

Time in School: A Conceptual Framework, Synthesis of the Causal Research, and Empirical Exploration

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We examine the fundamental and complex role that time plays in the learning process. We begin by developing a conceptual framework to elucidate the multiple obstacles schools face in converting total time in school into active learning time. We then synthesize the causal research and document a clear positive effect of additional time on student achievement typically of small to medium magnitude depending on dosage, use, and context. Further descriptive analyses reveal how large differences in the length of the school day and year across public schools are an underappreciated dimension of educational inequality in the United States. Finally, our case study of time loss in one urban district demonstrates the potential to substantially increase instructional time within existing constraints.

KEYWORDS: instructional time, learning time, student achievement, time in school, lost time

Introduction

For decades, policymakers have argued that the American education system fails to provide the necessary instructional time for U.S. students to remain competitive in an increasingly globalized economy. In 1983, the landmark report *A Nation at Risk* warned that the “mediocre educational performance” of American students threatened the very safety and economic security of the country. The report attributed this competitive decline, in part, to the

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comparatively fewer hours Americans spent in school and the ineffective use of instructional time (Gardner et al., 1983). Ten years later, the National Education Commission on Time and Learning characterized the American school system as “a prisoner of time” (C. Kane, 1994). President Obama echoed these sentiments in 2009, arguing that the American school calendar “puts us at a competitive disadvantage” and that “the challenges of a new century demand more time in the classroom” (Martin, 2009).

Most recently, policymakers have advocated for major increases to time in school as a response to the loss of in-person instructional time caused by the COVID-19 pandemic (T. Kane & Reardon, 2023; Perez, 2021). Some states and districts have moved in this direction with the support of federal dollars from the Elementary and Secondary School Emergency Relief (ESSER) Fund and the American Rescue Plan Act (ARPA). In Texas, 46 elementary and middle schools in the Dallas Independent School District opted to extend the school year by 5 weeks (Little, 2022). District and union leaders in the Los Angeles Unified School District agreed to the addition of 4 optional instructional days after contentious negotiations (Sequeira, 2022). Most recently, New Mexico passed legislation to raise the minimum amount of mandatory instructional time by over 1,000 hours per year (Mahnken, 2023). In marked contrast, hundreds of districts across the United States have also reduced instructional time by adopting 4-day weeks as a response to teacher staffing challenges and budget constraints (Thompson, Gunter, et al., 2021).

In this article, we aim to inform the ongoing national dialogue about expanding instructional time in U.S. public schools in three primary ways. First, we propose a conceptual framework of time in school that illustrates how a multitude of challenges prevent schools from converting total time in school to active learning time. Second, we conduct a systematic review of research employing methods capable of supporting causal inferences to answer the question: What is the effect of time in school on student achievement? Third, we draw on a range of international, national, and district datasets to produce a novel set of empirical facts about time allocation and use in U.S. public schools. Our descriptive analyses are aimed at answering three interrelated research questions:

- How does total time in U.S. schools compare to other countries?
- How much does total time in school vary in the U.S.?
- How much instructional time is lost within the school day?

Together, our conceptual model, literature synthesis, and descriptive analyses illuminate key insights and policy trade-offs that would not be evident if each were considered in isolation.

Scholars have long studied the relationship between total time in school and student achievement, relying primarily on case studies and correlational evidence to conclude there is a weak positive relationship (Aronson et al., 1998; Berliner, 1990; Cotton, 1989; Fraser et al., 1987; Huyvaert, 1998;

Karweit, 1985). The most influential and highly cited review of the modern literature synthesizes 15 studies published prior to 2010, many of which employed weak research designs unable to support causal inferences (Patall et al., 2010). As Karweit (1982) wrote in her review over 40 years ago, we should be cautious about ascribing causal interpretations to correlational studies because “other factors, which covary with time but which are not measured, may be responsible for the observed effects.” However, the increasing use of experimental and quasi-experimental methods in the social sciences over the last decade has resulted in a growing body of more rigorous empirical evidence on the causal relationship between time and achievement.

We identify and synthesize the findings from 74 studies that apply credible causal research designs to estimate the effect of total time on students’ academic achievement. We find that there exists enormous variability in what constitutes a treatment across these studies rendering simple summary statistics such as pooled effect size estimates somewhat uninformative for policy and practice. Instead, we organize our review of the literature around five education policies that influence the amount and structure of total time in school: bundling additional time with a package of school reforms, extending the school year, extending the school day, adopting a 4-day school week, and setting school start times.

Existing research provides a compelling body of evidence that increasing total time in school typically leads to small to medium-sized gains in academic achievement, on average. The magnitude of effects across studies vary considerably and appear to depend critically on a range of interrelated factors such as the existing amount of time, the amount of time added, the margin on which time is increased, how time is used, and the context in which the study took place. Studies of whole-school reforms (e.g., urban charter and turnaround schools) demonstrate that extending the school day and year can produce large effects when combined with efforts to maximize student engagement and instructional quality. Studies of substantial expansions of total time in school such as moving from half-day to full-day kindergarten in the United States or transitioning from double shift to single, full-day schooling in the international context also tend to produce larger effects. Conversely, research consistently shows that student achievement declines when districts reduce time in school by adopting 4-day school weeks.

Given that time is an important input for learning, we aim to provide policymakers and administrators with a better understanding of the landscape of total time in U.S. public schools. We estimate that the typical K–12 public school in the United States is in session for 6.90 hours per day and 178.59 days per school year, on average, for a total of 1,231 hours per year. Despite claims of being left far behind, the United States ranks eighth in terms of average instructional time compared to other high-income countries, with a relatively longer school day but shorter school year. We then show that the decentralized education system in the United States has resulted in large

differences in total time across K–12 public schools. For example, schools at the 90th percentile of the distribution of total time are in session almost 200 hours more than schools at the 10th percentile. This is equivalent to over 5 and a half weeks per year, or 2 full school years over the course of a K–12 education. Large differences in total time are also evident across states. Over the course of a K–12 education, students living in the five states with the highest median number of school hours will have access to the equivalent of 1.4 more years of schooling compared to students living in the five states with the lowest median hours.

We conclude with a case study of the Providence Public School District (PPSD) to illustrate the importance of lost instructional time within the school day. Making conservative assumptions about time loss, we estimate that students in PPSD lose between 16% and 25% of the time during the school day specifically allocated to instruction. Aggregate instructional time loss is likely even higher given that our estimates do not incorporate additional challenges such as off-task student behavior that prevents schools from converting instructional time into active learning time.

Our study makes several important contributions to the academic literature and policy debate. Our conceptual model helps to highlight how underappreciated daily obstacles in school erode instructional time, pointing to productive areas for further research. We extend the findings of prior literature reviews on time in school (Dağlı, 2019; Gromada & Shewbridge, 2016; Holland et al., 2015; Patall et al., 2010; Redd et al., 2012; Scheerens et al., 2013; Silva, 2007) by presenting the first synthesis focused exclusively on causal research. Our descriptive analyses illuminate how differential access to time in school is an underappreciated dimension of educational inequality in the United States. Finally, our case study illustrates the key educational challenge of converting instructional time into learning time, as highlighted in our conceptual framework.

Conceptual Framework

The connection between time and learning is an age-old idea. The philosopher and educator William James made these points in several speeches to teachers around the turn of the 19th century (Berliner, 1990). Equally intuitive is the insight that not all time in school is spent learning. Carroll (1963) formalized this intuition in his seminal model of learning, providing a foundation for future empirical studies of time in school. He theorized that learning was a function of two primary factors: the time each student requires to learn and the time they spend learning. In the Carroll model, time in school is simply an “opportunity” or “empty vessel”—necessary for learning but not sufficient.

Scholars have since extended the Carroll model in several ways that help refine how time relates to student learning. Bloom (1968) posited that with the appropriate amount of time—an amount that would vary based on individual student aptitude—and individualized instruction, all children could develop

mastery of core academic subjects. Wiley and Harnischfeger (1974) further extended the Carroll model, defining learning as not only a function of the amount of total time allocated for learning, but also the proportion of that time that is usable and actively used. Total time, for example, was not usable when students were absent or teachers did not properly align their instruction to the learning goals. Karweit (1982) further quantified additional factors preventing total time from becoming learning time including teacher strikes, school closings, nonacademic events, and poor classroom management.

In the 1980s, Henry Levin published a collection of studies that drew upon economic theory to illustrate key potential limitations to policies aimed at raising student achievement via extended learning time. Building on the Carroll model, he outlined learning as a function of (a) student capacity, (b) student effort, (c) total time allocated to learning, and (d) the quality of learning resources (Levin, 1984). Because student effort itself is a function of the amount of total time in school, he posited that extending learning time may not raise achievement because students may not be able (or choose) to sustain the same level of effort over longer periods of time. In this way, extended learning time could even be counterproductive if there were few intrinsic or extrinsic rewards for students to maintain their attention.

The eminent sociologist James Coleman framed time as key input into what he characterized as the “intensity” of schooling. He viewed intensity as a conceptual index measure of the total time dedicated to schooling, the amount of resources available, and the quality of these resources (Coleman, 1968). From a sociological perspective, more intensive schooling can serve to reduce inequalities by compensating to a greater degree for the unequal learning environments students experience outside of school. Thus, time in school matters not only for supporting students’ ability to learn but may also play a role in reducing inequality.

We build on prior conceptual models (see Berliner, 1990, for a review) to propose a framework centered on three broad concepts, each denoted by color in Figure 1:

Total time—the amount of time in an academic calendar

Instructional time—the amount of time dedicated to instruction

Learning time—the amount of time students spend learning

That figure presents a cascading model of time to illustrate how incremental challenges collectively erode the amount of *active learning time* that individual students experience in school. We begin by defining *allocated total time* (which we abbreviate to *total time* and use synonymously with *time in school*) to mean the number of planned days per year multiplied by the number of planned hours per day in line with previously established definitions (e.g., Abadzi, 2009; Gromada & Shewbridge, 2016; Patall et al., 2010; Phelps

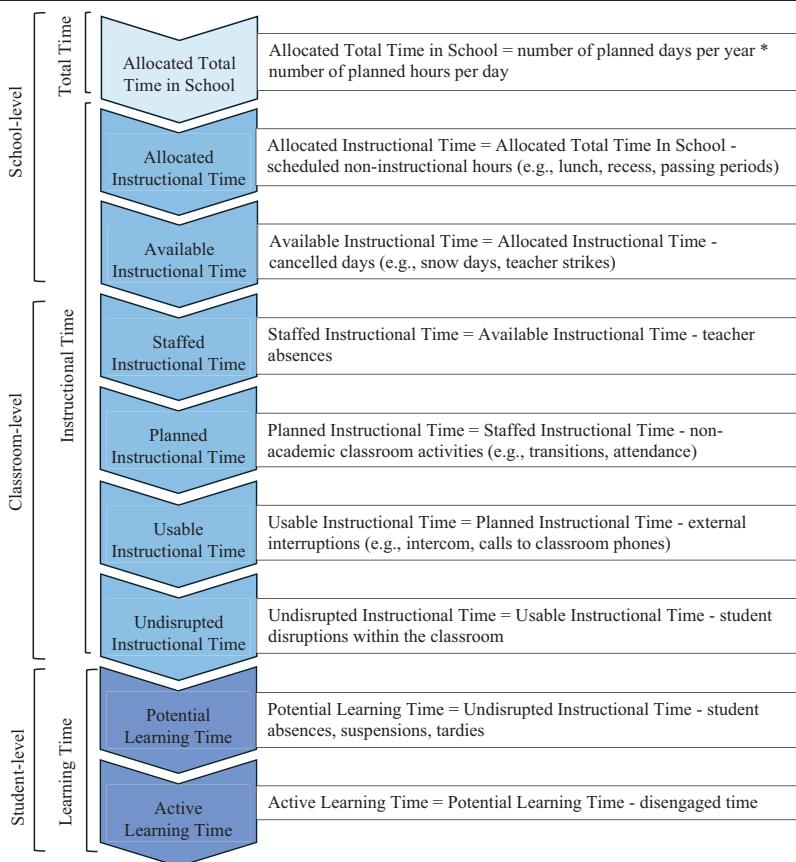


Figure 1. Conceptual framework of time in school.

et al., 2012; Wiley & Harnischfeger, 1974). Next, we subtract scheduled non-instructional hours such as recess, lunch, and passing periods to form *allocated instructional time* (which we abbreviate to *instructional time*). *Instructional time* is the most optimistic definition of time that students could be learning and is typically uniform across a school or district.

A variety of organizational challenges can reduce the amount of time available for instruction at a school. Most basically, schools can be unexpectedly closed due to weather, teacher strikes, or other unplanned occurrences. We subtract these closures to define *available instructional time*. Although these days are sometimes made up at the end of the academic year, we expect that additional instructional time after testing during anticipated summer breaks is far from a perfect substitute.

Time varies within a school by classroom as well. Teacher absences, which occur by classroom, further limit instructional time to an amount we call *staffed instructional time*. Evidence suggests learning suffers during teacher absences even when absences are covered by a substitute teacher (Herrmann & Rockoff, 2012). Next, teachers have to proactively use instructional time for academic activities, but some of this time is invariably lost to nonacademic routines such as taking attendance, transitions between activities, and waiting time. We label this time *planned instructional time*. Classroom interruptions, like use of the intercom or calls to classroom phones, further subtract time to create a quantity we denote as *usable instructional time* (Kraft & Monti-Nussbaum, 2021). *Usable instructional time* can be thought of as the amount of time inside a classroom that is free from external interruptions, which again can vary at the individual classroom level, even within a school. *Undisrupted instructional time* is then a subset of *usable instructional time* minus the time taken up by student disruptions that occur in the classroom.

