.01
Minutes if EDUC>0	813	384.08	199.26	568	351.53	185.48	-32.55***
Class							
Participated		0.44			0.40		-0.03
Minutes if CLASS>0	457	327.05	130.51	284	303.80	132.43	-23.25**
Homework							
Participated		0.47			0.46		0.00
Minutes if HWORK>0	615	177.06	142.32	440	180.93	134.93	3.87
Work							
Participated		0.20			0.20		0.00
Minutes if WORK>0	262	358.82	168.92	199	358.74	177.69	-0.08
Leisure							
Participated		0.95			0.95		0.00
Minutes if LEISURE>0	1411	316.82	191.09	972	341.46	199.84	24.64***
Socializing							
Participated		0.42			0.30		-0.11***
Minutes if SOC>0	620	109.31	133.65	316	119.77	123.63	10.45
Screen time							
Participated		0.82			0.84		0.02
Minutes if SCREEN>0	1232	207.97	156.04	868	248.25	180.58	40.28***
Exercise/Sports							
Participated		0.27			0.26		-0.02
Minutes if EXERCISE>0	384	118.44	92.66	282	112.66	92.89	-5.78
Sleep							
Participated		1.00			1.00		0.00
Minutes if SLEEP>0	1466	566.36	132.56	1,025	571.95	133.93	5.59

Notes: *** .01; ** .05; *.10; All analysis uses sample weights.

Table 2 Descriptive Statistics by Income Category

	Mid-to-High Income, Pre-Pandemic (N=1,073)		Mid-to-High Income, Pandemic (N=787)			Low Income, Pre-Pandemic (N=395)		Low-Income, Pandemic (N=240)			
	Obs	Mean	Obs	Mean	Diff-in-Means	Obs	Mean	Obs	Mean	Dif-in-Means	Diff-in-Means by Income
		[1]		[2]	[3] = [2]-[1]		[4]		[5]	[6] = [5]-[4]	[7] = [6] - [3]
Education Participated		0.65		0.64	-0.01		0.63		0.62	-0.02	-0.01
Minutes if EDUC>0	597	375.69	436	355.24	-20.45	216	412.05	132	337.31	-74.74	-54.30*
Class Participated		0.44		0.41	-0.03		0.43		0.39	-0.04	-0.01
Minutes if CLASS>0	337	322.69	216	313.18	-9.52	120	341.79	68	267.28	-74.51	-64.99**
Homework Participated		0.47		0.46	-0.01		0.46		0.47	0.01	0.01
Minutes if HWORK>0	451	168.45	337	177.59	9.13	164	205.72	103	193.19	-12.53	-21.66
Work Participated		0.19		0.20	0.01		0.20		0.21	0.01	0.00
Minutes if WORK>0	187	367.90	147	360.30	-7.60	75	330.22	52	353.31	23.09	30.69
Leisure Participated		0.96		0.95	-0.01		0.91		0.95	0.04	0.05
Minutes if LEIS>0	1040	322.61	746	343.99	21.38	371	296.90	226	332.07	35.17	13.79
Socializing Participated		0.44		0.31	-0.13		0.36		0.27	-0.09	0.04
Minutes if SOC>0	476	111.92	257	114.02	2.10	144	98.85	59	144.26	45.41	43.31
Screen time Participated		0.82		0.83	0.01		0.80		0.85	0.05	0.04
Minutes if SCREEN>0	909	209.90	662	246.61	36.71	323	201.49	206	254.18	52.69	15.98
Exercise Participated		0.28		0.28	0.00		0.24		0.18	-0.06	-0.06
Minutes if EXER>0	299	115.01	226	117.17	2.16	85	131.96	56	86.06	-45.90	-48.06**
Sleep Minutes if SLEEP>0	1072	561.29	786	566.10	4.81	394	582.95	239	593.60	10.65	5.84

Notes: All analysis uses sample weights. Low income is \$34,999 or less (~25th percentile of the distribution).

Table 3 Marginal Effects - Extensive Margin

	(1) EDUC	(2) CLASS	(3) HWORK	(4) WORK	(5) LEISURE	(6) SOCIAL	(7) SCREEN	(8) EXERCISE
Covid Ind.	0.005 (0.025)	-0.019 (0.026)	-0.006 (0.023)	0.017 (0.016)	-0.004 (0.010)	-0.122*** (0.025)	0.026 (0.016)	-0.027 (0.025)
Age	-0.002 (0.005)	-0.011* (0.007)	-0.002 (0.006)	0.027*** (0.006)	-0.003 (0.003)	-0.004 (0.006)	-0.011** (0.005)	-0.005 (0.007)
Black, non-Hispanic	0.016 (0.026)	0.014 (0.043)	0.024 (0.045)	-0.033 (0.038)	0.020 (0.020)	-0.081** (0.041)	0.030 (0.032)	-0.027 (0.038)
Hispanic	0.010 (0.023)	-0.020 (0.030)	0.024 (0.039)	-0.051*** (0.017)	0.011 (0.013)	-0.029 (0.025)	0.033 (0.021)	0.027 (0.028)
Other Race/Eth.	0.047 (0.036)	0.028 (0.043)	0.058 (0.035)	-0.081** (0.038)	-0.030 (0.025)	-0.023 (0.034)	-0.057* (0.031)	-0.025 (0.041)
Female	0.008 (0.024)	0.014 (0.027)	0.060** (0.024)	-0.046** (0.018)	-0.028*** (0.009)	0.027 (0.025)	-0.081*** (0.015)	-0.075*** (0.023)
Income: \$25K-\$49K	-0.038 (0.038)	-0.041 (0.046)	-0.032 (0.036)	0.012 (0.032)	0.009 (0.023)	0.015 (0.048)	0.011 (0.030)	0.035 (0.051)
Income: \$50K-\$74K	-0.016 (0.035)	0.004 (0.041)	-0.013 (0.032)	0.038 (0.032)	0.017 (0.015)	0.053 (0.047)	0.018 (0.022)	0.030 (0.042)
Income: \$75K-\$99K	0.036 (0.039)	0.024 (0.039)	-0.022 (0.036)	0.047 (0.036)	0.000 (0.017)	0.044 (0.059)	0.001 (0.034)	0.046 (0.053)
Income: \$100K+	-0.010 (0.034)	-0.020 (0.033)	0.031 (0.032)	0.019 (0.035)	0.020 (0.025)	0.081* (0.045)	-0.014 (0.033)	0.096** (0.042)
HS FT	0.088 (0.066)	0.112 (0.094)	0.028 (0.089)	-0.328*** (0.092)	0.109 (0.092)	0.297*** (0.063)	0.052 (0.097)	0.128 (0.083)
College PT	-0.091 (0.081)	-0.126 (0.110)	-0.075 (0.116)	-0.102 (0.116)	0.082 (0.098)	0.207*** (0.063)	0.075 (0.114)	0.057 (0.077)
College FT	0.058 (0.063)	0.013 (0.100)	0.114 (0.104)	-0.267*** (0.091)	0.089 (0.098)	0.253*** (0.056)	0.058 (0.104)	0.082 (0.079)

N = 2,495. All results calculated using sample weights, clustered at the state-level. Standard errors in parentheses. All analysis includes holiday, month, metro, and region fixed effects.

