

# Organizing Schools to Improve Student Achievement: Start Times, Grade Configurations, and Teacher Assignments

Brian A. Jacob and Jonah E. Rockoff



## MISSION STATEMENT

The Hamilton Project seeks to advance America's promise of opportunity, prosperity, and growth.

We believe that today's increasingly competitive global economy demands public policy ideas commensurate with the challenges of the 21st Century. The Project's economic strategy reflects a judgment that long-term prosperity is best achieved by fostering economic growth and broad participation in that growth, by enhancing individual economic security, and by embracing a role for effective government in making needed public investments.

Our strategy calls for combining public investment, a secure social safety net, and fiscal discipline. In that framework, the Project puts forward innovative proposals from leading economic thinkers — based on credible evidence and experience, not ideology or doctrine — to introduce new and effective policy options into the national debate.

The Project is named after Alexander Hamilton, the nation's first Treasury Secretary, who laid the foundation for the modern American economy. Hamilton stood for sound fiscal policy, believed that broad-based opportunity for advancement would drive American economic growth, and recognized that “prudent aids and encouragements on the part of government” are necessary to enhance and guide market forces. The guiding principles of the Project remain consistent with these views.





# Organizing Schools to Improve Student Achievement: Start Times, Grade Configurations, and Teacher Assignments

Brian A. Jacob  
*University of Michigan*

Jonah E. Rockoff  
*Columbia Business School*

SEPTEMBER 2011

NOTE: This discussion paper is a proposal from the authors. As emphasized in The Hamilton Project's original strategy paper, the Project was designed in part to provide a forum for leading thinkers across the nation to put forward innovative and potentially important economic policy ideas that share the Project's broad goals of promoting economic growth, broad-based participation in growth, and economic security. The authors are invited to express their own ideas in discussion papers, whether or not the Project's staff or advisory council agrees with the specific proposals. This discussion paper is offered in that spirit.

BROOKINGS

# Abstract

Education reform proposals are often based on high-profile or dramatic policy changes, many of which are expensive, politically controversial, or both. In this paper, we argue that the debates over these “flashy” policies have obscured a potentially important direction for raising student performance—namely, reforms to the management or organization of schools. By making sure the “trains run on time” and focusing on the day-to-day decisions involved in managing the instructional process, school and district administrators may be able to substantially increase student learning at modest cost.

In this paper, we describe three organizational reforms that recent evidence suggests have the potential to increase K–12 student performance at modest costs: (1) Starting school later in the day for middle and high school students; (2) Shifting from a system with separate elementary and middle schools to one with schools that serve students in kindergarten through grade eight; (3) Managing teacher assignments with an eye toward maximizing student achievement (e.g. allowing teachers to gain experience by teaching the same grade level for multiple years or having teachers specializing in the subject where they appear most effective).

We conservatively estimate that the ratio of benefits to costs is 9 to 1 for later school start times and 40 to 1 for middle school reform. A precise benefit-cost calculation is not feasible for the set of teacher assignment reforms we describe, but we argue that the cost of such proposals is likely to be quite small relative to the benefits for students. While we recognize that these specific reforms may not be appropriate or feasible for every district, we encourage school, district, and state education leaders to make the management, organization, and operation of schools a more prominent part of the conversation on how to raise student achievement.

# Table of Contents

ABSTRACT	2
CHAPTER 1: INTRODUCTION	5
CHAPTER 2: SCHOOL START TIMES	7
CHAPTER 3: SCHOOL GRADE CONFIGURATION	12
CHAPTER 4: MANAGING TEACHER ASSIGNMENTS	17
CONCLUSION	19
AUTHORS	20
ENDNOTES	21
REFERENCES	22



---

# Chapter 1: Introduction

---

**E**ducation reform proposals tend to focus on systemic policy changes such as expanding charter schools, overhauling teacher tenure, or implementing more rigorous standards and accountability. Another stream of school reform focuses on curriculum and methods of instruction (e.g., the relative benefits of phonics versus whole language reading instruction). While these approaches may ultimately be effective, they also can be politically controversial, involve substantial resources, or have little research support.

School reformers and policy-makers have overlooked a potentially important direction for raising student performance—namely, reforms to the management or organization of schools. Although making sure the “trains run on time” may not be particularly sexy, emerging evidence suggests that some mundane reforms could produce substantial achievement gains at relatively low cost.

Recent work by Jason Grissom and Susanna Loeb (2009) on the Miami-Dade County School District, for example, emphasizes the importance of managerial success of a school principal. They find that a principal’s skill at organization management—which includes skills such as managing budgets and resources, hiring personnel, dealing with teacher concerns, managing noninstructional staff, maintaining campus facilities, ensuring a safe school environment, and so on—is more strongly associated with school performance gains than are any of the other skills they measure, including a principal’s ability to monitor and develop instructional practice within the school. Moreover, a principal’s organization and management skill is the only ability to be positively associated with teacher satisfaction and parent assessments of the school’s climate (Grissom and Loeb 2009).

In this paper, we describe three organizational reforms that recent evidence suggests have the potential to increase K–12 student performance:

***Adjust school start times*** for students in middle schools (Grades 6 to 8) and high schools (Grades 9 to 12). Early school start times reduce performance among disadvantaged students by an amount equivalent to having a highly ineffective teacher. In school districts with greater flexibility to adjust start times, starting school even an hour later can boost performance at low cost.

***Address deleterious effects of school grade configurations.*** Adolescent students attending middle schools (Grades 6 to 8) appear to underperform their peers in K–8 / 9–12 school configurations. Encouraging K–8 configurations or taking measures to address the difficult transition from elementary to middle school could boost achievement.

***Manage teacher assignments*** with an eye toward maximizing student achievement. For example, recent evidence suggests substantial benefits from teachers remaining at the same grade level for multiple years. Similarly, a growing body of research documents that elementary teachers are often noticeably more effective in teaching one subject than another (e.g., more effective teaching math than reading, or vice versa), suggesting significant benefits of teacher specialization.

To the extent that the benefits outweigh the costs for a specific school system, these reforms represent “low-hanging fruit” that have the potential to increase student achievement at relatively low cost. In Table 1, we present estimates of cost-benefit ratios for the organization reforms we present in this paper. We base our estimates of benefits on the best research evidence to date, and use cost estimates based on national data or specific cases of districts that have implemented the reforms. In each case, we have tried to provide conservative estimates, erring on the side of lower ratios of benefits to costs. However, our middle school reform estimate remains very high at 40 to 1, and later school start times for older students have a ratio of 9 to 1. For better management of teaching assignments, we lack data on direct financial costs and therefore do not report a cost-benefit ratio. However, we argue in our paper that these costs are likely to be quite small relative to the benefits for students.

TABLE 1

## Estimated Cost-Benefit Ratios for Organizational Reforms

Organizational Reform	Test Score Gains	Lifetime Earnings Gains Per Student	Cost per student	Benefit/Cost Ratio
Convert K-5/6-8 to K-8	0.1 SD	\$10,000	\$50 to \$250	40:1 to 200:1
Middle/Upper Grades Start 1 Hour Later	0.175 SD	\$17,500	\$0 to \$1,950	9:1 or more
Managing Teacher Assignments	0.02 SD	\$2000	\$0 financial, but other costs hard to measure	

Source: Transportation share expenditures taken from National Center for Education Statistics (NCES; 2007–2008). (Table 1 was prepared June 2010.) Per pupil spending data are taken from NCES (2010), Table 190, Columns 2 and 3, for the 2007–2008 school year.

School reformers and policy-makers have overlooked a potentially important direction for raising student performance – namely, reforms to the management or organization of schools.



---

## Chapter 2: School Start Times

---

**A**s any parent knows, it is very difficult to wake a sleeping teenager. Not only is it difficult to rouse them early in the morning, there is mounting evidence that it is also difficult to educate them early in the day. The earliest school start times are associated with annual reductions in student performance of roughly 0.1 standard deviations for disadvantaged students, equivalent to replacing an average teacher with a teacher at the sixteenth percentile in terms of effectiveness. Moving school start times later in the morning appears to improve sleep and ameliorate the biological barriers to learning. For schools with scheduling flexibility, starting class later can be an inexpensive way to boost achievement; even for schools where changes will be costly, we argue that investing the resources to alter busing schedules and accommodate later after-school activities can be a worthwhile investment.