Undisrupted instructional time is still at arm's length from becoming *active learning time*. For one, students must be present in the classroom to benefit from the instruction being delivered by their teacher(s). We characterize the time in which an individual student is present in their classroom, accounting for absences (excused and unexcused), suspensions (in-school and out-of-school), and tardies, as their *potential learning time*. This is the first level of our conceptual framework that varies by individual students, rather than at the classroom or school level. Finally, students can convert *potential learning time* into *active learning time* by engaging in the learning activities. In this way, the amount of *active learning time* for an individual student is a product of multiple factors including their own work ethic and internal motivation, the ability of their teachers and schools to motivate their effort, the curriculum, and their peers' behavior.

What Is the Effect of Time in School on Student Achievement?

The conceptual framework presented above suggests that the effect of time on student achievement is attenuated as it moves further up the causal cascade away from active learning time towards total time. While we are conceptually interested in the direct effects of active learning time, studies that employ research designs capable of supporting causal inferences and that examine this more fine-grained measure of time use are largely unavailable. This is because policymakers and administrators can manipulate how much total time—and in some instances, instructional time—exists, but they have little control over the individual classroom-level and student-level factors that diminish its potential. Thus, empirical research does not precisely quantify the effect of active learning time, but it can help us understand the more distal effects of total time and instructional time.

Here, we synthesize the evidence on time in school by conducting a systematic review of the empirical literature. Although summary statistics such as pooled effect sizes from meta-analyses can be helpful, we felt that a focus on meta-analytic averages would obscure the principal insight that effect sizes vary considerably and depend critically on a range of factors.

Search Procedures and Inclusion Criteria

We began by defining our focus to be on studies that examine time during the traditional school day and exclude literature on after-school and summer programs that have been surveyed extensively in other reviews (Durlak et al., 2010; Kidron & Lindsay, 2014; McCombs et al., 2019).¹ Our systematic review involved a three-part process. First, we identified articles using five search engines (Google Scholar, JSTOR, ERIC, NBER, and EconLit) and an iteratively developed set of search terms including “length of school day [year],” “extended school day [year],” “extended learning time,” and “increasing time in school.” Second, we reviewed references in prior reviews of time identified above and from the studies that met our inclusion criteria to cross-check our search process. Third, we contacted many authors of the articles included in this analysis to solicit their help in identifying additional studies.

We limited our search to papers written and published in English and focused on students in kindergarten through 12th grade. We also required studies to employ methods that were capable of supporting plausibly causal inferences about the effect of time. Studies were eligible if they used the following research designs: randomized control trials (RCT), instrumental variables (IV), regression discontinuity (RD) designs, difference-in-differences (DiD)/event-study designs, and panel methods with high-dimensional fixed effects. While causal identification is not a simple binary characteristic of a research design, these methods are generally viewed as being credible causal designs when important identifying assumptions are met and robustness tests rule out other plausible alternative explanations (Angrist & Pischke, 2009). Although it was not our original intention, we ultimately chose to more narrowly focus on studies that estimated effects on student academic achievement given that the preponderance of research examines effects on standardized test scores. We emphasize, however, that time in school can have important consequences for a whole range of outcomes including social-emotional skills, contact with the juvenile justice system, parental employment, teacher labor markets, and property values (e.g., Clauertie & Neill, 2000; Graves et al., 2018; Ward, 2019).

Our search and review process resulted in 74 papers that meet our inclusion criteria. We provide a comprehensive list of all papers, the policies they evaluate, the magnitude of time changed, location, methods, outcomes, and effect sizes in Appendix A in the online version of the journal. We then group studies into five broad categories of policy changes that affect time in school

on distinct margins. Throughout our synthesis, we characterize effect sizes on student achievement relative to benchmarks based on the empirical distributions found in the broader literature (Evans & Yuan, 2022; Kraft, 2020).

Increased Total Time as Part of a Package of Inputs

Studies of charter public school operators such as KIPP, Promise Academy, and urban charter schools in Massachusetts that operate schools with extended days (and sometimes years) show positive and often moderate to large effect sizes on academic achievement as measured by test scores (Abdulkadiroglu et al., 2011; Angrist et al., 2012, 2013; Dobbie & Fryer, 2011; Hoxby & Murarka, 2009). Leveraging randomized lottery admission processes, these studies find effects as large as $.42\sigma$ in middle school math per year and $.25\sigma$ in middle school English (Abdulkadiroglu et al., 2011). However, determining the degree to which additional total time in these schools is responsible for driving these effects is a difficult empirical task given the inability to isolate time from other elements of the schools such as tutoring, lower student-to-teacher ratios, data-driven instruction, frequent teacher observations and feedback, and health interventions. Several studies attempt to disentangle the component parts of these package reforms through more exploratory regression analyses and find, to varying degrees, that additional total time is a predictor of schools with larger causal effects on achievement (Angrist et al., 2013; Dobbie & Fryer, 2013; Hoxby & Murarka, 2009).

There is also evidence of traditional school districts implementing similar bundled interventions and seeing positive results. Twenty public schools in Houston that implemented a set of best practices used in high-performing charter schools, including additional total time, experienced gains in math of over $.10\sigma$, with small gains in reading (Fryer, 2014). These reforms included extending the school day and year, increasing instructional time by 21%, and incorporating high-dosage tutoring throughout the extended school day. In Lawrence, Massachusetts, the state took over the traditional public school district and instituted a series of changes, including increasing school-level expenditures, replacing underperforming staff, and adding extra time for struggling students. In Year 2 of the takeover, the district also added 200 hours to the school year for all first through eighth graders. Using a DiD approach, researchers show math scores increased by $.30\sigma$ and English language arts (ELA) scores increased by $.10\sigma$ (Schueler et al., 2017).

We provide a visual overview of the effects of bundled education reforms that increase the amount of time in school in Figure 2, panel A. We plot the effect size distribution from the studies described above to illustrate the magnitude and variation in effects on standardized achievement in math and reading. In this panel, as in the others of this figure, we exclude research on nonstandardized test scores though we report the full results of our literature

review on other achievement outcomes (e.g., college entrance exams or grade repetition) in online Appendix A. The research on time as part of a package of inputs, which is entirely U.S.-based, suggests additional total time in school can have moderate to large effects when it is part of a broader reform effort to improve instructional quality.

Extending the School Year

Causal evidence on the effect of additional school days often leverages plausibly exogenous differences in the number of days that students are in school before taking standardized tests. These studies often find a small positive increase in achievement in math and ELA from the addition of 10 or more extra days (Aguero & Beleche, 2013; Aucejo & Romano, 2016; Fitzpatrick et al., 2011), while others find small positive effects in math but not ELA (Hansen, 2011; Sims, 2008). Optional extended school-year programs may also raise student achievement, but not all students will participate when they are voluntary. One study found that weeklong math-focused vacation academies in Massachusetts resulted in imprecisely estimated effects of .07 σ in math but no effect in ELA (Schueler, 2020).

Leveraging snowfall, strikes, and other plausibly exogenous events, research finds corresponding decreases in the overall academic performance of students who experience an unscheduled loss of total time. Several studies using weather-related school cancellations as an instrument find small negative effects of lost total time on math but not ELA (Hansen, 2011; Marcotte, 2007), while others find small declines in both math and ELA (Marcotte & Hemelt, 2008), and one finds no effect on either subject (Goodman, 2014). A recent study using DiD to examine the effects of an unexpected, regulatory change in Spain that reduced the school calendar documents moderate negative effects in Spanish and English (Sanz & Tena, 2021).

Several international studies examine policy changes that induced large increases in total time due to extended school calendars and find consistent patterns; increases in time improve student outcomes, while decreases in time harm them. Leuven et al. (2010) use an IV approach to study an increase of 1 month to the school year for 4-year-olds in the Netherlands and find small positive effects on language and math, though only the language score increase is statistically significant. Parinduri (2014) uses an RD to show that an additional 6 months of learning in Indonesia increased educational attainment by almost a full year. Pischke (2007) studies a decrease of 13 weeks of school in West Germany using a DiD design and finds it increased the likelihood of grade repetition by almost 30%.

As shown in Figure 2, panel B, the literature demonstrates that additional days of instruction lead to improved academic outcomes for students of generally small magnitude in both the United States and international context. More substantial expansions of the school year do appear to produce larger

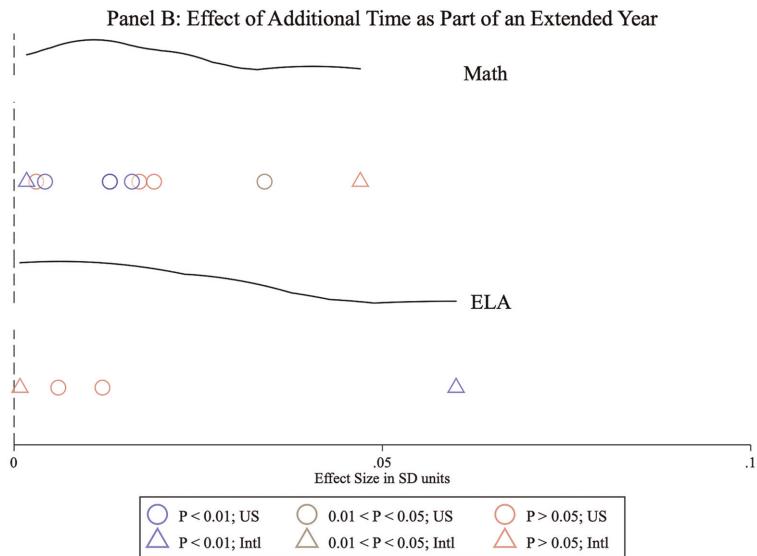
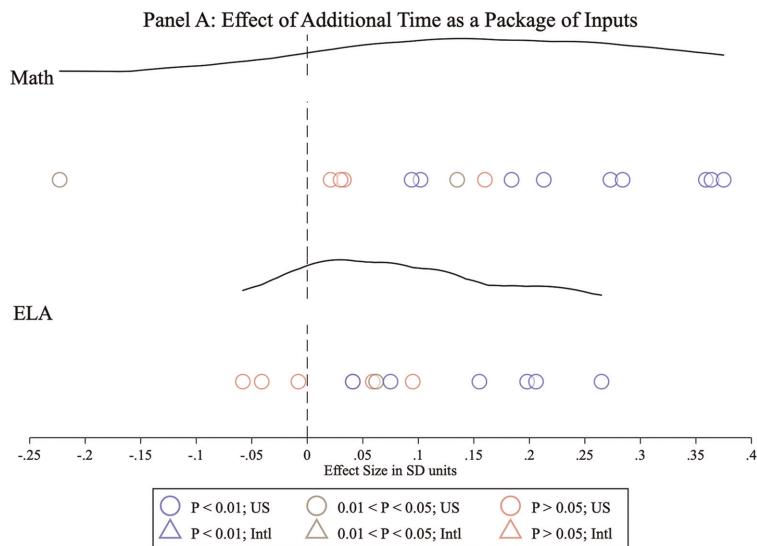


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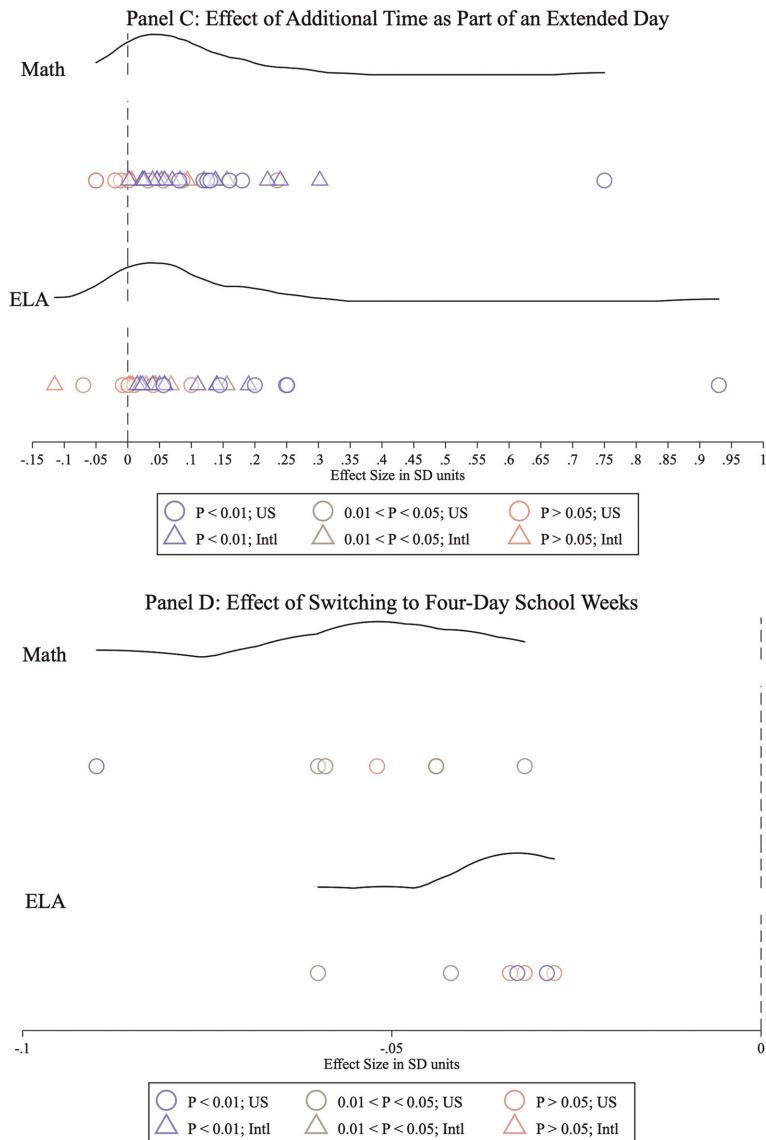


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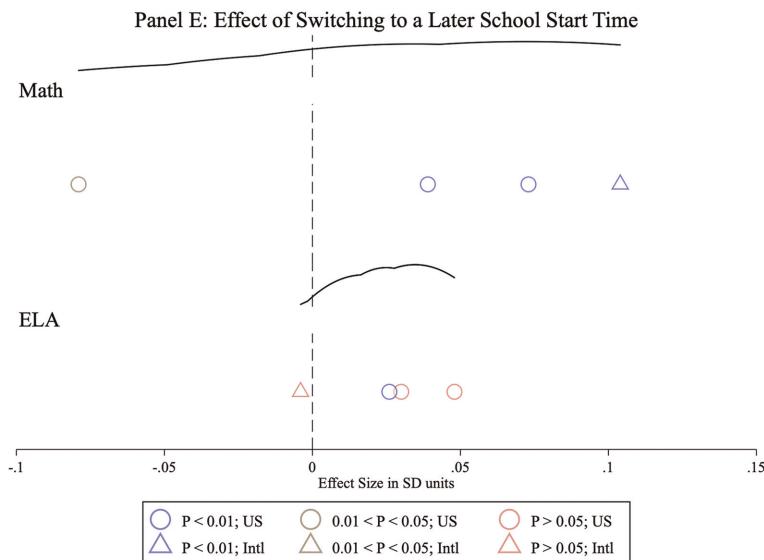


Figure 2. Effect sizes from selected studies that use research designs capable of supporting causal inferences to identify the effect of total time/instructional time on student achievement.