*** p<0.01, ** p<0.05, * p<0.10

Table 4 Marginal Effects - Intensive Margin for Students Participating in A_j

VARIABLES	(1) EDUC	(2) CLASS	(3) HWORK	(4) WORK	(5) LEISURE	(6) SOCIAL	(7) SCREEN	(8) EXERCISE	(9) SLEEP
Covid Ind.	-34.226*** (12.179)	-17.633** (8.325)	2.964 (7.967)	-2.792 (17.514)	19.098* (10.532)	1.099 (9.884)	37.263*** (8.373)	3.783 (8.361)	5.559 (6.559)
Age	0.181 (3.959)	-2.629 (3.340)	6.688** (2.623)	3.474 (3.251)	-8.982*** (2.070)	2.032 (2.835)	-7.826*** (2.592)	-3.804 (2.697)	-8.136*** (1.717)
Black, non-Hispanic	11.142 (23.639)	21.346 (18.484)	-13.967 (13.679)	64.395** (30.374)	-22.264 (17.585)	-7.597 (20.248)	-1.724 (15.083)	-13.948 (15.251)	0.143 (16.027)
Hispanic	-17.080 (14.641)	33.668*** (8.365)	-32.642*** (11.162)	10.788 (22.726)	3.655 (8.279)	-9.509 (13.337)	6.121 (9.608)	-18.096 (11.786)	7.132 (7.909)
Other Race/Eth.	32.154 (19.332)	4.997 (16.118)	41.216*** (15.089)	-18.317 (27.412)	-27.789* (16.572)	12.570 (15.724)	-23.298 (14.914)	-32.535*** (11.658)	-6.651 (11.454)
Female	27.540** (13.383)	17.305** (7.069)	-2.203 (9.477)	-28.871 (18.252)	-67.405*** (7.975)	12.076 (9.675)	-57.394*** (8.810)	-25.951*** (6.907)	1.194 (7.159)
Income: \$25K-\$49K	-5.862 (17.077)	-15.260 (18.017)	22.770 (19.336)	34.497 (32.201)	18.211 (15.653)	38.038** (16.010)	3.200 (12.107)	-28.317 (18.238)	-24.898** (12.070)
Income: \$50K-\$74K	1.707 (21.464)	-3.285 (15.838)	-6.296 (19.449)	13.276 (25.839)	7.779 (16.830)	-4.897 (17.224)	-5.267 (14.630)	-5.043 (18.571)	-21.236** (10.274)
Income: \$75K-\$99K	14.720 (23.209)	1.496 (17.663)	23.285 (20.095)	-12.442 (25.034)	16.381 (14.482)	-6.501 (17.935)	3.992 (18.476)	-1.052 (21.212)	-38.785*** (13.552)
Income: \$100K+	-20.420 (22.320)	-10.278 (18.695)	-16.913 (20.674)	26.775 (26.666)	14.862 (13.314)	-1.629 (14.545)	-3.374 (15.095)	-16.855 (17.105)	-39.841*** (12.179)
HS FT	121.503** (50.757)	37.022 (27.699)	45.332 (38.357)	-0.143 (98.376)	-25.500 (47.899)	95.149** (39.050)	-57.619 (59.372)	45.709** (18.014)	-41.368 (29.472)
College PT	-34.714 (66.936)	-123.931*** (35.915)	87.232* (48.114)	122.876 (101.294)	-11.541 (56.930)	72.253* (40.290)	-20.295 (65.295)	46.867* (24.232)	-15.876 (31.835)
College FT	72.668 (55.350)	-73.939** (32.138)	99.868** (40.061)	57.407 (90.943)	-3.522 (49.743)	130.865*** (40.125)	-36.890 (62.337)	44.266* (25.254)	-17.401 (27.834)
Observations	1,381	741	1,055	461	2,383	936	2,100	666	2,491
R-squared	0.111	0.320	0.185	0.169	0.095	0.109	0.081	0.100	0.033

Robust standard errors in parentheses calculated using sample weights clustered at the state-level. All regressions include holiday, month, metro, and region fixed effects. *** p<0.01, ** p<0.05, * p<0.10

Table 5 Marginal Effects Separating Early and Later Covid Periods

	(1) EDUC	(2) CLASS	(3) HWORK	(4) WORK	(5) LEISURE	(6) SOCIAL	(7) SCREEN	(8) EXERCISE	(9) SLEEP
Panel A: Marginal Effects - Extensive Margin									
Early Covid Period	0.006 (0.030)	-0.055** (0.025)	0.011 (0.031)	0.021 (0.025)	-0.006 (0.012)	-0.169*** (0.024)	0.041 (0.025)	0.004 (0.030)	
Later Covid Period	0.005 (0.027)	0.003 (0.034)	-0.016 (0.025)	0.015 (0.017)	-0.003 (0.013)	-0.094*** (0.035)	0.017 (0.020)	-0.044 (0.030)	
Observations	2,495	2,495	2,495	2,495	2,495	2,495	2,495	2,495	
Panel B: Marginal Effects - Intensive Margin for Students Participating in A_j									
Early Covid Period	-61.867*** (17.402)	-31.069** (13.047)	7.441 (13.785)	-24.129 (20.697)	43.228*** (13.439)	22.925 (16.733)	61.309*** (8.449)	5.099 (10.329)	14.169* (7.961)
Later Covid Period	-18.281 (11.670)	-10.516 (9.208)	0.219 (9.015)	10.649 (23.625)	5.546 (13.573)	-9.616 (11.283)	23.769** (11.415)	2.868 (10.882)	0.730 (7.466)
Observations	1,381	741	1,055	461	2,383	936	2,100	666	2,491

Robust standard errors in parentheses calculated using sample weights clustered at the state level. All regressions include holiday, month, metro, and region fixed effects. *** p<0.01, ** p<0.05, * p<0.10

Table 6 Marginal Effects for High School Subsample

	(1) EDUC	(2) CLASS	(3) HWORK	(4) WORK	(5) LEISURE	(6) SOCIAL	(7) SCREEN	(8) EXERCISE	(9) SLEEP
Panel A: Marginal Effects - Extensive Margin									
Covid Ind.	-0.027 (0.029)	-0.047 (0.037)	-0.041 (0.031)	0.009 (0.015)	0.007 (0.010)	-0.128*** (0.031)	0.035 (0.023)	-0.035 (0.031)	
Observations	1,368	1,368	1,368	1,368	1,267 ⁺	1,368	1,368	1,368	
Panel B: Marginal Effects - Intensive Margin for Students Participating in A_j									
Covid Ind.	-33.492** (13.456)	-21.622*** (7.867)	10.891 (9.355)	-17.815 (28.503)	29.312*** (10.821)	11.714 (11.056)	40.528*** (10.272)	8.269 (9.300)	17.704* (10.257)
Observations	775	486	544	136	1,332	546	1,178	408	1,366
Panel C: Marginal Effects - Extensive Margin									
Early Covid Period	-0.019 (0.032)	-0.075* (0.039)	-0.026 (0.037)	0.020 (0.019)	-0.021 (0.017)	-0.174*** (0.038)	0.014 (0.023)	0.018 (0.035)	
Later Covid Period	-0.032 (0.036)	-0.031 (0.045)	-0.050 (0.039)	0.001 (0.018)	0.024** (0.011)	-0.101** (0.041)	0.048 (0.032)	-0.067 (0.041)	
Observations	1,368	1,368	1,368	1,368	1,267 ⁺	1,368	1,368	1,368	
Panel D: Marginal Effects - Intensive Margin for Students Participating in A_j									
Early Covid Period	-75.573*** (18.064)	-62.215*** (11.495)	29.315* (14.848)	-56.726* (32.343)	72.270*** (11.649)	46.112** (17.616)	76.615*** (13.778)	2.085 (12.180)	21.338** (10.226)
Later Covid Period	-7.078 (14.600)	1.280 (7.999)	-1.570 (10.322)	17.619 (30.945)	4.649 (15.298)	-4.826 (13.089)	19.824 (14.391)	13.280 (13.776)	15.534 (12.321)
Observations	775	486	544	136	1,332	546	1,178	408	1,366