School days start early in the morning. According to the National Household Education Survey (NCES 2001), roughly half of middle schools start at or before 8:00 a.m., and fewer than 25 percent start at 8:30 a.m. or later. High schools start even earlier. Wolfson and Carskadon (2005), surveying a random sample of public high schools, found that more than half of the schools reported start times earlier than 8:00 a.m. In 2005, two thirds of high schools in Kansas started at 8:00 a.m. or earlier, and more than 99 percent started at 8:30 a.m. or earlier. In the school year 2010–2011, roughly 10 percent of high schools in New York City started at 7:30 a.m. or earlier and more than 80 percent started at 8:30 a.m. or earlier.

College classes start much later, on average. In Fall 2010, for example, fewer than 2 percent of undergraduate courses at the University of Michigan started at 8:00 a.m. or earlier, and roughly 85 percent of classes started at 9:30 a.m. or later. And while some adults start work early, many start considerably later than the average high school student. According to the Bureau of the Census (2009), for example, roughly 30 percent of adults leave their houses for work *after* 8:00 a.m.

There are several common explanations for early school start times. The first involves student transportation schedules. In an effort to minimize the costs associated with busing, many districts arrange school schedules and bus routes so that the same bus can be used to transport more than one group of children to school in the morning. Suppose, for example, that a district needs to transport one thousand students each morning and that a standard school bus holds one hundred students. With a single start time, the district would need ten buses, but if half of the schools start at 7:00 a.m. and half of the schools start at 8:00 a.m., the district could use five buses, each transporting two loads of children to schools. This is known as a tiered transportation system. Many districts even have three-tiered transportation systems, where the same bus is used to transport three different sets of students to schools that start at three different times. Districts can reduce transportation costs by as much as 30 percent by using this system (Fugenschuh 2009; Keller and Muller 1979).

**For schools with scheduling flexibility, starting class later can be an inexpensive way to boost achievement; even for schools where changes will be costly, we argue that investing the resources to alter busing schedules and accommodate later after-school activities can be a worthwhile investment.**

In practice, districts with tiered busing systems have earlier start times for secondary schools than for elementary schools. According to some school officials, this often stems from concerns about safety of having younger children either waiting outside for buses or walking to school in the early morning when it may still be dark for much of the school year. Another commonly cited reason for starting high schools early is that it allows students to work or participate in athletics or other extracurricular activities, or both, after school. Indeed, in a 2001 survey, school administrators reported athletic practices and after-school activities as major barriers to moving school start and end times later in the day (Wolfson and Carskadon 2005).

### WHAT IS WRONG WITH STARTING SCHOOL SO EARLY?

The tendency for teenagers to sleep late has a clear biological basis. Circadian rhythms (also called sleep-wake cycles, or “internal clocks”) are physical, mental, and behavioral changes during a twenty-four-hour cycle that are governed by the body’s production of the sleep-inducing hormone melatonin. Important changes in the circadian rhythm during adolescence shift children’s internal clocks to later bed and wake times (see, for example, Carskadon, Vieira, and Acebo 1993; Crowley, Acebo and Carskadon 2007; Wolfson and Carskadon 1998). As noted by Carrell, Maghakian, and West (2011), melatonin levels peak at roughly 7:00 a.m. for adolescents and at 4:00 a.m. for adults, so waking a teenager at 7:00 a.m. is similar to waking an adult at 4:00 a.m.

Ideally, teenagers faced with early school start times would just go to bed early. However, a voluminous body of research demonstrates that earlier school start times lead teenagers to sleep less (see, for example, Dexter, Bijwadia, Schilling, and Applebaugh 2003; Hansen, Janssen, Schiff, Zee, and Dubocovich 2005; Wolfson and Carskadon 2003). In a recent study in Minnesota, students in schools where classes started at 8:30 a.m. reported getting about one hour more sleep than students in schools where classes started at 7:25 a.m. or 7:15 a.m. (Wahlstrom, Davison, Choi, and Ross 2001). Another survey found that high school students slept an average of two fewer hours on school nights than they slept on weekends or on weekdays during the summer (Hansen et al. 2005).

While it is tempting to blame late bedtimes among teenagers on a combination of lax parenting and electronic entertainment, much of their preference is likely driven by biology. Given the circadian timing in adolescents, it is very difficult for teenagers to adjust fully to an early school day. They should be asleep when their bodies want to be awake, and they are forced to be awake when their bodies want to be asleep (Carrell et al. 2011).

### WOULD LATER SCHOOL START TIMES NOTICEABLY INCREASE STUDENT ACHIEVEMENT?

Recent studies provide compelling evidence that later school starting times could substantially improve the academic achievement of adolescents. The strongest evidence on the impact of early start times on academic performance comes from a recent study by Carrell and colleagues (2011) who focus on first-year students in the U.S. Air Force Academy. These students have no choice over their course schedules and, during the two years of the study, are assigned start times ranging from 7:00 a.m. to 8:50 a.m.<sup>1</sup> Moreover, unlike most high schools, all first-year Air Force students take the same classes and the same standardized course exams, providing a consistent objective outcome measure.

Carrell and his colleagues (2011) found that students assigned to start classes prior to 8:00 a.m. performed worse not only in their first-period course, but in *all* of their courses. Moreover, the size of the effect was substantial, with a one-hour delay associated with a 0.15 standard deviation increase in performance. For sake of comparison, note that the achievement gap between black and white students in the United States is roughly 1.0 standard deviation.

Do the results from the Air Force study have broader implications? We think so. College freshmen are just slightly older than high school students and share many of the biological characteristics associated with their sleep cycles. While Air Force cadets are clearly a special group, we cannot think of a good rationale why such high-achieving and highly disciplined young men and women would be *more* adversely affected by early start times than are typical teenagers.

Two other recent studies are more directly related to the K–12 setting. A recent study of school start times for middle schools takes advantage of changes to the tiered busing system in Wake County, North Carolina. Due to rapid enrollment growth and changes to school attendance boundaries, many of the district’s middle schools experienced changes in start times, with some students being picked up earlier and others later in the morning. An analysis by Edwards (2011) indicates that school start times shifted one hour later increase reading test scores by 0.03 to 0.10 standard deviations and math test scores by 0.06 to 0.09 standard deviations. Disadvantaged students benefited the most, with effects roughly twice as large as advantaged students; the effects persisted into high school.

Several aspects of this study make it particularly compelling. First, it examines actual changes in school start times that would be feasible for many districts to implement. Second, it focuses on middle school students, many of whom may be just entering adolescence, and provides a counterbalance to the study of college freshmen discussed above. Third, in addition

to documenting effects on achievement test scores, the analysis finds that students whose schools start one hour later watch roughly fifteen minutes less TV per day and spend roughly seventeen minutes more per week on homework, providing context on how start times can impact achievement.<sup>2</sup>

A study of high school students in the Chicago Public Schools provides some additional insight. Cortes, Bricker, and Rohlf (2009) examine how high school students perform in morning versus afternoon classes in Chicago, where school typically starts by 8:00 a.m. and students are commonly tardy. The authors find students are absent roughly six more days per year in first period relative to other periods. Moreover, they find that student grades and test score performance are notably lower for their first-period courses. For example, students assigned to a math class in first period do systematically worse on the end-of-year standardized math exam, whereas students assigned to English during first period do worse on the English exams.<sup>3</sup> This study highlights the fact that start times might influence adolescent performance not simply because they are less alert early in the mornings, but also because they may be more likely to miss early morning classes.

One piece of countervailing evidence on the issue comes from a careful reanalysis of changes that Minneapolis made to its school schedule in 1997–1998 (Hinrichs 2011). Minneapolis and several nearby suburban districts moved high school start times from 7:15 a.m. to 8:40 a.m. while St. Paul and other suburban districts maintained their 7:30 a.m. start time. Hinrichs finds that neither student attendance nor ACT scores changed in these districts that shifted their start times later relative to those districts who maintained a consistent, earlier start time. He suggests reasons why earlier start times may *not* be a problem for adolescent students, including these: students might adapt in other ways (e.g., drink caffeinated beverages to stay alert, or study more in the evenings); teachers may be more effective early in the morning; before-school activities may nullify later starting times; or adolescents might be less alert during their midafternoon classes, counteracting the benefits of being more alert in their morning classes. While Hinrichs’ analysis is well done, it is likely that the ACT does

not fully capture changes in student learning. Moreover, it is not possible to disentangle completely the schedule changes from other factors that may have changed in Minneapolis over this period.