Note. This figure shows the effect sizes in standard deviation units from the body of literature reviewed in this article. The figure includes only studies that reported or where we could calculate effect sizes in standard deviations on a math or English language arts (ELA) standardized exam. We present estimated effects for each grade/schooling level from a study and privilege estimates from the first year of an intervention when studies report results measured at multiple points in time. We also exclude one outlier study—Fitzpatrick et al. (2011)—because the amount of additional time added (250 days) greatly exceeds the amount of time added in other studies. For more details, see online Appendix A.

effects, but these are often measured in terms of on-time educational progress and attainment and are not shown in the figure. Reductions in the length of the school year often have the opposite effect, harming student achievement.

Extending the School Day

The causal literature on extending the school day consists primarily of international studies of policy changes using DiD, RD, and panel data methods. Importantly, the amount of additional total time added varies meaningfully across contexts, and thus, so does the scale of the impact. In Colombia, when the school day went from 3.5 to 7 hours per day, it increased achievement by between $.04\sigma$ to $.14\sigma$ across grades and subjects (Hincapie,

2016). In Mexico, a new program that extended the school day from 4.5 to 8 hours led to large positive effects in math and language test scores with effects growing over time (Cabrera-Hernandez, 2020; Padilla-Romo, 2022). Researchers saw similarly large positive effects in math and language test scores in a Brazilian state that expanded the length of the school day from 4.5 to 8 hours (Rosa et al., 2022). In Chile, reforms increased the length of the school day from about 5.3 to 6.75 hours per day with more mixed evidence of its impact on student achievement. Across studies, one finds moderate effects in math and language (Bellei, 2009), while another finds no effect on math and a small effect on language (Barrios Fernández & Bovini, 2017), and a third study shows a moderate effect on reading (Berthelon et al., 2016). A fourth study shows positive effects on educational attainment (Dominguez & Ruffini, 2021). In Peru, scholars find that a 2-hour increase in the length of the day increased math test scores by $.24\sigma$ and reading test scores by $.14\sigma$ using an RD approach (Aguero et al., 2021). In Ethiopia, an increase of 1 to 2 hours per day led to large increases in numeracy and writing achievement, though not in literacy (Orkin, 2013).

Smaller increases in the length of the school day—90 minutes or less—also lead to positive results, albeit with smaller effect sizes. In Germany and Israel, when schools added 1 to 2 more hours per week, DiD and IV approaches showed small increases in achievement across multiple subjects (Huebener et al., 2017; Lavy, 2019). Work in Italy and Denmark, though, where total time increased by less than an hour per day, showed medium positive effects in math but no other subjects (Battistin & Meroni, 2016; Jensen, 2013; Meroni & Abbiati, 2016). Finally, two studies with smaller samples conducted in Germany and the Netherlands find medium positive, but not statistically significant, effects on academic achievement from increasing the school day by 45 to 60 minutes (Dahmann, 2017; Meyer & Van Klaveren, 2013).

Three studies evaluate schools that adopted extended days in the U.S. context with more mixed results. Using a comparative interrupted time series design, Checkoway et al. (2013) find that the Expanded Learning Time Initiative in Massachusetts, in which 26 schools added at least 300 instructional hours to the school year, had no effect on achievement in math, ELA, or science. A study leveraging admissions lotteries as IVs within a DiD framework found that extending the school day by 2 hours for high-dosage tutoring at one Boston area charter school increased achievement in ELA by as much as $.25\sigma$ with no effect in math (Kraft, 2015). Figlio et al. (2018) use an RD design to analyze a Florida policy that required the 100 lowest-performing elementary schools to add an additional hour of reading instruction each day and find it increased reading test scores by $.05\sigma$ in the first year.

Three related studies leverage data collected by the Programme for International Student Assessment (PISA) to examine the effect of subject-specific instructional time (Cattaneo et al., 2017; Lavy, 2015; Rivkin & Schiman, 2015). These studies isolate within-student or within-school

variation in instructional time across subjects and find small to medium effects; a single hour of additional instruction per week in a subject increases achievement by between $.02\sigma$ and $.07\sigma$. A similar study uses data from the Trends in International Mathematics and Science Study (TIMSS) and finds a $.02\sigma$ increase in academic achievement for every additional hour in the school day (Wu, 2020). In the United States, some districts have also begun expanding instructional time in specific subjects without changing total instructional time. Using RD and DiD designs, studies show small or medium positive effects of double-dose math classes on math achievement and larger effects on high school graduation and college enrollment (Cortes & Goodman, 2014; Cortes et al., 2015; Taylor, 2014a).

Full-day kindergarten offers the best example of a widespread expansion in the length of the school day in the United States. Estimated effects of full-day kindergarten on end-of-year achievement are almost uniformly positive and of medium or large magnitude across studies using fixed effects (Lee et al., 2006; Zvoch et al., 2008), IVs (Cannon et al., 2006; Gibbs, 2014b; Warburton et al., 2012), DiDs (Cannon et al., 2011), and RCTs (Amsden et al., 2005).² However, studies that examine longer-run outcomes find that these positive effects tend to fade out over time (Friesen et al., 2022; Gibbs, 2014a; Gottfried et al., 2019).

Overall, the literature on extending the length of the school day suggests a consistent positive effect of adding more total time on student achievement as shown in Figure 2, panel c. International studies indicate consistent positive effect sizes of small to often medium magnitude on student achievement. The much smaller research base focused on the United States is more divided, showing positive effects in some studies and no effects in others. The overall pattern of findings across these studies is also broadly consistent with a theory of positive but marginally decreasing returns to additional time during the school day; larger increases in time in education systems with fewer total hours demonstrate larger overall effects.

The Structure of School Time

In addition to lengthening the school day or school year, districts can also change the way that they structure their existing time. The structure of school time can have important consequences for the amount of active learning time students experience even when total time and learning time are held constant. This is because the length of the school day and year, as well as start and ending times, have direct effects on many of the school-level, classroom-level, and student-level factors that can prevent schools from converting total time into active learning. For example, the structure of time in school can impact teacher and student attendance as well as students' ability to focus and stay on task.

Important dimensions of how time is structured in school include academic calendars, class schedules, the number of school days in a week, and school start times. We point readers to prior reviews of the limited causal

literature on year-round calendars (Graves et al., 2013; N. Pope & Landon, 2023; P. von Hippel, 2016), which suggests staggering school breaks has very minimal effects. We found scant causal evidence on block schedules.³ Thus, we focus our discussion below on 4-day weeks and school start times. We find that 4-day weeks rarely improve student academic outcomes and often lead to decreases in performance, while delaying start times can improve outcomes but does not always.

Four-Day School Weeks

Four-day weeks, with the potential to decrease HVAC and busing costs, are an increasingly popular tool to restructure time. These schedules are currently being used in over 850 districts in at least 24 states (Morton et al., 2023). When 4-day weeks maintain the same total time in a school year by lengthening the day but shortening the number of days, research shows mixed effects. In Colorado, researchers find that the switch to a 4-day week in small rural districts led to a small increase in the percentage of students scoring proficient on math and reading tests for upper elementary students (Anderson & Walker, 2015). In Oklahoma, a DiD study shows no effect on achievement but does find that the shortened school week saves districts money and decreases bullying and fights among the student body (Morton, 2021, 2022).

Studies show the most common approach is shifting to a 4-day school week and reducing the total number of hours in the school year, with students in a 4-day week school experiencing 85 fewer total instructional hours per school year on average (Thompson, Gunter, et al., 2021). The effects of this reorganization and reduction of instructional time are more uniformly negative, with studies employing DiD designs finding corresponding small to moderate decreases in math and reading test scores (Kilburn et al., 2021; Thompson, 2019, 2021; Thompson & Ward, 2022). Two recent studies that examine effects across multiple districts, some of which changed total time and some of which did not, find decreases in achievement levels and achievement growth between $.03\sigma$ and $.09\sigma$ (Morton et al., 2023; Thompson, Tomayko, et al., 2021).

The overall pattern of results from research on 4-day school weeks in the United States, summarized in Figure 2, panel D, suggests that 4-day school weeks typically have a small negative effect on student achievement.

School Start Times

In addition to expanding or restructuring time, schools can also shift their start and end times to address concerns about students coming to school well rested and ready to learn. Later school start times have been shown to increase sleep, mood, and attention while decreasing car accidents given adolescents' later sleep schedules (e.g., Bostwick, 2018; Gariépy et al., 2017). A study using DiD methods in North Carolina shows that a 1-hour delay in middle school start times caused a small increase in math and reading achievement

(Edwards, 2012), while another study using IV in Florida finds medium-sized increases in math and reading achievement across 3rd through 10th grade (Heissel & Norris, 2019). In South Korea, research using DiD finds that a policy to move start times in secondary schools back by 1 hour to 9 a.m. led to a medium increase in math scores but had no significant effects on test scores in Korean and English (Kim, 2022). Studies on a later high school start in Minnesota show no effects on ACT scores but a positive effect on grade point average (GPA) (Hinrichs, 2011; James et al., 2023). When a county in North Carolina moved high school start times earlier, research using DiD methods showed ACT scores were not affected (Lenard et al., 2020). A school fixed effects model in North Carolina showed a similar null result on ACT scores, but a medium negative result on math test scores (Bastian & Fuller, 2018). A student fixed effects model, also in North Carolina but with middle school students, who may be differently affected by the time shift, showed small positive results on math and reading (Bastian & Fuller, 2023).

As summarized in Figure 2, panel E, research on the effects of delaying school start times in middle and high school shows small to moderate positive effects on state standardized tests.

Empirical Facts About Time in U.S. Schools

The existing body of research demonstrates clearly that total time has direct positive benefits to student achievement. Here, we explore the implications of these findings by examining how the United States compares to its international peers as well as the degree to which time in school varies within the United States. Data on cross-country and cross-state comparisons of time capture the macro parameters that policymakers can influence and researchers can measure: total time and instructional time.

We first describe the key international and state-specific differences in these coarse measures. These analyses serve to highlight the inequity in access to time in school both across countries, on average, and within the United States across states and schools. We then explore the scale and scope of time lost to specific school-level, classroom-level, and student-level factors that erode instructional time using detailed data from a district case study. Our case study serves as a concrete example of the specific ways in which instructional time is lost along the causal cascade shown in Figure 1 as schools try to convert instructional time into active learning time.

How Does Instructional Time in U.S. Schools Compare to Other Countries?

We draw on data collected in 2021 by the Organization for Economic Cooperation and Development (OECD) that captures instructional time in lower secondary schools across OECD member countries and partners. National ministries and departments of education provide data to the OECD on the average intended instructional hours per year and the average number

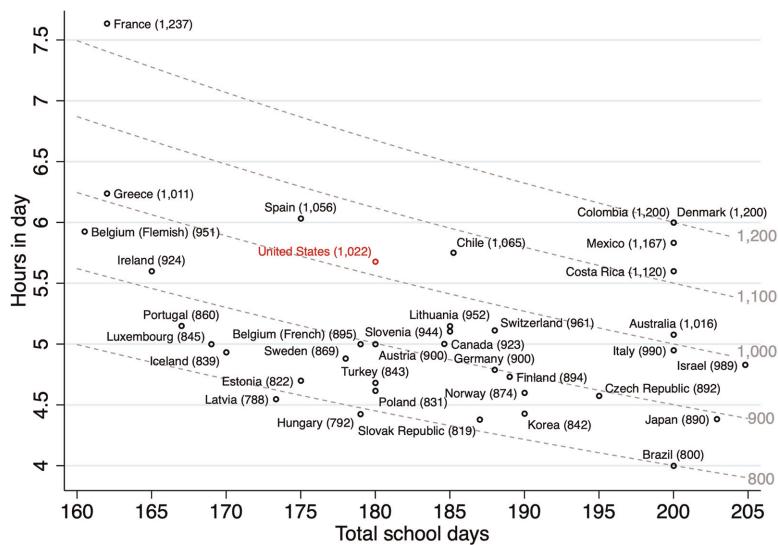


Figure 3. Scatterplot of the intended instructional hours in a school day and days in a school year for lower-secondary schools across countries using 2021 data collected by the OECD.

of instructional days per year (OECD, 2021).⁴ Lower secondary schools in the United States are, on average, providing 1,022 hours of instructional time across 180 days per year. Dividing instructional time by the average number of days provides an estimate of 5.7 hours per day.