Robust standard errors in parentheses calculated using sample weights clustered at the state level. All regressions include holiday, month, metro, and region fixed effects. +Does not include June or Holidays due to lack of variation in the outcome within these categories. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 7 Marginal Effects for College Subsample

	(1) EDUC	(2) CLASS [^]	(3) HWORk	(4) WORK	(5) LEISURE	(6) SOCIAL	(7) SCREEN	(8) EXERCISE	(9) SLEEP
Panel A: Marginal Effects - Extensive Margin									
Covid Ind.	0.035 (0.031)	0.008 (0.038)	0.016 (0.034)	0.022 (0.030)	-0.019 (0.016)	-0.106*** (0.038)	0.016 (0.022)	-0.023 (0.032)	
Observations	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	
Panel B: Marginal Effects - Intensive Margin for Students Participating in A_j									
Covid Ind.	-42.616*** (15.192)	-22.093 (15.812)	-9.497 (13.267)	12.023 (20.484)	13.966 (12.875)	-17.017 (16.265)	38.873*** (10.846)	-8.443 (11.914)	-4.874 (7.042)
Observations	606	255	511	325	1,051	390	922	258	1,125
Panel C: Marginal Effects - Extensive Margin									
Early Covid Period	-0.019 (0.032)	-0.040 (0.049)	-0.026 (0.037)	0.020 (0.019)	-0.021 (0.017)	-0.174*** (0.038)	0.014 (0.023)	0.018 (0.035)	
Later Covid Period	-0.032 (0.036)	0.036 (0.041)	-0.050 (0.039)	0.001 (0.018)	0.024** (0.011)	-0.101** (0.041)	0.048 (0.032)	-0.067 (0.041)	
Observations	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	
Panel D: Marginal Effects - Intensive Margin for Students Participating in A_j									
Early Covid Period	-58.252** (26.854)	2.690 (27.873)	-19.417 (16.565)	3.445 (20.841)	19.322 (23.929)	-12.876 (27.663)	51.444*** (15.052)	5.479 (14.307)	5.709 (10.052)
Later Covid Period	-34.432** (14.337)	-34.189* (17.846)	-4.101 (16.318)	16.905 (26.293)	11.046 (16.324)	-19.187 (18.388)	31.946** (13.678)	-16.142 (13.325)	-10.418 (7.662)
Observations	606	255	511	325	1,051	390	922	258	1,125

Robust standard errors in parentheses calculated using sample weights clustered at the state level. All regressions include holiday, month, metro, and region fixed effects. *** p<0.01, ** p<0.05, * p<0.10

[^]Excludes the holiday indicator due to limited variation within the subsample.

Table 8 Marginal Effects of Covid on the Extensive Margin by Household Income

	(1) EDUC	(2) CLASS	(3) HWORK	(4) WORK	(5) LEISURE	(6) SOCIAL	(7) SCREEN	(8) EXERCISE
Panel A: Covid Indicator								
Low Income	-0.001 (0.067)	-0.006* (0.065)	0.008 (0.065)	-0.002 (0.036)	0.036 (0.030)	-0.094* (0.056)	0.054 (0.042)	-0.054 (0.039)
Mid-to-High Income	-0.014 (0.026)	-0.041 (0.026)	-0.016 (0.024)	0.023 (0.018)	-0.011 (0.010)	-0.127*** (0.026)	0.018 (0.021)	-0.011 (0.026)
Panel B: Two Covid Periods								
Early Pandemic Period								
Low Income	-0.022 (0.087)	-0.103* (0.061)	0.034 (0.096)	-0.017 (0.061)	0.067*** (0.015)	-0.010 (0.067)	0.128 (0.037)	-0.000 (0.061)
Mid-to-High Income	0.010 (0.031)	-0.052 (0.034)	0.014 (0.033)	0.030 (0.028)	-0.022 (0.016)	-0.199*** (0.027)	0.012 (0.030)	0.010 (0.033)
Later Pandemic Period								
Low Income	0.008 (0.067)	0.042 (0.076)	-0.005 (0.059)	0.004 (0.035)	0.023 (0.041)	-0.132* (0.069)	0.021 (0.052)	-0.081 (0.040)
Mid-to-High Income	-0.027 (0.031)	-0.035 (0.034)	-0.032 (0.028)	0.018 (0.020)	-0.005 (0.011)	-0.086** (0.034)	0.022 (0.024)	-0.023 (0.033)

Notes: *** .01; ** .05; * .10; All analysis uses sample weights. Low income is considered \$34,999 or lower (~25th percentile of the distribution). Marginal effects are calculated from the probit model including interactions between the Covid indicator and low income indicator along with all additional covariates.

Table 9 Marginal Effects of Covid on the Intensive Margin by Household Income

	(1) EDUC	(2) CLASS	(3) HWORK	(4) WORK	(5) LEISURE	(6) SOCIAL	(7) SCREEN	(8) EXERCISE	(9) SLEEP
Panel A: Covid Indicator									
Low Income	-62.96** (22.96)	-50.26*** (18.25)	-21.76 (18.57)	1.20 (47.25)	35.15 (22.29)	37.05 (23.31)	52.94** (19.88)	-35.12** (14.91)	9.17 (15.08)
Mid-to-High Income	-28.72** (13.89)	-12.93 (11.24)	7.15 (8.27)	-0.48 (17.09)	20.05* (11.87)	-4.43 (11.23)	36.10*** (10.53)	8.543 (9.04)	2.90 (8.11)
Panel B: Two Covid Periods									
Early Pandemic Period									
Low Income	-105.07*** (29.67)	-86.24*** (24.62)	-6.32 (35.66)	-42.92 (50.62)	96.087*** (30.435)	79.364 (49.785)	79.670*** (25.161)	-48.615** (18.446)	22.233 (18.833)
Mid-to-High Income	-46.01** (18.29)	-15.49 (17.35)	10.72 (11.05)	-9.86 (27.06)	28.722** (13.052)	5.037 (14.652)	55.370*** (11.461)	17.856 (11.053)	9.444 (9.982)
Later Pandemic Period									
Low Income	-43.79* (13.79)	-37.37* (21.88)	-29.13 (23.60)	18.46 (54.83)	4.905 (23.580)	6.916 (24.822)	38.595 (25.900)	-24.737 (16.313)	2.970 (16.061)
Mid-to-High Income	-18.54 (13.79)	-11.41 (11.57)	4.94 (9.89)	5.22 (22.91)	15.443 (15.830)	-8.121 (13.257)	25.609* (13.047)	2.713 (11.531)	-0.715 (8.679)

Notes: *** .01; ** .05; * .10; All analysis uses sample weights clustered at the state-level. Low-income is considered \$34,999 or lower (~25th percentile of the distribution). Marginal effects are calculated from the OLS model including interactions between the Covid indicator and low-income indicator along with all additional covariates.