## PROPOSAL

Given the weight of the evidence, we believe that school districts should explore starting secondary schools later in the morning. Districts with tiered busing systems in which middle or high schools start early could switch to having elementary schools start first or eliminate the tiered system and have all schools start at the later time. Districts with a single start time for all schools could shift to a later start or move to a tiered system where middle and high schools start later. The idea of federal support for later high school start times was first raised in 1999 as the “Z’s to A’s Act.” We provide greater details on how this change might work in practice.

### *How Much Would This Cost Districts?*

Changing the ordering of elementary and high schools in a tiered system would have little, if any, direct financial costs to school districts, whereas moving from a tiered to a single system would entail an increase in transportation expenditures.<sup>4</sup> In his study of Wake County, North Carolina, Edwards (2011) estimates that it would cost roughly \$150 per student to allow all students to start at 9:15 a.m.<sup>5</sup> If we aggregate costs of \$150 per student per year over the thirteen years a student is in a K–12 system, we arrive at an increase in transportation costs of \$1,950 over the student’s school career. However, in recent years, some districts have eliminated or cut back on transportation services, particularly for secondary school students. In such cases, the financial cost of shifting the school day would be negligible. Another option that might be feasible for some urban districts would be to have older students use public transportation to get to and from school.<sup>6</sup>

**Disadvantaged students benefited the most from later start times, with effects roughly twice as large as advantaged students...**

### *Would the Benefits of Later Starting Times Outweigh the Costs?*

The estimates from Carrell and his colleagues (2011) and Edwards (2011) suggest that moving start times one hour later for students in Grades 6 through 12 would increase student achievement by roughly 0.175 standard deviations on average, with even larger benefits for disadvantaged students (Table 1).<sup>7</sup> In order to translate this achievement gain into a dollar value, we follow the methodology used in Krueger (2003). A 1.0 standard deviation rise in test scores raises future earnings by 8 percent, which we match to the age-earnings profile in the Current Population Survey (2008) and assume a 1 percent growth rate for real wages and productivity. We calculate the present value of lost wages for an increase in achievement of 0.175 standard deviations and a discount rate of 4 percent. Doing so, we estimate that moving start times one hour later would result in roughly \$17,500 in increased future earnings per student in present value.

### *What About Conflicts with After-School Activities?*

The average length of the school day in the United States is 6.6 hours, so 9:00 a.m. start times would coincide with 3:30 p.m. dismissal for most districts (NCES 2007–2008). Later school hours in high school could present problems for students who want to work or participate in after-school activities. According to a recent nationally representative survey of tenth graders, roughly 50 percent of students participate in at least one interscholastic sport and 50 percent of students participate in some other after-school extracurricular activity.<sup>8</sup> While a substantial fraction of students do participate in after-school activities, only a subset of such activities are likely to be seriously impacted by later dismissal. Perhaps most obviously, outdoor sports that take place during seasons with early sunsets would clearly be affected. For example, among tenth-grade boys (girls), 27.3 percent (6.0 percent) reported participating in football, 8.3 percent (8.6 percent) in soccer, and 15.2 percent (9.7 percent) in an individual sport, which may or may not take place outdoors.

Although later dismissals would cause conflicts in these circumstances, we believe that schools and districts should be able to make adjustments to allow students to continue to participate in such activities. For example, many secondary students have study halls or free periods in their schedule, particularly later in high school. It might be possible for schools to coordinate student schedules so that those students who participate in after-school activities would have their “free” periods at the end of the day, and permit students to participate in extracurricular activities during this time. Alternatively, student athletes could be exempt from their physical education requirement, providing additional room in the schedules in order to arrange for an early dismissal. It is common for schools to dismiss students early to participate in special activities (e.g., the chess club participating in a tournament), and this could certainly continue. Local jurisdictions might also create provisions to accommodate students whose legitimate work needs would be hampered by the late starting time. Finally, it is worth noting that some of the conflicts associated with later start times could be minimized if the change in school schedules took place at a regional rather than at a district level.

Districts might even consider installing lights for athletic fields that allow students to practice later in the day. While this would certainly be an additional expense, a back-of-the-envelope calculation suggests that the benefits of later starting times would outweigh the costs. Officials in the Ann Arbor Public Schools, for example, estimate that it costs roughly \$110,000 to erect lights for an athletic field, and \$2,500 annually to operate such lights.<sup>9</sup> Even if a district had to construct and maintain lights at multiple high schools, this investment certainly seems worthwhile compared with the estimated \$17,500 per student benefit of later start times.

### *A Pilot Study*

Every district will face its own set of challenges associated with changing school start times, and the benefits of such changes may well vary. Moreover, Hinrichs' (2011) reanalysis of Minneapolis schools suggests at least some caution in adopting later start times. For this reason, we suggest that districts conduct pilot studies to determine the benefits of moving to a later start time and assess the feasibility of various ways to implement this change. Districts with one high school might institute a split schedule, as is often done when a school is overcrowded, whereby one set of students start at the regular time and another set of students start later. Districts with more than one high school could choose to have one or more of those schools start later. Regardless of the nature of the pilot, it is critical that the district use the opportunity to carefully study the impact of the schedule change.

Piloting of later start times should be done first in those areas with the highest expected net benefit. Based on the estimates provided in Table 1, schools that should pilot first are those that currently do not use a tiered busing system and those with more disadvantaged students for whom the benefits will be greater. In general, this should not be viewed as a blanket proposal for all schools but rather as a policy change that might produce net benefits in some schools and thus should be considered along with other operational changes.

While decisions regarding school schedules should be left to individual districts, we believe that state and federal governments can play an important role in encouraging districts to experiment with later schedules. For example, the federal Department of Education might sponsor a grant competition to provide some districts with funding to support schedule changes on a trial basis.

**We suggest that districts conduct pilot studies to determine the benefits of moving to a later start time and assess the feasibility of various ways to implement this change.**