As shown in Figure 3, the United States ranks near the top of the distribution of instructional time: 8th among the 37 countries. Overlaid “isoquant” curves highlight how countries achieve similar instructional time per year through different combinations of the length of the school day and year. We achieve this ranking through the combination of a relatively long school day (ranked 8th) and short school year (tied for 24th). Fifteen countries have school calendars that are at least 2 weeks longer than the average 180 days in the United States. We also draw on estimates of total regular instructional hours per week in lower secondary schools constructed from student responses on the 2018 PISA (Programme for International Student Assessment) as a robustness check for the relative ranking of the United States. Similar to our estimates of the length of the school day based on data reported by governments, the PISA data shows the United States ranked 8th among 77 countries using this alternative measure (OECD, 2020).⁵

How Much Does Total Time in School Vary Within the United States?

State Laws on Minimum Time in School

Unlike most countries where a central governing body sets national education policies, the U.S. system of government delegates authority over education to individual states. States set the minimum length of the school year, the minimum number of total hours in school, and/or the minimum number of hours in a school day. A database maintained by the Education Commission of the States shows that, in February 2023, 16 states mandated both the length of the school year and the amount of total hours, while 10 states gave districts the freedom to meet either a minimum number of days or total hours requirement (Silva-Padron & McCann, 2023). Eleven states required only a minimum number of days, and 13 states only set a minimum requirement for the number of total hours.⁶

This patchwork system results in markedly different minimum school time requirements for U.S. students depending on where they live. Among the 37 states that identify a minimum number of days per year, the majority (28) set the minimum at 180 days, with a range between a low of 160 in Colorado to a high of 186 in Kansas. Thirty-nine states specify a minimum number of hours per year, with high school hours ranging between 720 hours in Arizona to 1,260 hours in Texas. Even setting these two outliers aside, there exist large differences across states. High school students in Alaska, Florida, and Connecticut are only required to have 900 hours of school per year, while public high school students in Maryland are required to have 1,170 hours (Silva-Padron & McCann, 2023). Graduating seniors in Maryland will have been required to attend high school for 30% longer—approximately 160 more days across 4 years—than students in Alaska, Florida, and Connecticut.

Total Time in School

While there exist stark differences in the minimum number of hours and days across states, districts maintain the autonomy to increase time requirements so long as their budgets can cover the expansion. We draw upon the 2017–2018 National Teacher and Principal Survey (NTPS) to quantify the actual amount of total time students spend in U.S. public schools. The NTPS is a nationally representative survey of K–12 public schools, including both traditional and charter schools.⁷

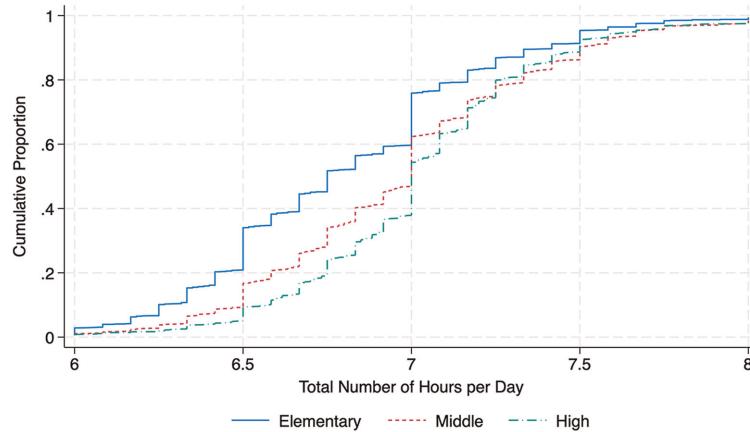
We estimate that the typical K–12 public school in the U.S. is in session for 6.90 hours per day and 178.59 days per school year, on average, for a total of 1,231 hours per year. In Table 1, we describe the wide variation in the number of school hours per day, days per year, and hours per year. Students attending schools at the 90th percentile of the distribution of the number of hours per day are in school more than an hour longer each day than those at the 10th percentile (7.50 vs. 6.33 hours). Similarly, schools at the 90th percentile of the distribution of the number of days per year are in session 2 weeks more

Table 1
Allocated Total Time in U.S. Public Schools Across Schooling Levels in 2017–2018

Percentile	Hours in Day			Days in Year			Hours in a Year					
	Overall	Primary	Middle	High	Overall	Primary	Middle	High	Overall	Primary	Middle	High
1	6.00	6.00	6.07	6.07	147	154	159	146	1,064	1,065	1,080	1,052
5	6.25	6.17	6.33	6.50	170	171	170	170	1,110	1,095	1,138	1,140
10	6.33	6.25	6.50	6.57	173	173	174	173	1,136	1,125	1,155	1,170
25	6.50	6.50	6.67	6.80	177	178	178	178	1,170	1,165	1,197	1,215
50	6.92	6.75	7.00	7.00	180	180	180	180	1,230	1,211	1,246	1,260
75	7.17	7.00	7.25	7.25	180	180	180	180	1,275	1,260	1,290	1,293
90	7.50	7.42	7.50	7.50	183	183	184	183	1,332	1,313	1,346	1,335
95	7.67	7.50	7.67	7.67	186	186	186	185	1,365	1,350	1,387	1,371
99	8.08	8.00	8.17	8.17	190	190	190	190	1,479	1,463	1,504	1,456
Mean	6.90	6.80	6.97	7.03	178.59	178.86	179.03	178.60	1,231	1,216	1,248	1,256
SD	0.47	0.40	0.45	0.59	7.14	5.70	6.01	8.86	89.15	76.31	83.79	114.13
<i>n</i> (sample)	6,518	3,153	1,161	1,508	6,518	3,153	1,161	1,508	6,518	3,153	1,161	1,508
<i>N</i> (population)	79,623	47,973	13,043	12,996	79,623	47,973	13,043	12,996	79,623	47,973	13,043	12,996

Note. The following types of schools are excluded from the sample: alternative schools, schools with special education emphasis, special education schools, and career/technical/vocational schools. Estimates are produced using inverse probability weights. Source: National Teacher and Principal Survey 2017–2018.

Panel A: Hours per day.



Panel B: Days per year.

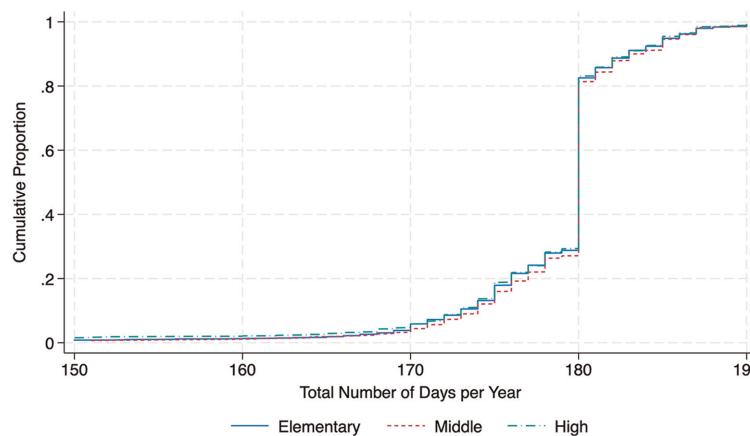


Figure 4. (continued)

Panel C: Total hours per year.

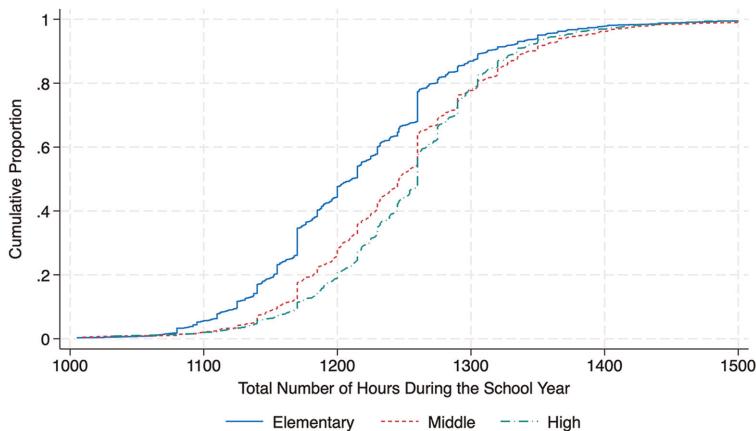


Figure 4. The cumulative distribution of total time across U.S. public schools using data from the 2017–2018 National Teacher and Principal Survey.

Note. Figures exclude schools below the 1st and above the 99th percentiles.

than schools at the 10th percentile (183 vs. 173 days). Cumulatively, the total number of school hours per year differs by almost 200 hours between schools at the 90th and 10th percentiles (1,332 vs. 1,136 hours). This gap equates to a difference of approximately 5 and half weeks of schooling, or more than 2 full school years over the course of a K–12 education.⁸

Figure 4 illustrates the variation in the time schools are open in the United States and how this differs across elementary, middle, and high schools. As shown in Table 1, schools are in session a similar number of days per year across schooling levels but are in session for more hours a day, on average, as students become older (elementary, 6.80 hours; middle, 6.97 hours; high, 7.03 hours). The 90th to 10th percentile difference in total hours per year remains quite large even when restricting comparisons within schooling levels (elementary, 187.50 hours; middle, 190.83 hours; high, 165.00 hours).

We further explore the variation in the total number of hours in a school year by plotting the full population-weighted sample of schools in Figure 5. This scatterplot illustrates the wide variation in the total number of hours per school year. The outlying cluster in the upper left quadrant represents schools that are in session only 4 days a week (~150 days a year) for upwards of 8 total hours a day. Although these schools achieve a similar number of hours as many schools that are in session, the standard 4 days a week, research described above suggests that the number of days per week and hours per day are not perfect substitutes in the extremes.

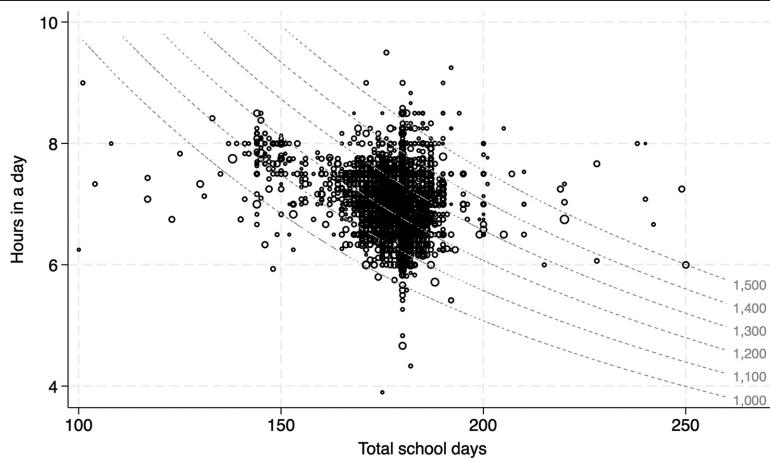


Figure 5. Scatterplot of the total hours in a school day and days in a school year for U.S. public schools using data from the 2017–2018 National Teacher and Principal Survey.

We next explore the degree to which systematic differences across states account for the variation in total time across individual U.S. public schools described above. We estimate that 23% of the variation in total school hours is accounted for by differences across states. Thirty-one percent of the variation in hours per day is explained by states, compared to only 20% of the variation in the number of days per year. We depict the substantial variation in the number of hours per year across states in Figure 6 and report average and median estimates by state in online Appendix B. The five states where students attend schools the longest (Texas, Nebraska, Arkansas, Mississippi, and Alabama) are in session at least 133 hours more, at the median, than the five states where schools are open the fewest hours (Hawaii, Nevada, Maine, Oregon, and Rhode Island). Over the course of a K–12 education, students living in the states that ranked in the top five for total hours will have access to the equivalent of 1.4 more years of schooling, at the median, compared to students living in the states ranked in the bottom five for total hours.⁹

We next examine heterogeneity in school hours by school type and location using the NTPS data. We find that, on average, charter public schools are in session for 65 more total hours than traditional public schools (1,291 vs. 1,226) and rank at the 82nd percentile among noncharters. The distribution of charter schools has a thick upper tail consisting of predominantly urban charter schools that have notably extended the length of the school day and/or year. The total number of hours per school year also varies by schools' locations. Suburban schools are in session the least (1,212 hours on average), whereas

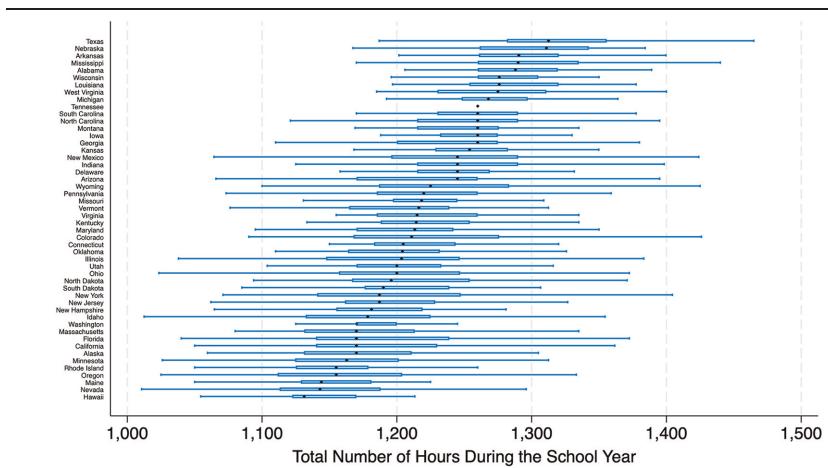


Figure 6. Box-plots depicting the variation in total hours in a school year for U.S. public schools across states using data from the 2017–2018 National Teacher and Principal Survey.

Note. Boxes represent 25th to 75th percentiles with medians indicated with black diamonds. There is no variation among schools in Tennessee because the vast majority of sampled schools had exactly 1,260 hours.

schools in rural areas (1,241 hours) and towns (1,240 hours) have the longest average time in school. There is considerably more variation in the total hours among schools in cities (1,239 hours), with schools in the upper range of the distribution being much more likely to be in cities than elsewhere.