Table 10 Marginal Effects of Covid on Intensive and Extensive Time Use using Hierarchical Data

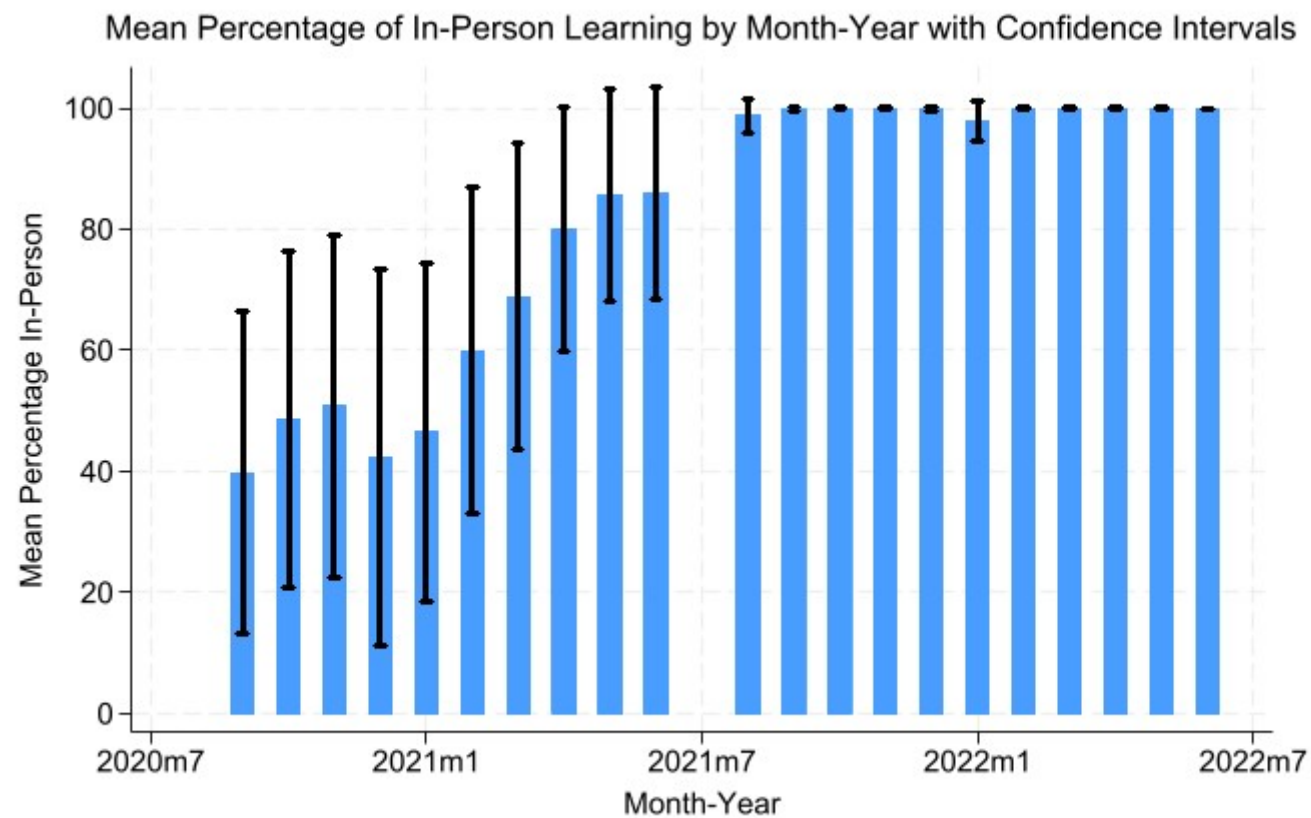
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Educ - Home	Educ - School [^]	Educ - Other	Class - Home [^]	Class - School [^]	HW - Home	HW - School [^]	HW - Other [^]
Panel A: Covid Indicators without Interactions								
Extensive Margin								
Covid Ind.	0.061** (0.031)	-0.157*** (0.018)	-0.137*** (0.018)	0.121*** (0.012)	-0.151*** (0.018)	0.014 (0.032)	-0.043*** (0.014)	-0.015 (0.011)
Intensive Margin								
Covid Ind.	62.345*** (9.071)	-13.105 (11.097)	29.214* (15.440)	166.135*** (41.523)	-14.332* (8.350)	14.718 (8.803)	21.290 (26.769)	-35.745 (30.047)
Panel B: Covid Indicators with Interactions								
Extensive Margin								
Low Income	0.080 (0.088)	-0.176*** (0.047)	-0.220*** (0.042)	0.154*** (0.027)	-0.156*** (0.046)	0.037 (0.081)	-0.052** (0.022)	-0.047* (0.024)
Mid-to-High Income	0.044 (0.028)	-.164*** (0.025)	-0.129*** (0.023)	0.109*** (0.013)	-0.162*** (0.025)	-0.001 (0.031)	-0.040** (0.016)	-0.007 (0.012)
Intensive Margin								
Low Income	47.793*** (16.270)	-30.656 (22.635)	42.096 (31.903)	70.209 (85.671)	-24.721 (21.712)	0.684 (16.219)	-53.281 (68.087)	65.391 (125.065)
Mid-to-High Income	61.746*** (10.231)	-10.027 (13.219)	27.647* (14.985)	168.524*** (51.196)	-14.361 (10.339)	14.192 (11.029)	20.844 (31.170)	-34.347 (32.931)

Notes: *** .01; **.05; *.10; All analysis uses sample weights clustered at the state-level.

Low income is considered \$34,999 or lower (~25th percentile of the distribution). Marginal effects are calculated from the OLS model including interactions between the Covid indicator and low income indicator along with all additional covariates.

[^]Models in Panel B, Intensive Margin estimated without the holiday indicator due to limited variation within the sample.

Fig. 1 Average Share of In-Person Learning by Month-Year



Note: Data are from <https://about.burbio.com/school-opening-tracker>.