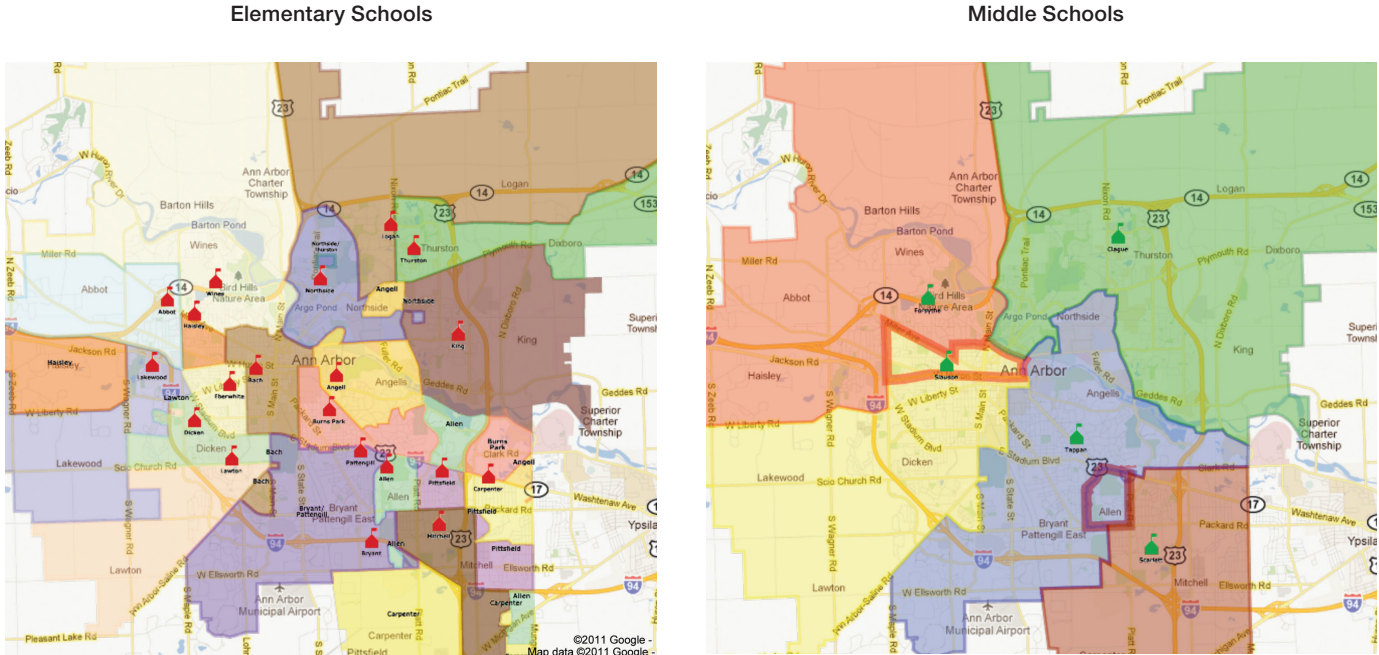
# Chapter 3: School Grade Configuration

One of the core managerial decisions made at the level of the school district is how to organize students into schools. While the vast majority of American public school students in Grades 9 through 12 attend a traditional high school, a wide variety of configurations are used to divide students in the primary grades (K–8) across school buildings. Although there is likely no single configuration that is optimal for every school district nationwide, it is unlikely that the hodgepodge we see today is based on a careful analysis of how grade configuration impacts student achievement. In particular, recent evidence suggests that districts should address problems in middle schools (Grades 6 to 8) and junior high schools (Grades 7 and 8), particularly in the year of entry, or eliminate the use of these types of schools altogether.

## WHY MIGHT MIDDLE AND JUNIOR HIGH SCHOOLS BE INEFFICIENT GRADE CONFIGURATIONS?

Middle and junior high schools were not always part of the educational landscape in America. They came into common use during two waves of educational reform: the junior high school (Grades 7 and 8) in the early 1900s and the middle school (Grades 6 to 8) in the 1960s and 1970s. Both were motivated by the idea that younger adolescents would benefit from schools that tailored educational practices to their needs and that focused on preparing them for the rigors of high school (see Juvonen, Le, Kaganoff, Augustine, and Constant 2004). These types of schools have never become popular in the private sector, where K–8 or K–12 institutions continue to be the most common grade configuration.<sup>10</sup> If middle and junior high schools are effective organizational forms, it is curious that the private sector continues to eschew them.

FIGURE 1  
Ann Arbor, Michigan, School Attendance Boundaries



Source: Ann Arbor Public Schools n.d.

We believe an important channel for the underperformance of middle and junior high schools relative to K–8 primary schools stems from the interaction of two salient characteristics of these types of schools. First, middle and junior high schools typically have large catchment areas encompassing multiple elementary schools. A great example is Ann Arbor, Michigan (Figure 1), where students from twenty different elementary schools are streamed into just five middle schools. This “hub and spoke” structure, by its very nature, means students enter middle and junior high schools alongside a large group of new peers who may have had widely different experiences in their prior schools.

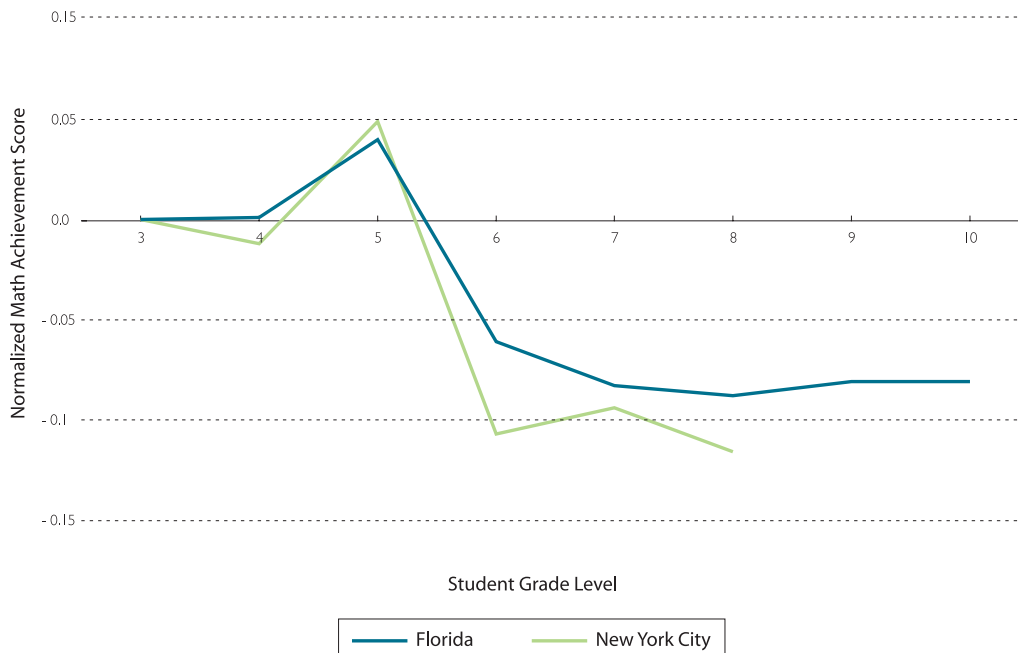
This type of change might not, in and of itself, be a bad thing, but it occurs during a period of childhood marked by major changes in attitudes and motivation, low self-esteem, poor ability to judge risks and consequences, decreased respect for authority, and other behaviors that may make students more difficult to educate (see Eccles, Midgley, and Adler 1984; Eccles, Wigfield, Midgley, Reuman, MacIver, and Feldlaufer 1983). In other words, students undergo a difficult transition at precisely the time when they may need increased attention to social and academic needs. This in turn puts teachers and administrators in a difficult position, dealing with large numbers of students with whose backgrounds and learning styles they are unfamiliar.

## WHAT DOES THE RESEARCH SAY?

The clearest and most worrisome evidence on middle and junior high schools comes from two recent studies, one in New York City (Rockoff and Lockwood 2010) and the other in Florida (Schwerdt and West 2011). Both are statistical analyses of large administrative databases that track student achievement over the majority of the primary grades and, in the Florida case, into high school. The clear result of both of these studies is that students who move to a middle or junior high school in Grades 6 or 7 experience a sharp decrease in their learning trajectories and continue to struggle, relative to their peers who attended K–8 schools, through Grade 8 and into high school.

Figure 2 reproduces findings on math achievement for students transitioning to middle school. The figure compares the performance of students in middle schools in Florida and New York City, relative to students attending K-8 schools. The effect of the transition to middle school is dramatic, resulting in a fall of 0.12 to 0.15 standard deviations in math achievement. By eighth grade, the middle school students have lost roughly 0.1 standard deviations relative to their K–8 peers. In Florida, where tests are administered through tenth grade, we see that the detrimental effects of middle school are not mitigated in high school. Since success in high school was one of the main motivations for the creation of middle and junior high schools, this long-term negative outcome is especially noteworthy.