The composition of students attending schools with more total hours differs from schools with fewer hours. In Table 2, we present average student characteristics among schools grouped by quintiles of total hours per year. We find that African American students disproportionately attend schools with more total hours. African Americans represent 21% of students at schools in the top quintile of time, but just 10% in the bottom quintile. This is partially due to the fact that, nationally, African American students are twice as likely to attend a charter school as a traditional public school (28% vs. 14%) and the longer school days and years in many southern states. Similar to African American students, students eligible for free- or reduced-price lunch disproportionately attend schools in the top quintile of time. Students from low-income families comprise 68% of the student body in top quintile schools, but only 58% in bottom quintile schools. Asian and Hawaiian/Pacific Islander students follow an opposite trend, disproportionately attending schools in the bottom quintile. This is not surprising given Hawaii, Oregon, California, and Washington State all rank in the bottom 11 states in terms of total hours per school year. Hispanic students show a bimodal

Table 2
Student Characteristics by Quintiles of the Total Hours in a School Year for U.S. Public Schools in 2017–2018

	Overall	Bottom Quintile	Second Quintile	Third Quintile	Fourth Quintile	Top Quintile
Female (%)	48.47	48.58	48.19	48.40	48.44	48.76
African American	15.27	10.42	12.92	14.44	17.32	21.23
American Indian (%)	1.62	1.84	1.62	1.56	1.54	1.57
Asian (%)	3.86	6.18	4.93	3.26	2.66	2.40
Hawaiian Native / Pacific Islander (%)	0.39	0.96	0.38	0.19	0.23	0.23
Hispanic (%)	22.27	26.52	21.28	16.71	19.63	28.17
Multiracial (%)	3.27	4.11	3.83	3.36	2.75	2.33
White (%)	53.32	49.96	55.04	60.48	55.88	44.08
Free- and reduced-price lunch (%)	58.40	57.72	53.15	54.56	59.19	68.06
Average daily attendance (%)	93.33	93.08	93.28	93.27	93.38	93.63
<i>n</i> (sample)	6,445	1,069	1,282	1,354	1,384	1,356
<i>N</i> (population)	78,879	14,572	16,504	16,242	16,581	14,979

Note. The following types of schools are excluded from the sample: alternative schools, schools with special education emphasis, special education schools, and career/technical/vocational schools. Source: National Teacher and Principal Survey 2017–2018.

distribution, clustering at the bottom and top quintiles, while White students cluster in the middle of the distribution.

How Much Instructional Time Is Lost Within the School Day?

A large body of research that examines teaching and learning within classrooms documents how instructional time is lost to organizational disruptions, off-task behavior, and mundane activities like transitions. Reviews of the Process-Product literature from the 1970s and 1980s conclude that optimizing instructional time is among the most important factors for improving student achievement (Brophy & Good, 1984; Hawley et al., 1984). Phelps et al. (2012) collect instructional logs from thousands of classrooms and estimate that, on average, students miss instruction in math and ELA about 40 days per year due to a range of factors including student and teacher absences, special events, and testing. We examine the amount of instructional time lost in Providence Public School District (PPSD) in 2016–2017 due to a range of student, teacher, and organizational factors highlighted in Figure 1 to better understand the magnitude of time loss in U.S. schools. Specifically, we calculate the instructional hours that remain after accounting for student absences, suspensions, and tardies as well as teacher absences and outside interruptions to estimate the potential gains from better utilizing currently allotted time. (See online Appendix C for a detailed description of our methods.) This exercise helps to demonstrate how translating instructional time into active learning time can be an elusive goal that remains at arm's length for schools and teachers.

Setting

PPSD is a midsize urban school district in Rhode Island. PPSD operated 41 schools serving over 24,000 students in 2016–2017. The district predominantly serves students of color from low-income families. Sixty-four percent of PPSD students are Hispanic, 17% are African American, and 9% are White. Over 85% of students receive free- or reduced-price lunch. One in four students is an English language learner, and 15% receive special education services.

The state of Rhode Island requires public schools to be in session at least 6 hours a day for 180 days a year, a total of 1,080 hours. PPSD exceeds these minimum requirements by lengthening the school day to 6.52 hours in elementary schools and 6.75 hours in secondary schools. Multiplying by 180 days in the PPSD academic year produces a total of 1,174 hours for elementary schools and 1,215 hours for secondary schools. This places PPSD at the 35th percentile of the national distribution for elementary schools, the 35th percentile for middle schools, and the 27th percentile for high schools.

While PPSD is not unusual in terms of total time, it was a prepandemic outlier in the degree to which students are absent or suspended. In 2015–2016, 45% of PPSD high school students missed more than 18 days of school, the equivalent of 10% of the school year (Rhode Island KIDS COUNT, 2017).

This compares to 26% of students statewide who missed more than 18 days and less than 14% nationally. PPSD also suspends students at relatively high rates, issuing 21 in-school or out-of-school suspensions per every 100 students in the district compared to 17 statewide (Rhode Island KIDS COUNT, 2017). However, chronic absenteeism has increased substantially after the COVID-19 pandemic such that many districts and even states now have rates of chronic absenteeism approaching levels found in Providence prior to the pandemic (Chang et al., 2022).

The Rhode Island Department of Education took over PPSD for a 5-year term starting in 2019 after the release of an independent district review documenting major concerns over low student achievement and chronic absenteeism, deteriorating buildings, unsafe learning conditions, a demoralized teaching staff, and families who felt marginalized and without a voice (L. Borg, 2019; Johns Hopkins School of Education, 2019). Thus, PPSD serves as a case study of a district facing considerable challenges in supporting students' success—and an example of a district where students might greatly benefit from more effective use of existing instructional time. Although the specific results of our case study likely have limited generalizability, we believe the general lessons can be broadly informative given that the COVID-19 pandemic increased attendance challenges nationwide.

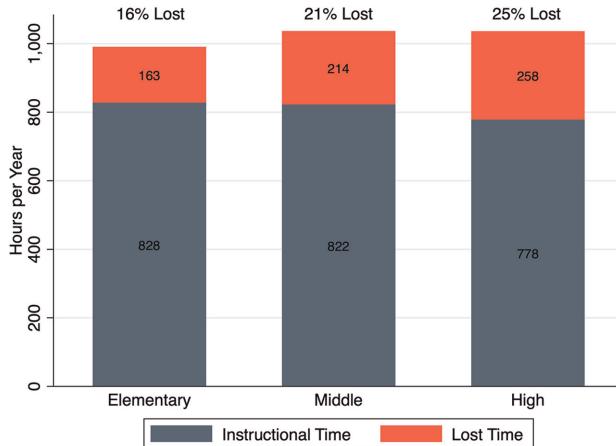
Case Study Findings

In Figure 7, we illustrate how instructional time loss affects students in elementary, middle, and high schools across the district. As shown in panel A, we estimate that the average elementary school student in PPSD loses 16% of instructional time, while the typical middle school student loses 21%. High school students lose a total of 25%, a full fourth of their instructional time. Assuming that additional time would suffer from the same rate of loss, we estimate that Providence would need to add an extra 1.85 hours of total time to every school day to achieve the 5.76 hours of instructional time that the district intends for its high school students.

Disaggregating our time loss estimates reveals that three factors account for the majority of lost instructional time. As shown in Figure 7, panel B, unexcused student absences account for the largest portion, particularly in high school. Outside interruptions and teacher absences, the second and third largest contributors to lost instructional time, respectively, limit student learning in the classroom and are arguably more directly under the control of school districts. These outside interruptions to instruction include intercom announcements, calls to classroom phones, and the subsequent disruptions these interruptions cause. Notably, middle school teachers report more frequent outside interruptions than those in elementary and high schools.

Teacher absences constitute the third largest source of lost instructional time. Although it is possible that students do learn from substitute teachers,

Panel A: Lost instructional time.



Panel B: Components of lost instructional time.

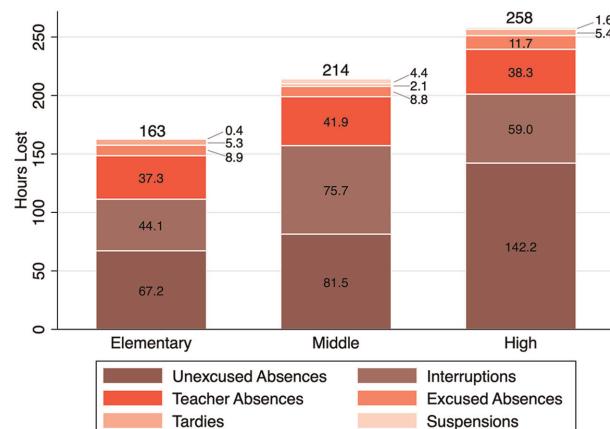


Figure 7. Instructional time loss by school level in Providence Public Schools in 2016–2017.

our classroom observations in PPSD suggest that substitutes are rarely successful at delivering sustained instruction and that requests for substitutes frequently go unfilled. Together, interruptions and teacher absences cost the average PPSD high school student 97.3 hours per year. Excused absences, suspensions, and tardies account for the remainder of the lost time, bringing the total amount of instructional time lost in high schools to 258 hours per year—approximately 45 days of school.

Our analyses provide a lower bound estimate of the instructional time lost in PPSD. Our estimates do not capture how usable instructional hours are further eroded by disruptions within the classroom and nonacademic activities in class as illustrated in our conceptual framework (Figure 1). Estimates of off-task behavior, transitions, and wait-time suggest these activities occupy between 17% and 29% of instructional time (Fisher, 2009; Godwin et al., 2016; Rosenshine, 2015; Schwartz et al., 2018).

Discussion

Interpreting the Evidence

Synthesizing the causal research on time in school presents a challenge because time is measured, organized, and implemented in different ways across very diverse contexts. Conceptually, many researchers and policy-makers are implicitly interested in drawing conclusions about the causal effect of undisrupted learning time—the amount of instructional time schools provide when teachers and students are present and the learning environment is free of impediments to active learning. As our case study illustrates, this construct is extremely challenging to measure at the scale required by well-powered causal research designs. Instead, researchers must rely on two proxies: total time and instructional time. This is both because of the measurement challenges and because causal research on time in school relies overwhelmingly on quasi-experimental methods that exploit shifts in school and district calendars (i.e., total time). Although some studies leverage shifts in instructional time from changes in school schedules and initiatives like double-dose algebra, even this measure is still at arm's length from capturing undisrupted learning time.

Overall, the empirical evidence we review establishes a clear positive causal effect of increasing total time and instructional time on student achievement. Estimates are overwhelmingly positive and significant. Quantifying the magnitude of these effects is more challenging because studies differ considerably in the amount of time added and the baseline levels of time. In our review, estimates reflect the effect of increasing total time by as little as 1 day per year or 20 minutes per day to as much as 6 months per year or 3 hours per day. Even efforts to convert these estimates onto a common unit scale would not create an apples-to-apples comparison. As Levin (1984) theorized over 40 years ago, the causal effect of time on student academic outcomes is likely a nonlinear relationship with diminishing marginal returns that could even become negative in the extreme. Extending an already long school day from 7 to 8 hours is unlikely to have the same benefit as increasing a short school day from 5 to 6 hours. Consistent with prior reviews (Dağlı, 2019; Gromada & Shewbridge, 2016), we find evidence of diminishing marginal returns to increased schooling in the pattern of results across studies as well

as within individual analyses (Aguero & Beleche, 2013; Rivkin & Schiman, 2015; Taylor, 2014b; Wu, 2020).

Our read of the literature suggests that nontrivial expansions of total time in school (e.g., a 10% increase or more) are most likely to produce small increases in student achievement in the U.S. context (less than $.05\sigma$), but more often produce medium size effects (between $.05\sigma$ and $.20\sigma$) in international settings. Large effects (greater than $.20\sigma$) are the exception and are found almost exclusively in bundled treatment effects of urban charter school and turnaround schools in the United States (Abdulkadiroglu et al., 2011; Angrist et al., 2013) and strikingly large changes in learning time in the international context (Parinduri, 2014; Pischke, 2007). The largely positive but variable effects of time in school suggest two things are true: (a) most school systems that substantially increase total time are able to convert this additional time into at least small gains in academic achievement, and (b) how time is used matters.

The small to moderate effect sizes we find also suggest that the direct effect of active learning time is likely quite substantial, but our conceptual framework illustrates why this concept may be elusive. Schools dedicate time to lunch, recess, and nonacademic activities for good reason. Schools are complex social organizations where unpredictable things happen. There are substantial challenges to delivering undisrupted instructional time and, even when successful, students have to take the final step to convert it into active learning time.

Important questions remain about whether extended learning time is a reform that is equity enhancing or might widen existing opportunity gaps. From an educational achievement perspective, work by Carroll (1963) and Levin (1984) suggest that increasing total time in schools could exacerbate inequality if students with higher aptitude are better able to take advantage of this time or because more advantaged students attend schools that are more successful, on average, at converting total time into undisrupted instructional time. On the other hand, Coleman's (1968) concept of the intensity of schooling frames longer school hours as an equity enhancing reform because it reduces the amount of time students spend outside of schools where there exist wide differences in access to enriching learning environments. Research on summer learning loss suggests that differences in student achievement arise largely before students begin formal school and grow over the summer months (P. T. von Hippel et al., 2018). Longer school days and years may even be a compensatory policy that reduces educational inequity. From an economic standpoint, more time in school is equity enhancing because it provides free childcare and decreases barriers to labor force participation, which benefits families from lower socioeconomic backgrounds the most. From a long-term outcome perspective, research suggests that longer school days can reduce teen pregnancy and incarceration (Dobbie & Fryer, 2015) and increase future wages (Parinduri, 2014).