Fig. 2 Mean Education Time

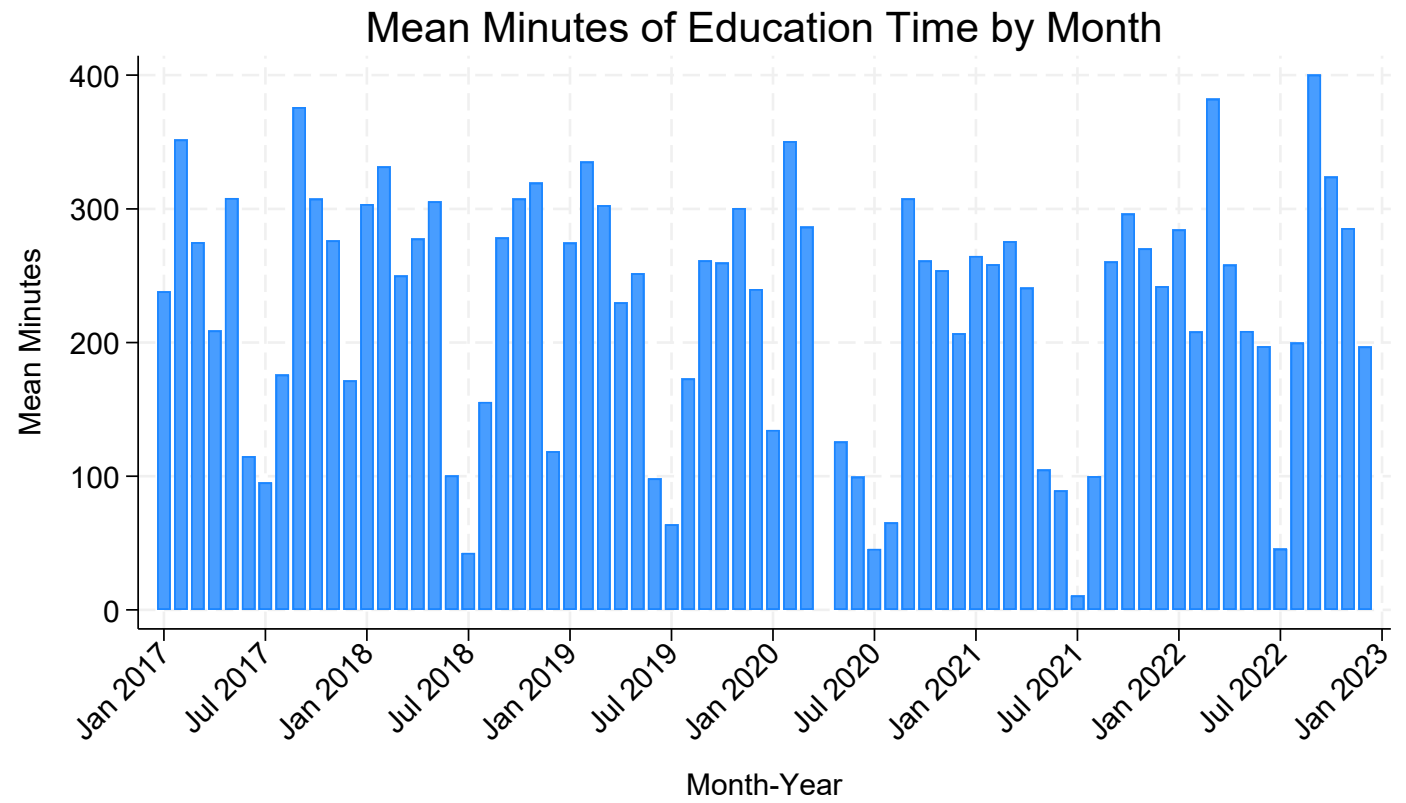


Fig. 3 Mean Class Time

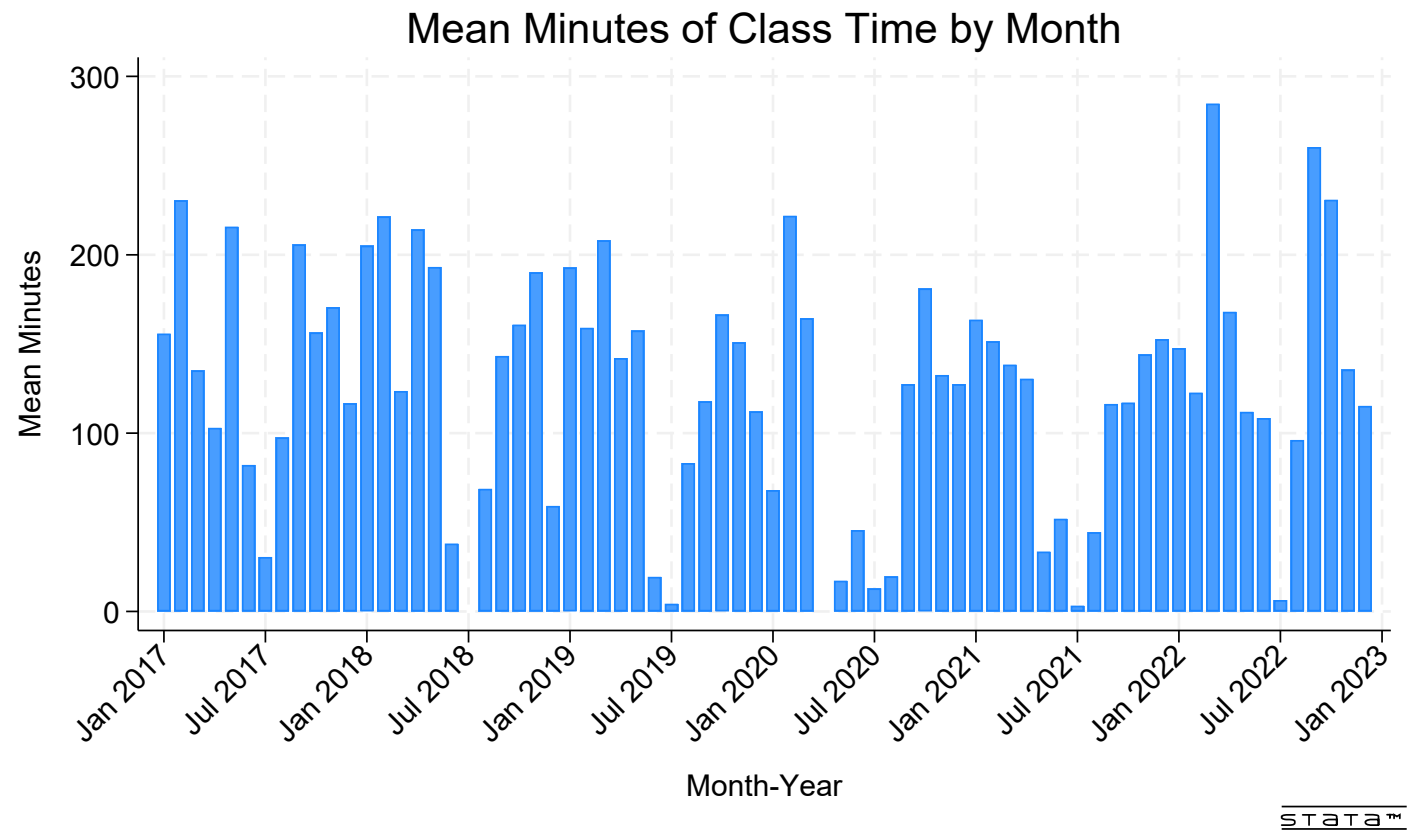


Fig. 4 Mean Homework Time