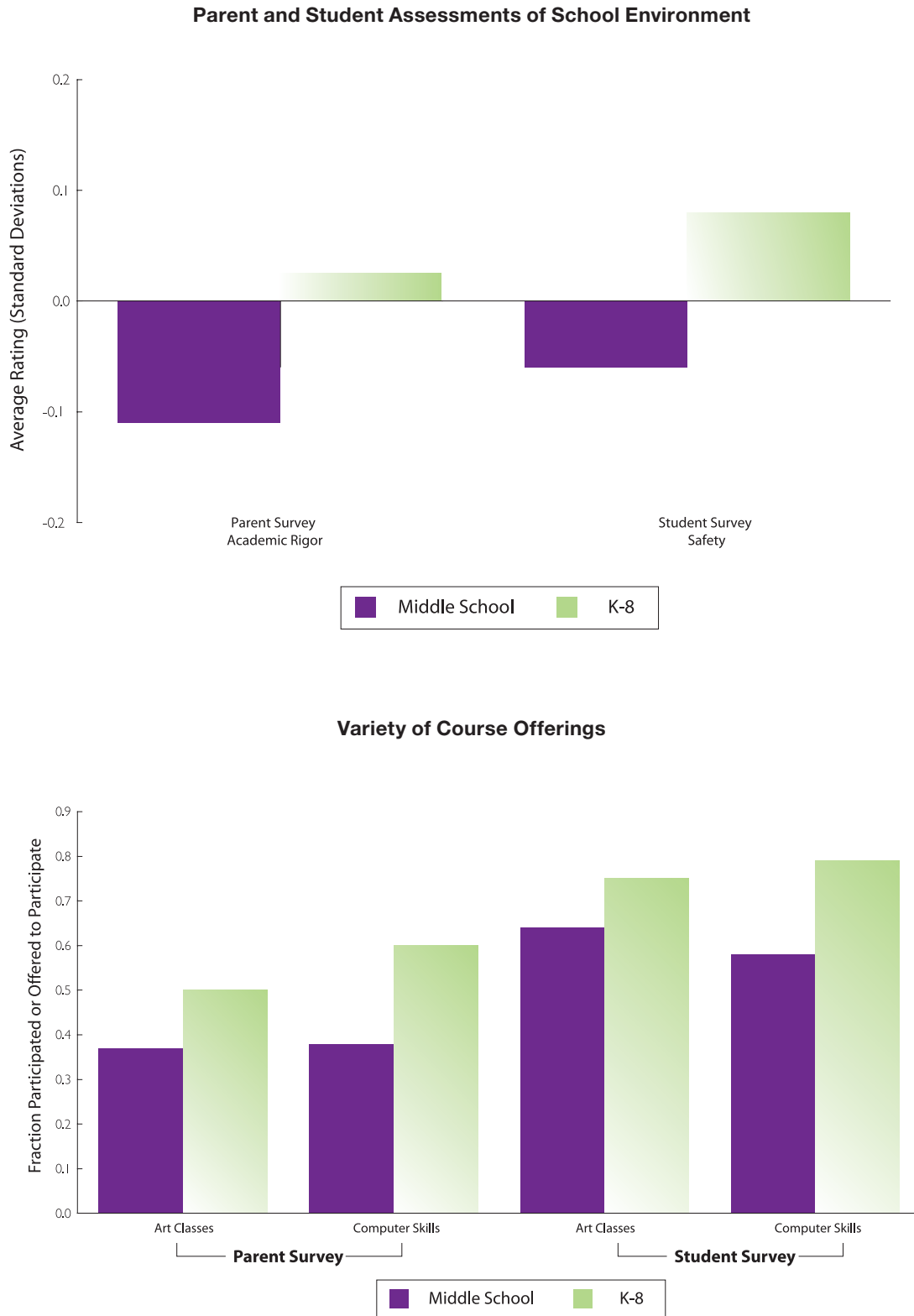
**FIGURE 2**  
**Normalized Math Achievement Scores, Relative to Students in K-8 Schools**



Source: Figure produced using Table A1 from Rockoff and Lockwood (2010) for NYC and Table A2 from Schwerdt and West (2011) for Florida.

FIGURE 3

## Non-test Based Evidence on Grade Configuration from NYC



Note: Figure produced using data from Tables 4 and 6 from Rockoff and Lockwood (2010)



Student achievement test scores are a critical outcome in evaluating educational policies because they are objective and standardized, but also because there is strong evidence linking achievement measures with future labor market success. As with school start times, the cost from lost future wages is considerable for the loss in student achievement associated with grade configuration. Achievement in middle and junior high schools that falls by 0.1 standard deviations—roughly the magnitudes observed in New York City and Florida—represents roughly \$10,000 in earnings per student.

Nevertheless, there are many observers who are skeptical of basing policy only on test scores. The New York City study also analyzes a wide variety of other data sources and finds that middle schools consistently perform worse on other dimensions of educational quality. From parents' views on academics and school safety to the availability of course offerings in arts and technology, middle schools got lower marks than their K–8 counterparts (see Figure 3).

No study is definitive, but the findings from New York City and Florida do not stand alone in suggesting that grade configuration is an important area for reform. Many studies have found that the transition to middle school is associated with a loss of academic achievement, elevated suspension rates, and reduced self esteem (Alspaugh 1998a, 1998b; Byrnes and Ruby 2007; Cook, MacCoun, Muschkin, and Vigdor 2008; Eccles et al. 1993; Weiss and Kipnes 2006), and a nationwide study found that districts switching to middle schools experienced decreases in subsequent high school completion rates (Bedard and Do 2005).

## POTENTIAL CRITICISMS OF THE RESEARCH

Despite the research highlighting the negative effects of middle and junior high schools, there are several potential objections to this work. First, one might argue that it is not the middle schools themselves but rather the transition to a new school that is responsible for lower student achievement. While we doubt transitions are the whole story, what remains important is that, by definition, these types of grade configurations necessitate a school transition during the primary years.

Second, if low-achieving students do better in middle and junior high schools, even if average students do not, one could make a case for these schools based on equity concerns. However, the New York City and Florida studies suggest that the negative impact of middle and junior high schools may be even greater for lower-achieving students.

Third, it may be that educating adolescents in middle and junior high schools is more economically efficient; in other words, they might be worse but cost a lot less on a year-to-year

basis. As economists, we take costs as seriously as benefits. Unfortunately, it is not possible to definitively answer whether operating middle schools cost less because the detailed data necessary for such analysis are not available on a national level. However, pupil-teacher ratios—a major driver of operational expenditures—are similar in primary and middle schools, suggesting that financial savings do not counterbalance the achievement costs of middle and junior high schools (National Center for Education Statistics [NCES] 2007). Additionally, the two major studies discussed above found that, relative to K–8 configurations, per pupil school expenditures for middle and junior high schools were just as high in New York City and only slightly lower in Florida. Of course, it is likely that many expenditures that should be attributed to schools appear on a district's budget (e.g., time devoted by central office staff to professional development, school improvement, etc.), so even comprehensive school-level expenditure data may mask the true costs of different grade configurations. Although our cost-benefit analysis below will address the costs of converting from middle schools to K–8 schools, operating costs deserve greater attention by any district considering changes to their school grade configurations.

There are two caveats we believe deserve more attention. The first is that the New York City and Florida studies cannot examine achievement below Grade 3. It is possible that the K–8 school structure could be *worse*, for whatever reason, for students in kindergarten through third grade than the elementary school structure (i.e., a school with a K–5 or K–6 configuration). If that were the case, then a district might still be better off having a highly effective elementary school paired with a highly ineffective middle or junior high school, rather than a unified K–8 school. To be clear, we know of no evidence either for or against this hypothesis. In our view, it can be well addressed only if researchers gain access to an appropriate dataset with standardized achievement data in the early grades. However, we doubt that elementary schools could be sufficiently better than K–8 schools for primary grade students to offset the dramatic negative effects of middle and junior high schools.

Second, the typical use of a “hub and spoke” system with multiple elementary schools and a single middle school may decrease racial and economic segregation in a district's public schools.<sup>11</sup> As we have already mentioned, middle schools do not appear to be better for low-achieving students, and in New York City and Florida middle school students tend to be racial minorities. However, we recognize that integration may serve another valuable purpose. Nevertheless, we would point out that many urban areas have open district choice systems, so that moving to a K–8 system would not necessarily entail greater segregation of student populations.

## Policy Responses

What can be done to alleviate the problems faced by middle and junior high schools? We believe policy-makers should address the issue at the level of both the district and the school. At the district level, consideration should be given to alterations in grade configuration that benefit students and make sense given physical and financial constraints. Several major districts, including Cincinnati, Cleveland, Baltimore, and Philadelphia, have either increased the number of K–8 schools or have converted completely to a K–8 structure in response to dissatisfaction with middle or junior high school performance (see Pardini 2002). David M. Herszenhorn in a *New York Times* article (“Broad Overhaul in New York City to Replace Many Middle Schools,” March 3, 2004) reports that a recent move to K–8 in New York City required creative use of school facilities and the operation of multiple schools within a single building.

Of course, for any district currently using middle schools, it is important to weigh the potential benefits of moving to a K–8 structure against the associated costs (Table 1). In order to gain some insight into this question, we analyzed budget data on nine conversions from K–5 to K–8 undertaken by Denver Public Schools between 2005 and 2009. One-time costs such as new classroom furniture and upgrades to science labs, libraries, and art studios totaled roughly \$120,000 per school; amortized over time, these costs come to less than \$20 per student for the cohorts that moved from middle schools to K–8 schools. There also were recurring costs due to the need for additional buses and bus routes as a result of the conversions that totaled roughly to \$14,000 per school per year; this works out to a little more than \$30 per student for the three extra years each student would attend the K–8 school.