Our review of the literature suggests there is no consistent pattern of heterogeneous effects of time along dimensions of student prior achievement, socioeconomic status, race, or gender. There exists evidence of equity

enchaining effects of additional time (Aucejo & Romano, 2016; Cannon et al., 2011; Cattaneo et al., 2017; Cortes et al., 2015; Hincapie, 2016; Marcotte & Hemelt, 2008; Wu, 2020), evidence that it benefits more advantaged students (Aguero & Beleche, 2013; Figlio et al., 2018; Orkin, 2013), and evidence of no heterogenous treatment effects (Bellei, 2009; Cannon et al., 2006; Dominguez & Ruffini, 2021; Rosa et al., 2022). These results suggest that how time affects educational equity has more to do with who has access to its benefits rather than how it benefits students differentially.

U.S. Policy Considerations

While the U.S. education system provides a comparable amount of instructional time to most other high-income countries, on average, many students are being left behind. Over 19% of public schools are in session at least a full week less than the national median (180 days), while another 14% of public schools have school days that are shorter than the national median (6.9 hours) by 30 minutes or more. These differences represent substantial inequities in the amount of total time students are provided by schools that add up to stunning differences across a K-12 education. Millions of public school students in the United States will have access to what amounts to 2 years of additional time in school during their K-12 educational career compared to millions of their peers simply because of where they live.

Raising minimum school time requirements across states to be closer to the national average would be one promising policy response to the COVID-19 pandemic. Minimum time requirements are blunt instruments, but they offer a feasible top-down policy reform that is within the control of policymakers. Given that research suggests time in school has diminishing marginal returns, focusing on those schools that offer the least amount of time might also produce the largest returns. As a thought experiment, imagine if the five states where schools are open the fewest hours raised state minimum time requirements to 7 hours a day (e.g., 8:30 a.m. to 3:30 p.m.) for 180 days a year. The 94% of schools in Hawaii, Nevada, Maine, Oregon, and Rhode Island that do not meet these minimums would gain an average of 125 hours of schooling per year, an increase of 1,625 hours over 13 years. This would effectively add 1.3 years to the schooling trajectories of over 368,000 students. A parallel nationwide effort to adopt 7-hour, 180-day minimums would increase total time in 71% of U.S. public schools. The effect would be to add more than 4.6 million hours of additional time per year across U.S. public schools, potentially benefitting more than 32 million students.

However, increasing time in school is a financially costly policy that may not make sense for all states and districts. Federal relief funds in response to COVID-19 provided districts with the opportunity to cover the costs of expanding time in the short run. Even flushed with federal dollars, most districts were hesitant to make changes to school schedules given the

considerable uncertainty about sustaining these costs after one-time federal funds are spent down. Extending time in school is an expensive policy that may not be as cost-effective as other alternative policies (Levin & Tsang, 1987) and does not always succeed (Checkoway et al., 2013).

Our research synthesis and case study point to several lower-cost, complementary approaches to maximizing time in schools. At a minimum, districts should fiercely avoid reducing time in school. There is a compelling body of evidence across multiple states documenting the negative effects of 4-day school weeks that decrease total time. There are also low-cost opportunities to adjust school calendars in ways that keep total time constant but might reduce the challenges of converting total time into active learning time. One such example is shifting school start times to be later for older students. Evidence shows that later start times produce achievement gains as well as other health benefits for students. Designing schedules so that students take core academic classes earlier in the day when their attention is highest would also maximize available time (N. G. Pope, 2016).

Our case study suggests that many U.S. public schools would also benefit from concentrated efforts to utilize instructional time more effectively. Schools have the potential to recover substantial amounts of lost instructional time without changing their schedules at all. This approach to increasing instructional time is far less malleable from a top-down policy perspective, but we expect it offers greater potential returns for many more schools. Behavioral interventions to increase student attendance, schoolwide systems to reduce disciplinary incidents that remove students from class, policies that limit school intercom and phone use, and incentives to curb teacher absenteeism could all play roles in maximizing instructional time.

Implementation Challenges

Building teacher and parent buy-in is also crucial to any efforts to expand time in school. Teachers can be hesitant to agree to extended day and year initiatives even when they are compensated for their time. This may be particularly true for teachers who were attracted to the profession because it allows them to care for their own children after school and during the summer. Teaching is also a physically and mentally exhausting job. Districts that expand time in school will have to take additional steps to attract and retain effective teachers given the rising rates of teacher turnover and burnout in the wake of the pandemic (Barnum, 2023; Steiner et al., 2022). Parent buy-in also presents a substantial obstacle to expanding school time. Support for more time in school is decidedly mixed among parents (Barnum, 2022). Many districts have navigated this challenge by making additional time voluntary for families or allowing individual schools to opt in, but this could widen achievement disparities if only the most motivated students or well-organized schools participate in these new programs.

Schools and districts also have to choose *how* to expand time. Extending the school day can be an attractive approach because it is marginally less expensive than adding days to the school year as it does not require additional food or transportation costs. However, it is likely more challenging for both schools and students to convert time added to the end of the school day into active learning time than it is to make additional school days productive. Longer school days often require teachers to adopt new instructional approaches and students to maintain their focus longer. Adding days to the start or end of the school year requires few organizational changes and, thus, may be the easier approach to adding time. The length of the school year is also the dimension of time where the United States lags behind other nations the most.

Conclusion

Stagnating test scores and increasing economic competition have led to repeated calls for expanding time in U.S. public schools over the last several decades. The COVID-19 pandemic and resulting learning loss experienced by students have sparked renewed interest. Deriving a single conclusion from the causal research literature on time in school is nearly impossible because of the multiple ways in which learning time is operationalized in schools (e.g., via the length of the school day, week, and year). Time operates similarly to another key resource in education: money. Time, like money, is necessary for supporting student academic success. Evidence demonstrates that schools can leverage additional time to improve students' academic success. But when time is used ineffectively or in ways unaligned with academic goals, it will produce little benefits for students.

Time use is always about trade-offs. Some families simply value the flexibility that shorter school days and years provide. Additional time in school might even be counterproductive if it crowds out enriching life experiences for students outside of school or if schools are unable to convert added time into active learning. After-school and summer activities can also have positive benefits for student achievement, social-emotional development, and mental well-being (Durlak et al., 2010; Kidron & Lindsay, 2014; McCombs et al., 2019). More instructional time alone will not ameliorate the deep harms caused by the COVID-19 pandemic. But the clear inequities in access to time and new urgency to support students' academic recovery in the wake of the pandemic suggest that targeted efforts to expand time in school and ensure that this time is used effectively would be a wise investment.

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Notes

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¹We recognize that the line between an afterschool program and an extended day program can be subjective, as can be the line between a summer program and an extended year program. We focus on traditional extended day and extended year programs whenever possible.

²Gibbs (2013) offers an exception to this, showing a positive effect using an instrumental variables approach but no significant effect using a regression discontinuity. Cannon et al. (2011) show positive, moderate, and statistically significant effects in kindergarten and negative (though statistically insignificant and small) effects by second grade.

³A recent RCT of block scheduling in Croatia found null effects, though there were positive effects for some grades (Labak et al., 2020, 2021). See Zepeda and Mayers (2006) for a review of the correlational evidence.

⁴For complete data, see Tables D1.1 and D1.2 in OECD (2021).

⁵Estimates based on survey responses from 15-year-olds about the number of academic periods in a school day and the length of a typical period. For complete data see Table V.B1.6.1 in OECD (2020).

⁶Further inconsistencies arise from a lack of clarity about whether state laws on minimum hours refer to total time or instructional time in school (i.e., whether the minimums include lunch or other purposefully noninstructional uses of time).

⁷We exclude from our sample a small fraction of schools that provide alternative or nontraditional education (6.0%), specialized schools with a targeted emphasis in a given subject such as STEM or performing arts (3.7%), special education schools (1.4%), and career/technical/vocational schools (1.4%) and apply appropriate population weights.

⁸A difference of 196.17 hours per year translates to 2.06 additional years over a student's 13 years in the U.S. school system. The math is as follows: (196.17 hours per year \times 13 years) / 6.9 hours per day / 179 days per year = 2.06 years.

⁹A difference of 133 hours per year translates to 1.4 additional years over a student's 13 years in the U.S. school system. The math is as follows: (133 hours per year \times 13 years) / 6.9 hours per day / 179 days per year = 1.4 years.

References

Abadzi, H. (2009). Instructional time loss in developing countries: Concepts, measurement, and implications. *World Bank Research Observer*, 24(2), 267–290. <https://doi.org/10.1093/wbro/lkp008>

Abdulkadiroglu, A., Angrist, J., Dynarski, S., Kane, T., & Pathak, P. (2011). Accountability and flexibility in public schools: Evidence from Boston's charters and pilots. *Quarterly Journal of Economics*, 126(2), 699–748. <https://doi.org/10.1093/qje/qjr017>

Aguero, J. M., & Beleche, T. (2013). Test-Mex: Estimating the effects of school year length on student performance in Mexico. *Journal of Development Economics*, 103, 353–361. <https://doi.org/10.1016/j.jdeveco.2013.03.008>

Aguero, J. M., Favara, M., Porter, C., & Sanchez, A. (2021). *Do more school resources increase learning outcomes? Evidence from an extended school-day reform* (Discussion Paper No. 14240). IZA. <https://docs.iza.org/dp14240.pdf>

Amsden, D. J., Buell, M. J., Paris, C., Bagdi, A., Cuevas, T., Edwards, N., Tressell, P. A., Gamel-McCormick, M., Hartranft, D., Walker, E. M., Qiu, W., Kamphaus, J., & Turner, J. (2005). *Delaware pilot full-day kindergarten evaluation: A comparison*

often full-day and eight part-day kindergarten programs, school year 2004-2005. <https://udspace.udel.edu/handle/19716/3046>

Anderson, D. M., & Walker, M. B. (2015). Does shortening the school week impact student performance? Evidence from the four-day school week. *Education Finance and Policy, 10*(3), 314–349. https://doi.org/10.1162/EDFP_a_00165

Angrist, J. D., Dynarski, S. M., Kane, T., Pathak, P., & Walters, C. (2012). Who benefits from KIPP? *Journal of Policy Analysis and Management, 31*(4), 837–860. <https://doi.org/10.1002/pam.21647>

Angrist, J. D., Pathak, P. A., & Walters, C. R. (2013). Explaining charter school effectiveness. *American Economic Journal: Applied Economics, 5*(4), 1–27. <https://doi.org/10.1257/app.5.4.1>

Angrist, J. D., & Pischke, J.-S. (2009). *Mostly harmless econometrics: An empiricist's companion* (1st ed.). Princeton University Press.

Aronson, J., Zimmerman, J., & Carlos, L. (1998). *Improving student achievement by extending school: Is it just a matter of time?* WestEd. <https://www.wested.org/resources/improving-student-achievement-by-extending-school-is-it-just-a-matter-of-time/>

Aucejo, E. M., & Romano, T. F. (2016). Assessing the effect of school days and absences on test score performance. *Economics of Education Review, 55*, 70–87. <https://doi.org/10.1016/j.econedurev.2016.08.007>

Barnum, M. (2022, March 23). Longer school days and years remain rare. *Chalkbeat*. <https://www.chalkbeat.org/2022/3/23/22992779/learning-loss-school-extended-day-year>

Barnum, M. (2023, March 6). Teacher turnover hits new highs across U.S. *Chalkbeat*. <https://www.chalkbeat.org/2023/3/6/23624340/teacher-turnover-leaving-the-profession-quitting-higher-rate>

Barrios Fernández, A., & Bovini, G. (2017). *It's time to learn: Understanding the differences in returns to instruction time* (CEPDP1521). Centre for Economic Performance, LSE. https://cep.lse.ac.uk/_new/publications/abstract.asp?index=5704

Bastian, K. C., & Fuller, S. C. (2018). Answering the bell: High school start times and student academic outcomes. *AERA Open, 4*(4). <https://journals.sagepub.com/doi/full/10.1177/2332858418812424>

Bastian, K. C., & Fuller, S. C. (2023). Late but right on time? School start times and middle grade students' engagement and achievement outcomes in North Carolina. *American Journal of Education, 129*(2), 177–203. <https://doi.org/10.1086/723063>

Battistin, E., & Meroni, E. (2016). Should we increase instruction time in low achieving schools? Evidence from Southern Italy. *Economics of Education Review, 55*(C), 39–56. <https://doi.org/10.1016/j.econedurev.2016.08.003>

Bellei, C. (2009). Does lengthening the school day increase students' academic achievement? Results from a natural experiment in Chile. *Economics of Education Review, 28*(5), 629–640. <https://doi.org/10.1016/j.econedurev.2009.01.008>

Berliner, D. C. (1990). What's all the fuss about instructional time? In M. Ben-Peretz & R. Bromme (Eds.), *The nature of time in schools: Theoretical concepts, practitioner perceptions* (pp. 3–35). Teachers College Press.