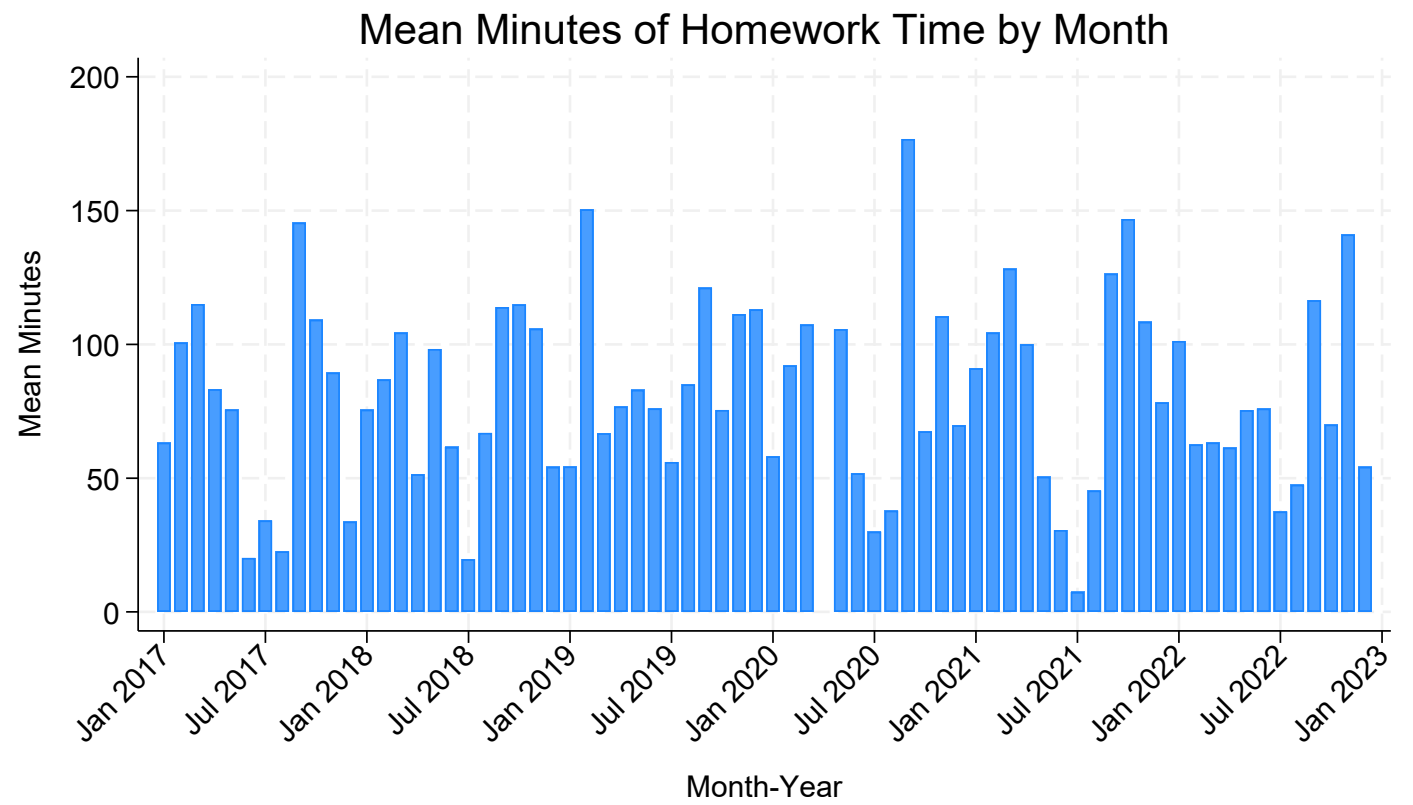


Fig. 5 Mean Educational Time at School

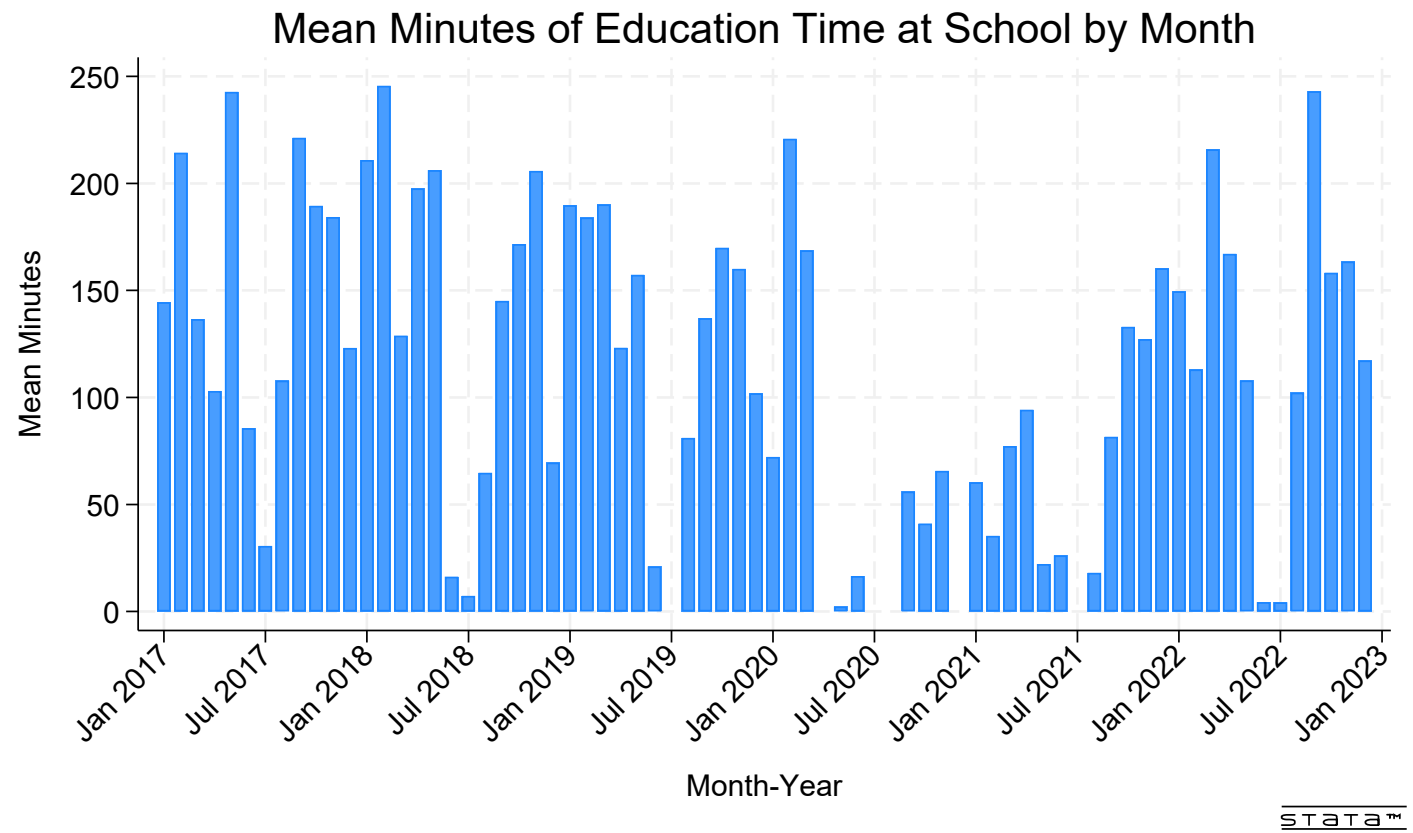


Fig. 6 Mean Educational Time at Home