Of course, both one-time and recurring costs of K–8 conversions will most certainly vary across districts. In our 2011 conversations with New York City officials regarding K–8 conversions, material upgrades for items such as furniture were budgeted at roughly twice the amount used by Denver. In addition, Denver public schools were in the fortunate circumstance of having space in their K–5 schools to accommodate students in Grades 6–8 and therefore only needed to upgrade materials. In New York City, K–8 conversions included major renovation work, which on an amortized basis came to roughly \$150 per pupil in additional expenses. Thus, depending on their circumstances, total costs for K–8 conversions likely range somewhere between \$50 and \$250 per student. These costs are nontrivial, but they are dwarfed in magnitude by the estimated benefits of \$10,000 per student in increased lifetime earnings. Thus, a simple cost-benefit calculation provides strong motivation for many districts throughout the United States to consider pursuing this reform strategy.<sup>12</sup>

Even if changes in grade configuration are not an option, the research discussed above suggests it is imperative that districts devote resources to eliminating the drop in achievement associated with middle schools. We believe a key factor is effectively managing students’ transition into a middle or junior high school. Our conversations with middle school principals confirm that they view this as a crucial task, and one to which some devote considerable time and attention. It may involve repeated school visits and an orientation period for incoming students, extensive coordination by teachers at sending and receiving schools to align curricula and exchange information on the needs of particular students, and other steps to facilitate the flow of information to both students and instructional staff.

Even if changes in grade configuration are not an option, research suggests it is imperative that districts devote resources to eliminating the drop in achievement associated with middle schools.

---

## Chapter 4: Managing Teacher Assignments

---

Teachers are at the front and center of school reform efforts today. Based on a large and growing body of evidence that teachers vary considerably in their ability to raise student performance (Staiger and Rockoff 2011), policy-makers have begun looking more carefully at ways to influence teacher recruitment, promotion, tenure, and compensation. Indeed, a key requirement of the latest round of Race to the Top funding was that states pledge to develop teacher evaluation systems that are more rigorous and more comprehensive and that place substantial emphasis on how a teacher influences student performance.

While teacher training, tenure, and compensation generally operate within structures established by districts and states, school administrators have considerable latitude when it comes to other potentially important decisions involving teachers. The same quantitative tools used to evaluate teacher performance can also inform the choices school administrators make about how to organize and manage their schools and faculty.

For example, principals control teachers' assignments within schools, and therefore principals control the rate at which teachers accumulate on-the-job experience in different grades and subjects, and their experience working with different student subgroups. One of the most consistent findings in the teacher effectiveness literature is the benefit of on-the-job experience; recent research, which we discuss in more detail below, suggests that teachers' experiences in specific assignments also influence how well their students perform.

Many factors probably contribute to the returns to experience, including a teacher's growing knowledge of the social, emotional, and cognitive abilities of children and a teacher's familiarity with the material children are expected to master in a particular grade and subject. It seems unlikely that three years of experience teaching math is as helpful for someone teaching English as three years of experience teaching English would be. Changes in the standard academic curriculum and the social and emotional abilities of young children as they age mean that teaching a group of second graders will present challenges that are different from those of teaching a group of fourth graders. The notion that all experience is not the same should not be surprising, and researchers have

found substantial returns to task-specific experience in other occupations (Clement, Koonce, and Lopez 2007; Gathmann and Schonberg 2010; Poletaev and Robinson 2008).

Below, we highlight the potential importance of teacher assignments in taking full advantage of the positive effects of experience and specialized expertise—at a grade level, among English language learners, and at the subject level. Based on the available evidence, we do not believe it is possible to recommend a single specific policy for all, or even many, schools. Rather, we urge school and district administrators to evaluate teacher assignments carefully and critically with an eye toward maximizing student learning.

### ASSIGNING TEACHERS TO GRADE LEVELS

Recent research suggests that elementary teacher grade assignments vary considerably from year to year, even among the set of teachers who maintain the same certification and continue teaching in the same school. In New York City, for example, roughly 38 percent of teachers switch grades from one year to the next. An even larger fraction of teachers switch grades over two or three years. Among third-year New York City elementary school teachers, only 28 percent had taught the same grade in all three years. The rates of grade switching are somewhat lower in other geographical areas, but are still substantial. In North Carolina, for example, roughly 30 percent of third- to fifth-grade teachers switch grades from one year to the next, and only 57 percent of third-year North Carolina elementary teachers had taught the same grade for three years. The rate of grade switching among upper elementary teachers in Los Angeles, Miami, and Gwinnett County, Georgia, are all greater than 20 percent.

There are several potential explanations for grade switching. Changing cohort sizes from year to year or turnover in staffing may lead administrators to reassign teachers to a different grade. Looking at New York City data, however, it appears that school grades that experience high faculty turnover or large changes in enrollment have only slightly higher rates of teacher grade switching. This suggests that the majority of switching is “voluntary” on the part of teachers or administrators. The teacher contract in New York City and many other districts

includes a clause allowing teachers to express preferences for grade assignments; administrators are under some obligation to honor these preferences. Teachers might request to switch grades in order to teach the age with which they feel most comfortable, or perhaps simply for a change of pace.

While grade switching is not necessarily a problem—and in some circumstances may even benefit teachers and students—there are good reasons to be concerned with the relatively high rates of grade switching described above. A recent study suggests that such frequent grade switching may reduce a teacher’s effectiveness. Following more than 30,000 elementary teachers in North Carolina, Ost (2010) finds that an elementary math teacher who receives the same grade assignment year after year will improve roughly 50 percent faster than a teacher who never repeats a grade assignment. Our analysis of New York City data shows similar results: that is, there is a noticeable return to grade-specific experience along with the well-established return to general experience.

To get a sense of the potential benefits of a policy to reduce switching, suppose that elementary teachers *never* switched grades or subjects. Given the distribution of general experience and our estimates of the return-to-grade specific experience in New York City, this admittedly extreme policy would increase district-wide average student achievement by approximately 0.02 standard deviations in math, with smaller effects in reading (Table 1). While this is a small effect, such a policy would likely entail very little, if any, direct financial cost.

## TEACHING ENGLISH LANGUAGE LEARNERS

New research on what makes an effective teacher of English language learners (ELLs) suggests that an individual’s prior experience teaching ELL students is one of the strongest predictors of his or her effectiveness in teaching future ELL students (Master, Loeb, Whitney, and Wyckoff 2011). Many ELL students are served in mainstream classrooms, possibly with additional support provided by an aide (often referred to as a “push-in” model of service, in contrast to “pull-out” models in which ELL students would receive additional support in a separate location). Given the large and growing number of ELL students in the United States, most teachers are in the position of instructing ELL students on a regular basis (Ballantyne, Sanderman, and Levy 2008; Master et al. 2011). This research suggests that if a school administrator wants to enhance a teacher’s facility with non-native English speakers, then it is critical to provide the teacher with experience working with such students.

How might an administrator use this information? One possibility would be for the administrator to assign ELL students to specific teachers systematically for several consecutive years to build their expertise in serving non-native speakers. Of course, in schools where ELL students are a high percentage of the enrollment, there may be good reasons to avoid filling an entire classroom with ELL students. In schools with smaller populations of ELL students, however, making sure that these students are assigned to a small set of teachers year after year will leverage the expertise the teachers have developed.

## SUBJECT AREA SPECIALIZATION

The logic of teacher specialization applies to a teacher’s subject area as well. As one might expect, elementary teachers who are effective at improving student math scores are also likely to be effective at improving English scores, and vice versa. A recent study of fourth- and fifth-grade teachers in North Carolina found a correlation of roughly 0.7 between measures of teacher effectiveness in English and math (Condie, Lefgren, and Sims 2011). However, even with this relatively high correlation, the authors of this study calculate that shifting teacher assignments so that each teacher taught only the subject in which she or he was most effective would lead to substantial increases in student achievement. Indeed, they estimate the benefits of this complete specialization would be larger than the benefit of firing the bottom 10 percent of teachers (based on student test scores).