Berthelon, M., Kruger, D. I., & Vienne, V. (2016). *Longer school schedules and early reading skills: Effects from a full-day school reform in Chile* (Discussion Paper No. 10282). IZA. <https://doi.org/10.2139/ssrn.2861027>

Bloom, B. S. (1968). Learning for mastery. In *Evaluation comment* (Vol. 1, Iss. 2). Regional Education Laboratory for the Carolinas and Virginia. <https://eric.ed.gov/?id=ED053419>

Borg, L. (2019, October 15). State takeover of providence schools starts November 1, will last 5 years. *The Providence Journal*. <https://www.providencejournal.com/>

story/news/education/2019/10/15/state-takeover-of-providence-schools-starts-nov-1-will-last-5-years/2512020007/

Bostwick, V. K. (2018). Saved by the morning bell: School start time and teen car accidents. *Contemporary Economic Policy*, 36(4), 591–606. <https://doi.org/10.1111/coep.12277>

Brophy, J., & Good, T. L. (1984). *Teacher behavior and student achievement* (Occasional Paper No. 73). Institute for Research on Teaching, College of Education, Michigan State University. <https://eric.ed.gov/?id=ED251422>

Cabrera-Hernandez, F. (2020). Does lengthening the school day increase school value-added? Evidence from a mid-income country. *Journal of Development Studies*, 56(2), 314–335. <https://doi.org/10.1080/00220388.2018.1563680>

Cannon, J. S., Jacknowitz, A., & Painter, G. (2006). Is full better than half? Examining the longitudinal effects of full-day kindergarten attendance. *Journal of Policy Analysis and Management*, 25(2), 299–321. <https://doi.org/10.1002/pam.20174>

Cannon, J. S., Jacknowitz, A., & Painter, G. (2011). The effect of attending full-day kindergarten on English learner students. *Journal of Policy Analysis and Management*, 30(2), 287–309. <https://doi.org/10.1002/pam.20560>

Carroll, J. B. (1963). A model of school learning. *Teachers College Record*, 64(8), 1–9. <https://doi.org/10.1177/016146816306400801>

Cattaneo, M. A., Oggeneffuss, C., & Wolter, S. C. (2017). The more, the better? The impact of instructional time on student performance. *Education Economics*, 25(5), 433–445. <https://doi.org/10.1080/09645292.2017.1315055>

Chang, H., Balfanz, R., & Byrnes, V. (2022, September 27). Pandemic causes alarming increase in chronic absence and reveals need for better data. *Attendance Works*. <https://www.attendanceworks.org/pandemic-causes-alarming-increase-in-chronic-absence-and-reveals-need-for-better-data/>

Checkoway, A., Gamse, B., Velez, M., & Linkow, T. (2013). *Evaluation of the Massachusetts Expanded Learning Time (ELT) initiative: Final study findings*. Society for Research on Educational Effectiveness. https://www.abtassociates.com/sites/default/files/migrated_files/fe87ef4f-3978-4e07-9704-2acbb010680c.pdf

Clauretie, T. M., & Neill, H. R. (2000). Year-round school schedules and residential property values. *Journal of Real Estate Finance and Economics*, 20(3), 311–322. <https://doi.org/10.1023/A:1007841326833>

Coleman, J. S. (1968). Equality of educational opportunity. *Equity & Excellence in Education*, 6(5), 19–28. <https://doi.org/10.1080/0020486680060504>

Cortes, K., & Goodman, J. S. (2014). Ability-tracking, instructional time, and better pedagogy: The effect of double-dose algebra on student achievement. *American Economic Review*, 104(5), 400–405. <https://doi.org/10.1257/aer.104.5.400>

Cortes, K., Goodman, J., & Nomi, T. (2015). Intensive math instruction and educational attainment: Long-run impacts of double-dose algebra. *Journal of Human Resources*, 50(1), 108–158. <https://doi.org/10.3386/w20211>

Cotton, K. (1989). *Educational time factors (School Improvement Research Series)*. Northwest Regional Educational Laboratory. <https://educationnorthwest.org/sites/default/files/EducationalTimeFactors.pdf>

Dağlı, Ü. (2019). Effect of increased instructional time on student achievement. *Educational Review*, 71(4), 501–517. <https://doi.org/10.1080/00131911.2018.1441808>

Dahmann, S. C. (2017). How does education improve cognitive skills? Instructional time versus timing of instruction. *Labour Economics*, 47, 35–47. <https://doi.org/10.1016/j.labeco.2017.04.008>

Dobbie, W., & Fryer, R. G. (2011). Are high-quality schools enough to increase achievement among the poor? Evidence from the Harlem Children's Zone. *American*

Economic Journal: Applied Economics, 3(3), 158–187. <https://doi.org/10.1257/app.3.3.158>

Dobbie, W., & Fryer, R. G. (2013). Getting beneath the veil of effective schools: Evidence from New York City. *American Economic Journal: Applied Economics*, 5(4), 28–60. <https://doi.org/10.1257/app.5.4.28>

Dobbie, W., & Fryer, R. (2015). The medium-term impacts of high-achieving charter schools. *Journal of Political Economy*, 123(5), 985–1037. <https://doi.org/10.1086/682718>

Domínguez, P., & Ruffini, K. (2021). Long-term gains from longer school days. *Journal of Human Resources*, 59(2), 0419–10160R2. <https://doi.org/10.3368/jhr.59.2.0419-10160R2>

Durlak, J. A., Weissberg, R. P., & Pachan, M. (2010). A meta-analysis of after-school programs that seek to promote personal and social skills in children and adolescents. *American Journal of Community Psychology*, 45(3–4), 294–309. <https://doi.org/10.1007/s10464-010-9300-6>

Edwards, F. (2012). Early to rise? The effect of daily start times on academic performance. *Economics of Education Review*, 31(6), 970–983. <https://doi.org/10.1016/j.econedurev.2012.07.006>

Evans, D. K., & Yuan, F. (2022). How big are effect sizes in international education studies? *Educational Evaluation and Policy Analysis*, 44(3), 532–540. <https://doi.org/10.3102/01623737221079646>

Figlio, D., Holden, K. L., & Ozek, U. (2018). Do students benefit from longer school days? Regression discontinuity evidence from Florida's additional hour of literacy instruction. *Economics of Education Review*, 67, 171–183. <https://doi.org/10.1016/j.econedurev.2018.06.003>

Fisher, D. (2009). The use of instructional time in the typical high school classroom. *Educational Forum*, 73(2), 168–176. <https://doi.org/10.1080/00131720902739650>

Fitzpatrick, M. D., Grissmer, D., & Hastedt, S. (2011). What a difference a day makes: Estimating daily learning gains during kindergarten and first grade using a natural experiment. *Economics of Education Review*, 30(2), 269–279. <https://doi.org/10.1016/j.econedurev.2010.09.004>

Fraser, B. J., Walberg, H. J., Welch, W. W., & Hattie, J. A. (1987). Syntheses of educational productivity research. *International Journal of Educational Research*, 11(2), 147–252. [https://doi.org/10.1016/0883-0355\(87\)90035-8](https://doi.org/10.1016/0883-0355(87)90035-8)

Friesen, J., Krauth, B., & Meilman Cohn, R. (2022). *The effect of universal full-day kindergarten on student achievement*. Department of Economics, Simon Fraser University. <https://ideas.repec.org/p/sfu/sfudps/dp22-01.html>

Fryer, R. G. (2014). Injecting charter school best practices into traditional public schools: Evidence from field experiments. *Quarterly Journal of Economics*, 129(3), 1355–1407. <https://doi.org/10.1093/qje/qju011>

Gardner, D. P., Larsen, Y., Baker, W., Campbell, A., & Crosby, E. A. (1983). *A nation at risk: The imperative for educational reform. An open letter to the American people. A report to the nation and the secretary of education* (Stock No. 20402). Superintendent of Documents, Government Printing Office. <https://eric.ed.gov/?id=ED226006>

Gariépy, G., Janssen, I., Sentenac, M., & Elgar, F. J. (2017). School start time and sleep in Canadian adolescents. *Journal of Sleep Research*, 26(2), 195–201. <https://doi.org/10.1111/jssr.12475>

Gibbs, C. (2013). *Reconciling experimental and quasi-experimental evidence on the impact of full-day kindergarten*. Society for Research on Educational Effectiveness. <https://eric.ed.gov/?id=ED564096>

Gibbs, C. (2014a). *A matter of time? Impact of statewide full-day kindergarten expansions on later academic skills and maternal employment* (Working Paper No. 34). Frank Batten School of Leadership and Public Policy.

Gibbs, C. (2014b). *Experimental evidence on early intervention: The impact of full-day kindergarten* (Working Paper). Frank Batten School of Leadership and Public Policy. <https://eric.ed.gov/?id=ED564096>

Godwin, K. E., Almeda, M. V., Seltzman, H., Kai, S., Skerbetz, M. D., Baker, R. S., & Fisher, A. V. (2016). Off-task behavior in elementary school children. *Learning and Instruction*, 44, 128–143. <https://doi.org/10.1016/j.learninstruc.2016.04.003>

Goodman, J. (2014). *Flaking out: Student absences and snow days as disruptions of instructional time* (Working Paper No. 20221). National Bureau of Economic Research. <https://doi.org/10.3386/w20221>

Gottfried, M. A., Sublett, C., & Kirksey, J. J. (2019). Students with disabilities attending full-day versus part-day kindergarten: Short- and long-term effects on achievement. *Early Childhood Research Quarterly*, 49, 175–187. <https://doi.org/10.1016/j.ecresq.2019.06.002>

Graves, J., McMullen, S., & Rouse, K. (2013). Multi-track year-round schooling as cost saving reform: Not just a matter of time. *Education Finance and Policy*, 8(3), 300–315. https://doi.org/10.1162/EDFP_a_00097

Graves, J., McMullen, S., & Rouse, K. (2018). Teacher turnover, composition and qualifications in the year-round school setting. *B.E. Journal of Economic Analysis & Policy*, 18(3), 1–27. <https://doi.org/10.1515/bejeap-2017-0240>

Gromada, A., & Shewbridge, C. (2016). *Student learning time: A literature review* (Working Papers). OECD Education, Article 127. <https://ideas.repec.org/p/oec/eduaab/127-en.html>

Hansen, B. (2011). *School year length and student performance: Quasi-experimental evidence* (SSRN Working Paper No. 2269846). Social Science Research Network. <https://doi.org/10.2139/ssrn.2269846>

Hawley, W. D., Rosenholtz, S., Goodstein, H. J., & Hasselbring, T. (1984). Good schools: What research says about improving student achievement. *Peabody Journal of Education*, 61(4), 1–178. <https://doi.org/10.1080/01619568409538458>

Heissel, J., & Norris, S. (2019). Rise and shine: How school start times affect academic performance. *Education Next*, 19(3), 54–62. <https://www.educationnext.org/rise-shine-how-school-start-times-affect-academic-performance/>

Herrmann, M. A., & Rockoff, J. E. (2012). Worker absence and productivity: Evidence from teaching. *Journal of Labor Economics*, 30(4), 749–782. <https://doi.org/10.1086/666537>

Hincapie, D. (2016). *Do longer school days improve student achievement? Evidence from Colombia* (Working Paper IDB-WP-679). IDB Working Paper Series. <https://doi.org/10.18235/0000268>

Hinrichs, P. (2011). When the bell tolls: The effects of school starting times on academic achievement. *Education Finance and Policy*, 6(4), 486–507. https://doi.org/10.1162/EDFP_a_00045

Holland, P., Alfaro, P., & Evans, D. K. (2015). *Extending the school day in Latin America and the Caribbean*. The World Bank. <https://doi.org/10.1596/1813-9450-7309>

Hoxby, C., & Murarka, S. (2009). *Charter schools in New York City: Who enrolls and how they affect their students' achievement* (Working Paper No. 14852). National Bureau of Economic Research. <https://doi.org/10.3386/w14852>

Huebener, M., Kuger, S., & Marcus, J. (2017). Increased instruction hours and the widening gap in student performance. *Labour Economics*, 47, 15–34. <https://doi.org/10.1016/j.labeco.2017.04.007>

Huyvaert, S. H. (1998). *Time is of the essence: Learning in schools* (1st ed.). Allyn & Bacon.

James, S. A., Erickson, D. J., Lammert, S., & Widome, R. (2023). School start time delays and high school educational outcomes: Evidence from the START/LEARN study. *Journal of Adolescence*, 95(4), 751–763. <https://doi.org/10.1002/jad.12151>

Jensen, V. M. (2013). Working longer makes students stronger? The effects of ninth grade classroom hours on ninth grade student performance. *Educational Research*, 55(2), 180–194. <https://doi.org/10.1080/00131881.2013.801244>

Johns Hopkins School of Education: Institute for Education Policy. (2019). *Providence Public School District: A Review*. Author. <https://jscholarship.library.jhu.edu/bitstream/handle/1774.2/62961/ppsd-revised-final.pdf>

Kane, C. (1994). *Prisoners of time: Report of the national education commission on time and learning* (NJ3). Education Commission of the States. <https://eric.ed.gov/?id=ED489343>

Kane, T., & Reardon, S. (2023, May 11). Parents don't understand how far behind their kids are in school. *New York Times*. <https://www.nytimes.com/interactive/2023/05/11/opinion/pandemic-learning-losses-steep-but-not-permanent.html>

Karweitz, N. (1982). *Time on task: A research review* (Report No. 332). Department of Education. <https://eric.ed.gov/?id=ED228236>

Karweitz, N. (1985). Should we lengthen the school term? *Educational Researcher*, 14(6), 9–15. <https://doi.org/10.3102/0013189X014006009>

Kidron, Y., & Lindsay, J. (2014). *The effects of increased learning time on student academic and nonacademic outcomes: Findings from a meta-analytic review* (p. 68). U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Appalachia.