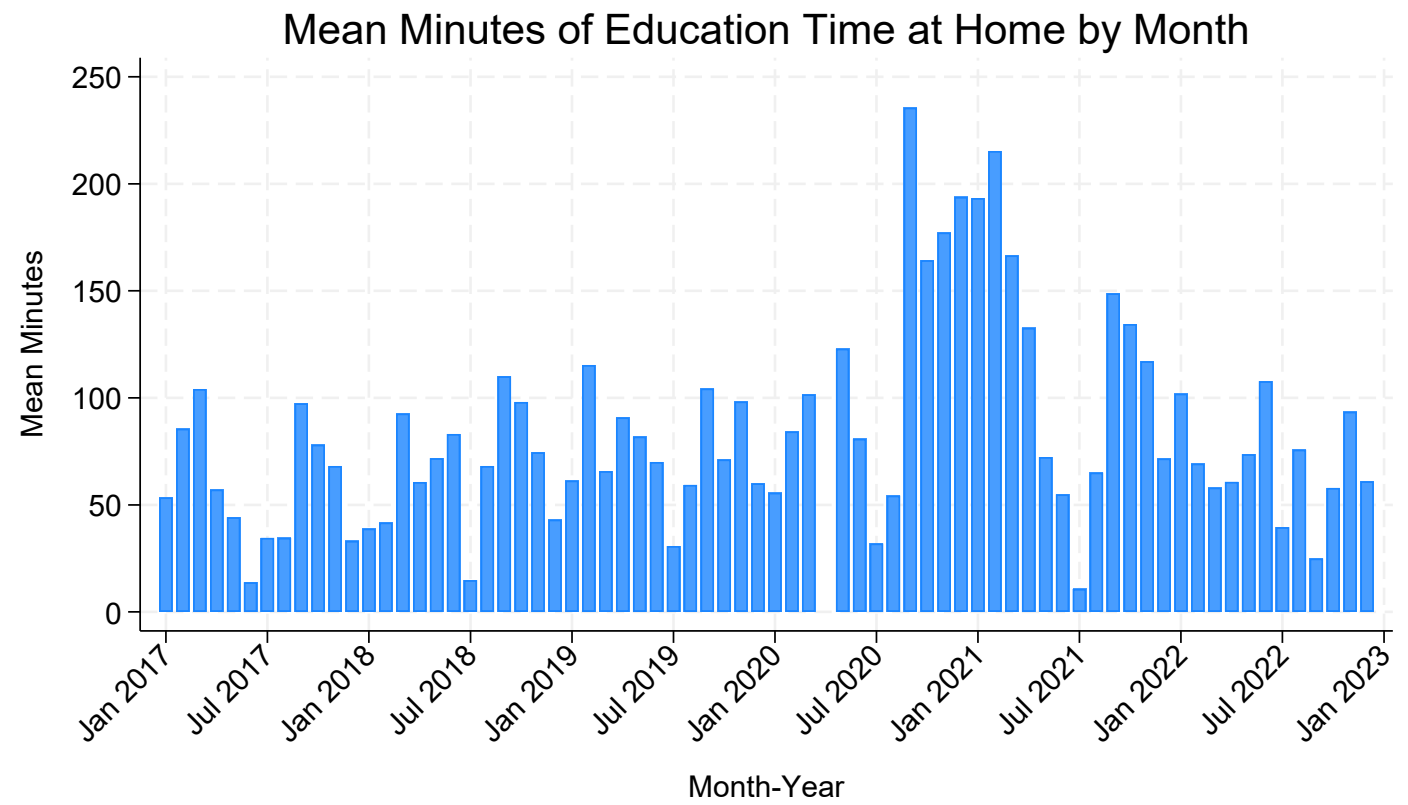


Fig. 7 Mean Educational Time Elsewhere

45

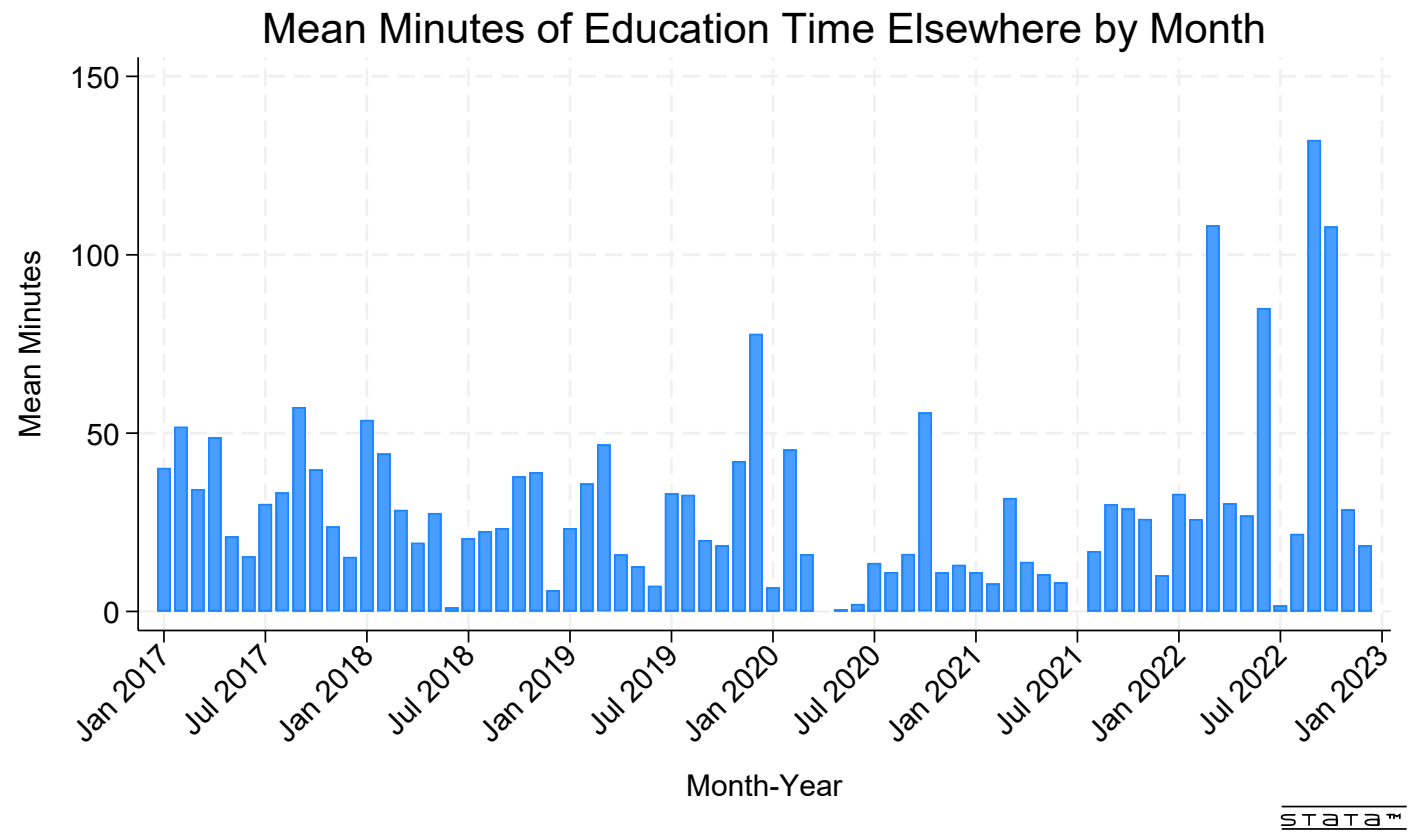
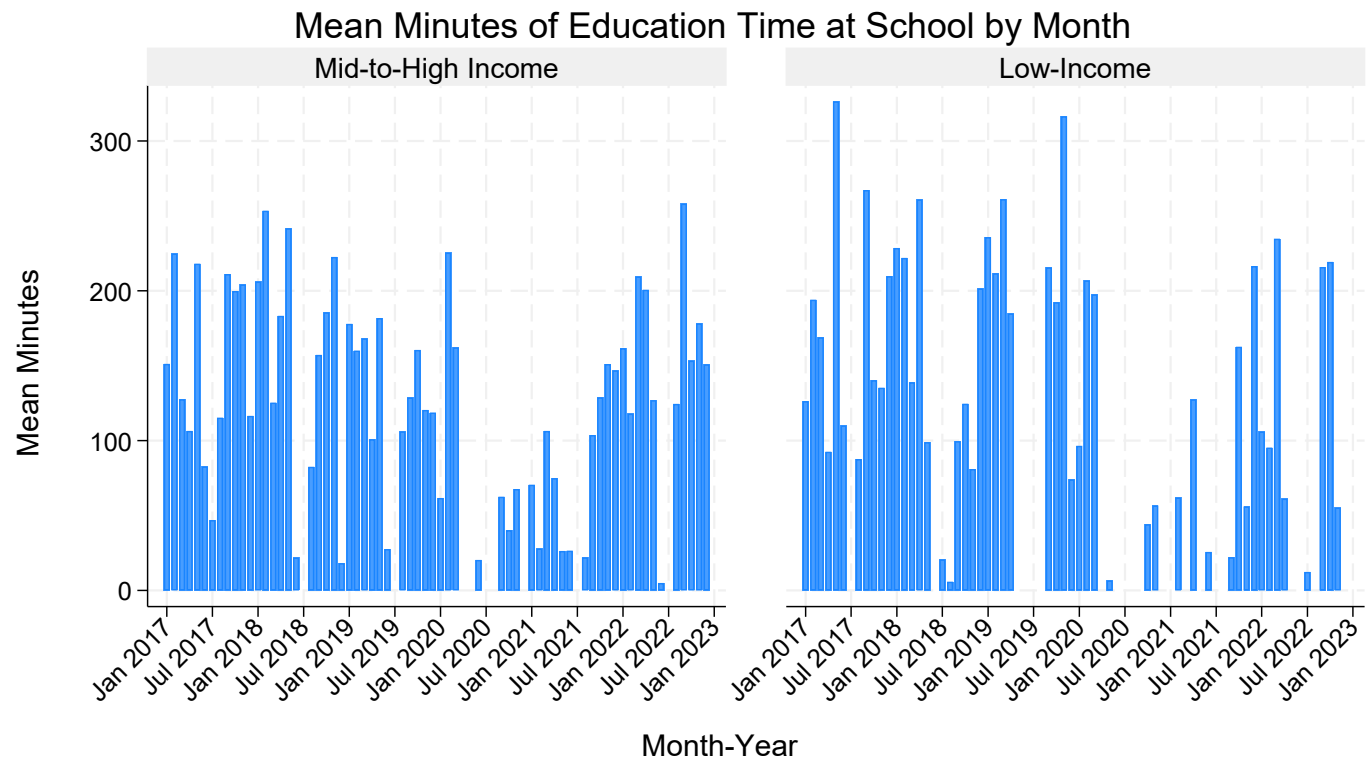