Of course, complete teacher specialization by subject would require large structural changes in the organization of schooling. For example, such specialization would require upper elementary schools be departmentalized in the sense that a single teacher (or small number of teachers) teach math or English to all students. Moreover, the type of complete specialization described in this study would involve teachers transferring across schools, or potentially across districts. For these reasons, the scenario of complete specialization may not pass a cost-benefit test and is almost certainly politically infeasible.

On the other hand, less-extreme forms of specialization would be feasible and could result in improved student learning. In a recent survey, for example, roughly 14 percent of core subject elementary teachers reported teaching in a departmentalized context, and more than 27 percent of elementary teachers in Grades 4 and 5 reported doing so.<sup>13</sup> In these schools, administrators should be able to determine whether the designated math and reading teacher(s) are actually assigned to the subject in which they are most effective, or whether another teacher in the school would be more effective teaching the subject to a large group of students.

---

# Conclusion

---

Reform in education today is often dominated by high-profile or dramatic policies—for example, proposals for publicly funded vouchers for students to attend private schools, computerized or Web-based learning, charter schools where teachers work eighty hours per week in exchange for \$100,000 salaries, or the firing of the bottom 10 percent of teachers. Some of these efforts have met with success, but historically most radical proposals have made little difference to the underlying nature of schooling in America (e.g., Cuban 2003; Tayak and Cuban 1997).

Debates over these types of “flashy” policies have obscured a potentially important direction for raising student performance—namely, reforms to the management or organization of schools. By making sure the “trains run on time” and focusing on the day-to-day decisions involved in managing the instructional process, school and district administrators may be able to substantially increase student learning at modest cost. It is important to recognize, however, that a focus on management and organization

does not imply business as usual. Indeed, some of the most promising reforms, including changing school start times and reconfiguring elementary and middle schools, involve a considerable departure from the status quo. In this way, the direction we are advocating here is completely consistent with efforts to “think outside the box.”

In this paper, we describe three organizational reforms that we believe have the potential to increase student performance at modest costs: instituting later school start times for students in Grades 6 through 12, shifting to schools with a K–8 grade configuration in lieu of a system with separate elementary and middle schools, and managing teacher assignments with an eye toward leveraging teachers’ experience and comparative advantages in teaching particular subjects or types of students. We encourage school, district, and state education leaders to consider these reforms carefully, and, more generally, to make the management, organization, and operation of schools an integral part of the conversation on how to raise student achievement nationwide.



---

# Authors

---

## **Brian A. Jacob**

*Walter H. Annenberg Professor of Education Policy and Professor of Economics, Gerald R. Ford School of Public Policy, University of Michigan*

Brian A. Jacob is the Walter H. Annenberg Professor of Education Policy and Professor of Economics in the Gerald R. Ford School of Public Policy at the University of Michigan, where he also serves as the Director of the Center on Local, State and Urban Policy. His primary fields of interest are labor economics, program evaluation, and the economics of education. Jacob's research on education covers a wide variety of topics from school choice to teacher labor markets to standards and accountability. His work has appeared in top economics journals including the *American Economic Review*, the *Quarterly Journal of Economics*, and the *Review of Economics and Statistics*. Earlier in his career, he served as a policy analyst in the NYC Mayor's Office and taught middle school in East Harlem. He is also a research associate at the National Bureau of Economic Research, and a member of the editorial boards of the *American Economic Journal: Applied Economics*, *Education Finance and Policy* and the *Review of Economics and Statistics*. Jacob received his BA from Harvard College and his PhD from the University of Chicago. In 2008 he was awarded APPAM's David N. Kershaw Prize for Distinguished Contributions to Public Policy by Age 40.

## **Jonah E. Rockoff**

*Sidney Taurel Associate Professor of Business, Columbia Business School*

Jonah E. Rockoff is Sidney Taurel Associate Professor of Business at the Columbia Graduate School of Business and a Faculty Research Fellow at the National Bureau of Economic Research. Rockoff's interests center on local public finance and the economics of education. He has done research on the determinants of property taxation and expenditure in local public school districts, the impact of crime risk on local property values, the importance of teachers and teacher certification in determining student achievement, subjective and objective evaluation of teacher performance, and other educational policies such as charter schools, school accountability systems, class size reductions, and grade configuration. He received his PhD in Economics from Harvard University and a BA in Economics from Amherst College.

# Acknowledgments

The authors would like to thank Jonathan Hershaff and Max Kaputsin for research assistance.

---

# Endnotes

---

1. First-period classes started between 7:00 a.m. and 8:00 a.m. over the course of the study, but not all students were assigned a first-period class. Second-period classes began between 8:05 a.m. and 8:50 a.m.
2. The most obvious mechanism for the effects would be increased hours of sleep for students with later start times, but data on sleep were unavailable.
3. Using data on students at Clemson University, Dills and Hernandez-Julian (2008) find that students perform better in classes that meet later in the day, even when controlling for student and course characteristics.
4. There may be nonfinancial costs to families associated with changing the ordering of elementary and secondary school start times in a tiered busing system. For example, one reason offered for elementary schools starting later than high schools is that parents are concerned about their young children waiting at bus stops in the early morning when it may not be light outside. On the other hand, later start times mean that parents who start work early have to find alternative arrangements for their younger children. Overall, it is not clear which start time order is more or less convenient for parents, and it likely varies widely across families.
5. Nationwide, student transportation makes up roughly 4.4 percent of current district expenditures (roughly \$500 per pupil). Estimates suggest that moving from a three-tier system to a single-tier bus system could increase transportation costs by roughly 40 percent, perhaps \$200 per pupil, in the absence of any other changes (Fugenschuh 2009; Keller and Muller 1979).
6. Schools may choose to subsidize reduced-cost passes for children riding public transportation, which may involve a small additional cost to districts.
7. Carrell and colleagues (2011) find effects of roughly 0.15 standard deviations for college freshmen. Edwards (2011) finds that a one-hour shift in start times increases math achievement among middle school students by 0.06 standard deviations, with no impact for elementary students. He is able to estimate only impacts for a small subset of high school students, and finds substantively large but statistically insignificant estimates. However, Edwards also finds that the impact of later start time is roughly twice as large for middle school students ages 13–15 relative to middle school students ages 11–13, which suggests a reasonable estimate for the general high school population in his sample might be roughly 0.12 standard deviations. Given this range of estimates, for the purpose of this benefit calculation, we assume that middle and high school students will realize a benefit of 0.1 standard deviations from shifting school start times one hour later, from roughly 8:00 a.m. to 9:00 a.m. While students may realize these benefits each year, prior research on other educational interventions suggests that the impacts on test scores may fade out significantly over time. For example, research on the benefits of having a highly effective teacher suggests that as much as three quarters of the initial benefits will disappear within three years (Chetty, Friedman, and Rockoff 2011; Jacob, Lefgren, and Sims 2010). For this calculation, we assume that students will retain only one quarter of the benefit they realize each year. Hence, to determine the cumulative impact of later school start times over a student's K–12 career, we multiply seven years (middle and high school) by 0.1 standard deviations per year and then divide by four. This yields the figure of 0.175 standard deviations we report in the text.
8. NCES (2002). This survey found that 54.4 percent (48.4 percent) of tenth-grade boys (girls) report participating in at least one sport and 39.0 percent (58.1 percent) of boys (girls) report participating in some other after-school extracurricular activity.
9. Personal communication from Randy Trent, executive director of physical properties at the Ann Arbor Public Schools, August 2011. Annual operating costs are based on an estimate of \$12/hr x 10 hrs/wk x 20 wks/yr, and include only electricity costs. There would likely be some additional costs for maintenance.
10. In 2008, 84 percent of U.S. private school students in seventh and eighth grades attended K–8 or K–12 institutions (NCES 2008a). Only 1.5 percent attended a middle school (Grades 6–8) and just 0.5 percent attended a junior high school (Grades 7–8). In the same year, only 4 percent of seventh and eighth graders in public schools attended a K–8 or K–12 school, while 56.6 percent and 16.5 percent attended a middle school or junior high school, respectively.
11. Rockoff and Lockwood (2010) show that indices of student dissimilarity based on ethnicity or poverty are slightly higher in New York City elementary schools than in nearby middle and junior high schools.
12. Related to one of the caveats we mention above, it is also worth noting that the Denver school board analyzed impacts on enrollment patterns and found the conversions would have a negligible impact on segregation.
13. Author's calculations from the 2007–2008 School and Staffing Survey (NCES 2008b).