Kilburn, M. R., Phillips, A., Gomez, C. J., Mariano, L. T., Doss, C. J., Troxel, W. M., Morton, E., & Estes, K. (2021). *Does four equal five? Implementation and outcomes of the four-day school week*. RAND Corporation. https://www.rand.org/pubs/research_reports/RRA373-1.html

Kim, T. (2022). The effects of school start time on educational outcomes: Evidence from the 9 o'clock attendance policy in South Korea. *B.E. Journal of Economic Analysis & Policy*, 22(3), 439–474. <https://doi.org/10.1515/bejap-2020-0194>

Kraft, M. A. (2015). How to make additional time matter: Integrating individualized tutorials into an extended day. *Education Finance and Policy*, 10(1), 81–116. https://doi.org/10.1162/EDFP_a_00152

Kraft, M. A. (2020). Interpreting effect sizes of education interventions. *Educational Researcher*, 49(4), 241–253. <https://doi.org/10.3102/0013189X20912798>

Kraft, M. A., & Monti-Nussbaum, M. (2021). The big problem with little interruptions to classroom learning. *AERA Open*, 7, 23328584211028856. <https://doi.org/10.1177/23328584211028856>

Labak, I., Sertić Perić, M., & Radanović, I. (2020). Effects of block vs. traditional scheduling on high school science success—lessons from biology classes. *Education Sciences*, 10(8), 209. <https://doi.org/10.3390/educsci10080209>

Labak, I., Sertić Perić, M., & Radanović, I. (2021). The effect of block class scheduling on the achievements of primary school students in nature and biology classes. *Education Sciences*, 11(9), Article 9. <https://doi.org/10.3390/educsci11090550>

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. <https://doi.org/10.1111/eco.12233>

Lavy, V. (2019). Expanding school resources and increasing time on task: Effects on students' academic and noncognitive outcomes. *Journal of the European Economic Association*, 18(1), 232–265. <https://doi.org/10.1093/jeea/jvy054>

Lee, V. E., Burkam, D. T., Ready, D. D., Honigman, J., & Meisels, S. J. (2006). Full-day versus half-day kindergarten: In which program do children learn more? *American Journal of Education*, 112(2), 163–208. <https://doi.org/10.1086/498994>

Lenard, M., Morrill, M. S., & Westall, J. (2020). High school start times and student achievement: Looking beyond test scores. *Economics of Education Review*, 76, 101975. <https://doi.org/10.1016/j.econedurev.2020.101975>

Leuven, E., Lindahl, M., Oosterbeek, H., & Webbink, D. (2010). Expanding schooling opportunities for 4-year-olds. *Economics of Education Review*, 29(3), 319–328. <https://doi.org/10.1016/j.econedurev.2009.10.004>

Levin, H. M. (1984). About time for educational reform. *Educational Evaluation and Policy Analysis*, 6(2), 151–163. <https://doi.org/10.3102/01623737006002151>

Levin, H. M., & Tsang, M. C. (1987). The economics of student time. *Economics of Education Review*, 6(4), 357–364. [https://doi.org/10.1016/0272-7757\(87\)90019-7](https://doi.org/10.1016/0272-7757(87)90019-7)

Little, D. (2022, May 13). *In Dallas, bold changes to the school calendar to address Covid slide* (P. Jordan, Interviewer) [Interview]. <https://www.future-ed.org/in-dallas-bold-changes-to-the-school-calendar-to-address-covid-slide/>

Mahnken, K. (2023, March 20). In rare move, New Mexico adds weeks' worth of extra K-12 class time. *The 74*. <https://www.the74million.org/article/new-mexico-extra-learning-days/>

Marcotte, D. E. (2007). Schooling and test scores: A mother-natural experiment. *Economics of Education Review*, 26(5), 629–640. <https://doi.org/10.1016/j.econedurev.2006.08.001>

Marcotte, D. E., & Hemelt, S. W. (2008). Unscheduled school closings and student performance. *Education Finance and Policy*, 3(3), 316–338. <https://doi.org/10.1162/edfp.2008.3.3.316>

Martin, J. (2009, March 11). Obama talks tough on teachers. *Politico*. <https://www.politico.com/story/2009/03/obama-talks-tough-on-teachers-019867>

McCombs, J. S., Augustine, C. H., Unlu, F., Zioli-Guest, K. M., Naftel, S., Gomez, C. J., Marsh, T., Akinniranye, G., & Todd, I. (2019). *Investing in successful summer programs: A review of evidence under the every student succeeds act*. RAND Corporation. https://www.rand.org/pubs/research_reports/RR2836.html

Meroni, E. C., & Abbiati, G. (2016). How do students react to longer instruction time? Evidence from Italy. *Education Economics*, 24(6), 592–611. <https://doi.org/10.1080/09645292.2015.1122742>

Meyer, E., & Van Klaveren, C. (2013). The effectiveness of extended day programs: Evidence from a randomized field experiment in the Netherlands. *Economics of Education Review*, 36, 1–11. <https://doi.org/10.1016/j.econedurev.2013.04.002>

Morton, E. (2021). Effects of four-day school weeks on school finance and achievement: Evidence from Oklahoma. *Educational Researcher*, 50(1), 30–40. <https://doi.org/10.3102/0013189X20948023>

Morton, E. (2022). Effects of four-day school weeks on adolescents: Examining impacts of the schedule on academic achievement, attendance, and behavior in high school. *Educational Evaluation and Policy Analysis*, 45(1), 52–78. <https://journals.sagepub.com/doi/10.3102/01623737221097420>

Morton, E., Thompson, P., & Kuhfeld, M. (2023). A multi-state, student-level analysis of the effects of the four-day school week on student achievement and growth. In *EdWorkingPapers.com*. Annenberg Institute at Brown University. <https://www.edworkingpapers.com/ai22-630>

Organization for Economic Cooperation and Development (OECD). (2020). *PISA 2018 results. Volume V: Effective policies, successful schools*. Author. https://www.oecd-ilibrary.org/education/pisa-2018-results-volume-v_ca768d40-en

Organization for Economic Cooperation and Development (OECD). (2021). *Education at a glance 2021: OECD indicators*. Author. https://www.oecd-ilibrary.org/education/education-at-a-glance-2021_b35a14e5-en

Orkin, K. (2013). The effect of lengthening the school day on children's achievement in Ethiopia. *Young Lives*. https://ora.ox.ac.uk/objects/uuid:047e7411-bdca-4677-9c4d-cb9875408a50/download_file?file_format=pdf&hyrax_fileset_id=m47f1923a9a46bb43dad00f710b7344bb&safe_filename=Young%2BLives%2BWorking%2BPaper%2B119&type_of_work=Working+paper

Padilla-Romo, M. (2022). Full-time schools, policy-induced school switching, and academic performance. *Journal of Economic Behavior & Organization*, 196, 79–103. <https://doi.org/10.1016/j.jebo.2022.01.025>

Parinduri, R. A. (2014). Do children spend too much time in schools? Evidence from a longer school year in Indonesia. *Economics of Education Review*, 41, 89–104. <https://doi.org/10.1016/j.econedurev.2014.05.001>

Patall, E. A., Cooper, H., & Allen, A. B. (2010). Extending the school day or school year: A systematic review of research (1985–2009). *Review of Educational Research*, 80(3), 401–436. <https://doi.org/10.3102/0034654310377086>

Perez, J., Jr. (2021, January 25). Longer days and Saturday classes: States explore costly ways to heal learning loss. *Politico*. <https://www.politico.com/news/2021/01/25/states-covid-learning-loss-462383>

Phelps, G., Corey, D., DeMonte, J., Harrison, D., & Loewenberg Ball, D. (2012). How much English language arts and mathematics instruction do students receive? Investigating variation in instructional time. *Educational Policy*, 26(5), 631–662. <https://doi.org/10.1177/0895904811417580>

Pischke, J.-S. (2007). The impact of length of the school year on student performance and earnings: Evidence from the German short school years. *Economic Journal*, 117(523), 1216–1242. <https://doi.org/10.1111/j.1468-0297.2007.02080.x>

Pope, N. G. (2016). How the time of day affects productivity: Evidence from school schedules. *Review of Economics and Statistics*, 98(1), 1–11. https://doi.org/10.1162/REST_a_00525

Pope, N., & Landon, T. J. (2023). *Schedule-driven productivity: Evidence from non-traditional school calendars* (SSRN Scholarly Paper 4509960). Social Science Research Network. <https://doi.org/10.2139/ssrn.4509960>

Redd, Z., Boccanfuso, C., Walker, K., Princiotta, D., Knewstub, D., & Moore, K. (2012). *Expanding time for learning both inside and outside the classroom: A review of the evidence base*. Child Trends.

Rhode Island KIDS COUNT. (2017). *Rhode Island Kids Count Factbook*. Author.

Rivkin, S. G., & Schiman, J. C. (2015). Instruction time, classroom quality, and academic achievement. *Economic Journal*, 125(588), F425–F448. <https://doi.org/10.1111/ecoj.12315>

Rosa, L., Bettinger, E., Carnoy, M., & Dantas, P. (2022). The effects of public high school subsidies on student test scores. *Economics of Education Review*, 87(C), 102201. <https://ideas.repec.org/a/eee/ecoedu/v87y2022ics0272775721001151.html>

Rosenshine, B. V. (2015). How time is spent in elementary classrooms. *Journal of Classroom Interaction*, 50(1), 41–53. <https://files.eric.ed.gov/fulltext/EJ1100409.pdf>

Sanz, I., & Tena, J. D. (2021). *The impact of instruction time and the school calendar on academic performance: A natural experiment* (EdWorkingPaper, 21–456). <https://doi.org/10.26300/DV8E-5866>

Scheerens, J., Hendriks, M. A., Luyten, J. W., Sleegers, P. J. C., & Glas, C. A. W. (2013). *Productive time in education. A review of the effectiveness of teaching time at school, homework and extended time outside school hours*. <https://research.ut>

wente.nl/en/publications/productive-time-in-education-a-review-of-the-effectiveness-of-tea

Schueler, B. E. (2020). Making the most of school vacation: A field experiment of small group math instruction. *Education Finance and Policy*, 15(2), 310–331. https://doi.org/10.1162/edfp_a_00269

Schueler, B. E., Goodman, J. S., & Deming, D. J. (2017). Can states take over and turn around school districts? Evidence from Lawrence, Massachusetts. *Educational Evaluation and Policy Analysis*, 39(2), 311–332. <https://doi.org/10.3102/0162373716685824>

Schwartz, H. L., McCombs, J. S., Augustine, C. H., & Leschitz, J. T. (2018). *Getting to work on summer learning: Recommended practices for success* (2nd ed.). RAND Corporation. https://www.rand.org/pubs/research_reports/RR366-1.html

Sequeira, K. (2022, April 26). Los Angeles unified school board approves longer 2022–23 school year. *EdSource*. <https://edsource.org/updates/los-angeles-unified-school-board-approves-longer-2022-23-school-year>

Silva, E. (2007). *On the clock: Rethinking the way schools use time*. Education Sector.

Silva-Padron, G., & McCann, M. (2023, February 6). *50-state comparison: Instructional time policies*. Education Commission of the States. <https://www.ecs.org/50-state-comparison-instructional-time-policies-2023/>

Sims, D. P. (2008). Strategic responses to school accountability measures: It's all in the timing. *Economics of Education Review*, 27(1), 58–68. <https://doi.org/10.1016/j.econedurev.2006.05.003>

Steiner, E. D., Doan, S., Woo, A., Gittens, A. D., Lawrence, R. A., Berdie, L., Wolfe, R. L., Greer, L., & Schwartz, H. L. (2022). *Restoring teacher and principal well-being is an essential step for rebuilding schools: Findings from the state of the American teacher and state of the American principal surveys*. RAND Corporation. https://www.rand.org/pubs/research_reports/RRA1108-4.html

Taylor, E. (2014). Spending more of the school day in math class: Evidence from a regression discontinuity in middle school. *Journal of Public Economics*, 117, 162–181. <https://doi.org/10.1016/j.jpubeco.2014.06.002>

Thompson, P. (2019). *Effects of four-day school weeks on student achievement: Evidence from oregon* (SSRN Scholarly Paper 3390191). Social Science Research Network. <https://doi.org/10.2139/ssrn.3390191>

Thompson, P. (2021). Is four less than five? Effects of four-day school weeks on student achievement in Oregon. *Journal of Public Economics*, 193, 104308. <https://doi.org/10.1016/j.jpubeco.2020.104308>

Thompson, P., Gunter, K., Schuna, J. M., Jr., & Tomayko, E. J. (2021). Are all four-day school weeks created equal? A national assessment of four-day school week policy adoption and implementation. *Education Finance and Policy*, 16(4), 558–583. https://doi.org/10.1162/edfp_a_00316

Thompson, P., Tomayko, E. J., Gunter, K. B., & Schuna, J. (2021). Impacts of the four-day school week on high school achievement and educational engagement. *Education Economics*, 30(5), 1–13. <https://doi.org/10.1080/09645292.2021.2006610>

Thompson, P., & Ward, J. (2022). Only a matter of time? The role of time in school on four-day school week achievement impacts. *Economics of Education Review*, 86, 102198. <https://doi.org/10.1016/j.econedurev.2021.102198>

von Hippel, P. (2016). Year-round school calendars: Effects on summer learning, achievement, parents, teachers, and property values. In K. Alexander, S. Pitcock, & M. Boulay (Eds.), *The summer slide: What we know and can do about summer learning loss*. Teachers College Press.

von Hippel, P. T., Workman, J., & Downey, D. B. (2018). Inequality in reading and math skills forms mainly before kindergarten: A replication, and partial correction, of

“Are schools the great equalizer?” *Sociology of Education*, 91(4), 323–357. <https://doi.org/10.1177/0038040718801760>

Warburton, W. P., Warburton, R. N., & Hertzman, C. (2012). Does full day kindergarten help kids? *Canadian Public Policy/Analyse de Politiques*, 38(4), 591–603. <https://www.jstor.org/stable/41756771>

Ward, J. (2019). *The four-day school week and parental labor supply* (SSRN Scholarly Paper 3301406). Social Science Research Network. <https://doi.org/10.2139/ssrn.3301406>

Wiley, D. E., & Harnischfeger, A. (1974). Explosion of a myth: Quantity of schooling and exposure to instruction, major educational vehicles. *Educational Researcher*, 3(4), 7–12. <https://doi.org/10.3102/0013189X003004007>

Wu, D. (2020). Disentangling the effects of the school year from the school day: Evidence from the TIMSS assessments. *Education Finance and Policy*, 15(1), 104–135. https://doi.org/10.1162/edfp_a_00265

Zepeda, S. J., & Mayers, R. S. (2006). An analysis of research on block scheduling. *Review of Educational Research*, 76(1), 137–170. <https://doi.org/10.3102/00346543076001137>

Zvoch, K., Reynolds, R. E., & Parker, R. P. (2008). Full-day kindergarten and student literacy growth: Does a lengthened school day make a difference? *Early Childhood Research Quarterly*, 23(1), 94–107. <https://doi.org/10.1016/j.ecresq.2007.08.001>

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