Fig. 8 Mean Educational Time at School by Income



Graphs by lowinc2

Fig. 9 Mean Educational Time at Home by Income

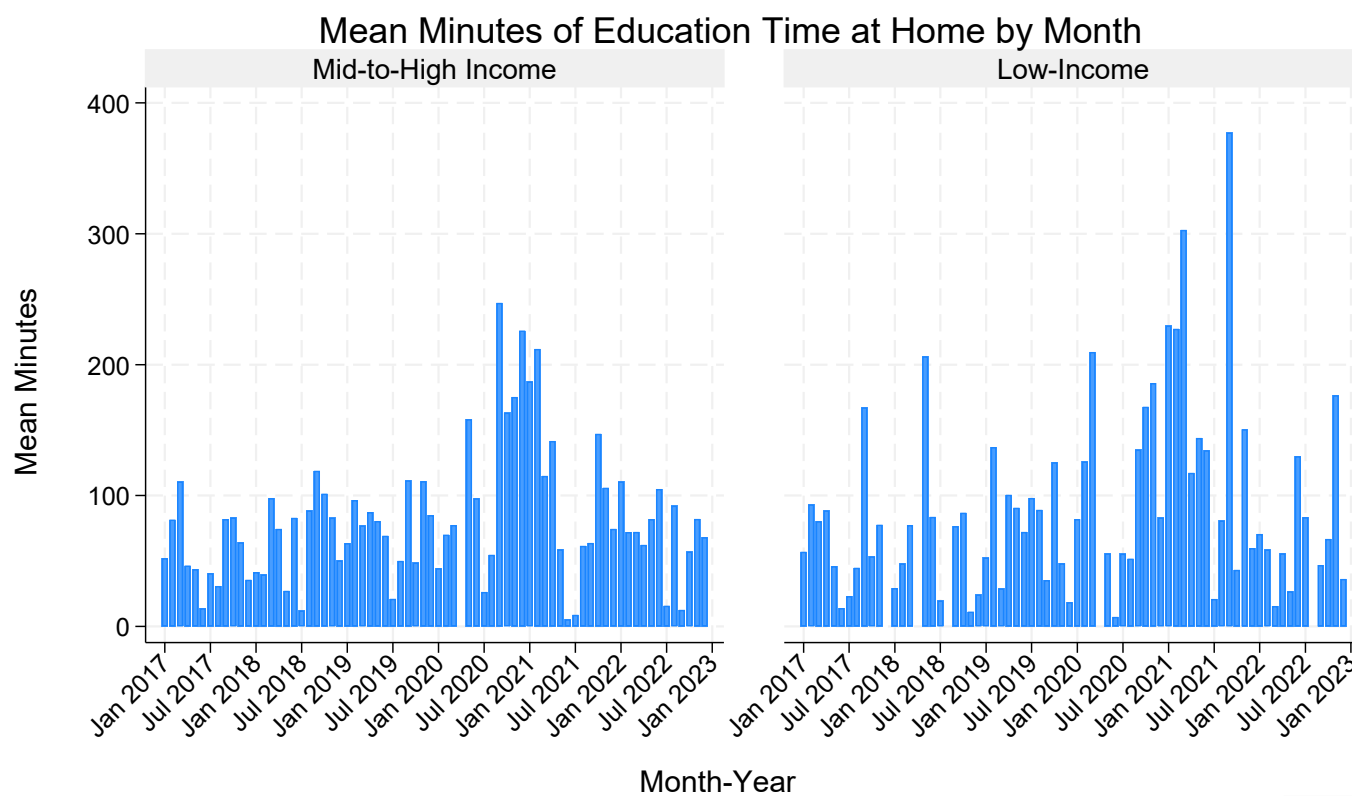
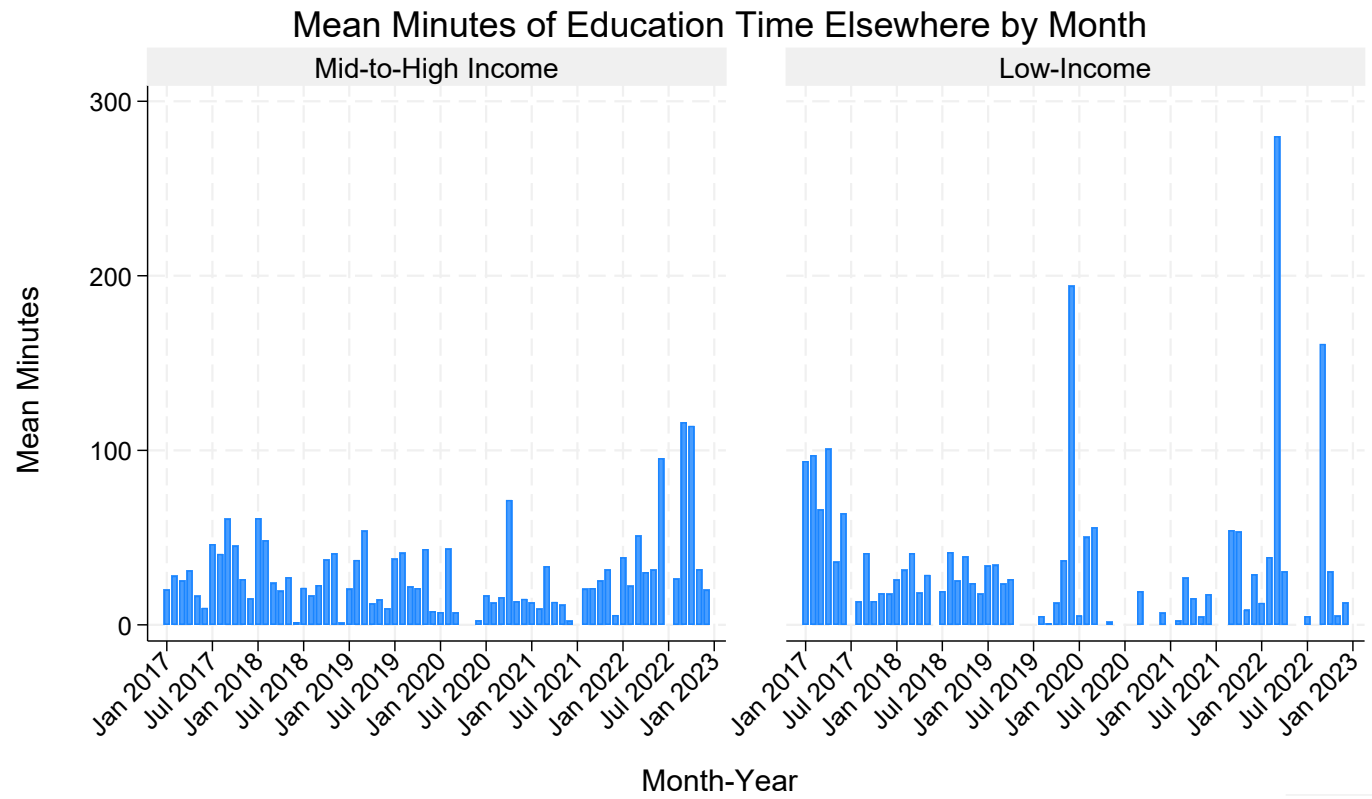


Fig. 10 Mean Educational Time Elsewhere by Income



Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Appendix.tex](#)
- [AppendixTimeUseduringCovid19REHO.pdf](#)