---

# References

---

- Alsbaugh, J. W. 1998a. "Achievement Loss Associated with the Transition to Middle School and High School." *Journal of Educational Research* 92 (1): 20–25.
- Alsbaugh, J. W. 1998b. "The Relationship of School-to-School Transitions and School Size to High School Dropout Rates." *High School Journal* 81 (3): 154–160.
- Ann Arbor Public Schools. n.d. "AAPS Attendance Boundary Maps."
- Ballantyne, K. G., A. R. Sanderman, and J. Levy. 2008. *Educating English Language Learners: Building Teacher Capacity*. Washington, DC: National Clearinghouse for English Language Acquisition. Retrieved from <http://www.ncela.gwu.edu/files/uploads/3/EducatingELLsBuildingTeacherCapacityVol1.pdf>.
- Bedard, K., and C. Do. 2005. "Are Middle Schools More Effective?: The Impact of School Structure on Student Outcomes." *Journal of Human Resources* 15 (3): 660–682.
- Bureau of the Census. 2009. "American Community Survey." Department of Commerce, Washington, DC.
- Byrnes, V., and A. Ruby. 2007. "Comparing Achievement between K–8 and Middle Schools: A Large-Scale Empirical Study." *American Journal of Education* 114 (1): 101–135.
- Carrell, S. E., T. Maghakian, and J. E. West. 2011. "A's From ZZZZ's? The Causal Effect of School Start Time on the Academic Achievement of Adolescents." *American Economic Journal* 3 (3): 62–71.
- Carskadon, M., C. Vieira, and C. Acebo. 1993. "Association Between Puberty and Delayed Phase Preference." *Sleep* 16 (3).
- Chetty, R., J. Friedman, and J. Rockoff. 2011. "The Long-Term Impacts of Teachers: Teacher Value-Added and Student Outcomes in Adulthood." Unpublished manuscript.
- Clement, M. B., L. Koonce, and T. J. Lopez. 2007. "The Roles of Task-Specific Forecasting Experience and Innate Ability in Understanding Analyst Forecasting Performance." *Journal of Accounting and Economics* 44 (3): 378–398.
- Condie, S., L. Lefgren, and D. Sims. 2011. "Heterogenous Match Quality and Teacher Value-Added: Theory and Empirics." Working Paper, Brigham Young University.
- Cook, P. J., R. MacCoun, C. Muschkin, and J. Vigdor. 2008. "The Negative Impacts of Starting Middle School in Sixth Grade." *Journal of Policy Analysis and Management* 27 (1): 104–121.
- Cortes, K. E., J. Bricker, and C. Rohlfs. 2009. "The Role of Specific Subjects in Education Production Functions: Evidence from Morning Classes in Chicago Public High Schools." *IZA Discussion Paper* No. 5031.
- Crowley, S., C. Acebo, and M. Carskadon. 2007. "Sleep, Circadian Rhythms, and Delayed Phase in Adolescents." *Sleep Medicine* 8.
- Cuban, L. 2003. *Oversold and Underused: Computers in the Classroom*. Cambridge: Harvard University Press.
- Current Population Survey. 2008. "March Supplement." Bureau of Labor Statistics, Department of Labor, Washington, DC.
- Dexter, D., J. Bijwadia, D. Schilling, and G. Applebaugh. 2003. "Sleep, Sleepiness and School Start Times: A Preliminary Study." *Wisconsin Medical Journal* 102 (1): 44–46.
- Dills, A., and R. Hernandez-Julian. 2008. "Course Scheduling and Academic Performance." *Economics of Education Review* 27: 646–654.
- Eccles, J., A. Wigfield, C. Midgley, D. Reuman, D. Mac Iver, and H. Feldlaufer. 1993. "Negative Effects of Traditional Middle Schools on Students' Motivation." *Elementary School Journal* 93 (5): 553–574.
- Eccles, J., C. Midgley, T. F. Adler. 1984. "Grade Related Changes in the School Environment: Effects on Achievement Motivation." In J. G. Nicholls (Ed.), *The Development of Achievement Motivation. Advances in Motivation and Achievement*, Vol. 3. Greenwich, CT: JAI.
- Edwards, F. 2011. "Early to Rise: The Effect of Daily Start Times on Academic Performance." Working Paper, University of Illinois at Urbana-Champaign.
- Fugenschuh, A. 2009. "Solving a School Bus Scheduling Problem with Integer Programming." *European Journal of Operational Research* 193: 867–884.
- Gathmann, C., and U. Schonberg. 2010. "How General Is Human Capital? A Task-Based Approach." *Journal of Labor Economics* 28 (1): 1–49.
- Grissom, J., and S. Loeb. 2009. "Triangulating Principal Effectiveness: How Perspectives of Parents, Teachers and Assistant Principals Identify the Central Importance of Managerial Skills." CALDER Working Paper 35.
- Hansen, M., I. Janssen, A. Schiff, P. Zee, and M. Dubocovich. 2005. "The Impact of School Daily Schedule on Adolescent Sleep." *Pediatrics* 115 (6): 1555–1561.
- Hinrichs, P. 2011. "When the Bell Tolls: The Effects of School Starting Times on Academic Achievement." *Education Finance and Policy* 6 (4): 1–22.
- Jacob, B., L. Lefgren, and D. Sims. 2010. "The Persistence of Teacher-Induced Learning Gains." *Journal of Human Resources* 45 (4): 915–943.
- Juvonen, J. L., V. Le, T. Kaganoff, C. Augustine, and L. Constant. 2004. "Focus on the Wonder Years: Challenges Facing the American Middle School." Santa Monica, CA: RAND Corporation.
- Keller, H., and W. Muller. 1979. "Optimierung Des Schulerverkehrs Durch Gemischt Ganzzahlige Programmierung." *Zeitschrift fur Operations Research* B 23: 105–122 (in German).



- Krueger, A. B. 2003. "Economic Considerations and Class Size." *Economic Journal* 113: F34–F63.
- Master, B., S. Loeb, C. Whitney, and J. Wyckoff. 2011. "Different Skills: Identifying Differentially Effective Teachers of English Language Learners." Working paper, School of Education, Stanford University.
- National Center for Education Statistics (NCES). 2001. "National Household Education Survey." Department of Education, Washington, DC.
- National Center for Education Statistics (NCES). 2002. "Educational Longitudinal Survey." Department of Education, Washington, DC.
- National Center for Education Statistics (NCES). 2007. "Common Core of Data." Department of Education, Washington, DC.
- National Center for Education Statistics (NCES). 2007–2008. "Common Core of Data (CCD), National Public Education Financial Survey." Department of Education, Washington, DC.
- National Center for Education Statistics (NCES). 2008a. "Private School Universe Survey, 2007–2008." Department of Education, Washington, DC.
- National Center for Education Statistics (NCES). 2008b. "Schools and Staffing Survey (SASS), Public School Questionnaire." Department of Education, Washington, DC.
- National Center for Education Statistics (NCES). 2010. "Digest of Educational Statistics." Department of Education, Washington, DC.
- Ost, B. 2010. "How Do Teachers Improve? The Relative Importance of Specific and General Human Capital." Working paper, Cornell University.
- Pardini, P. 2002. "Revival of the K–8 School." *School Administrator* 59 (3): 6–13.
- Poletaev, M., and C. Robinson. 2008. "Human Capital Specificity: Evidence From the Dictionary of Occupational Titles and Displaced Worker Surveys, 1984–2000." *Journal of Labor Economics* 26 (3): 387–420.
- Rockoff, J. E., and B. B. Lockwood. 2010. "Stuck in the Middle: Impacts of Grade Configuration in Public Schools." *Journal of Public Economics* 94 (11–12): 1051–1061.
- Schwerdt, G., and M. R. West. 2011. "The Impact of Alternative Grade Configurations on Student Outcomes through Middle and High School." Working paper, Harvard University.
- Staiger, D. O., and J. R. Rockoff. 2011. "Searching for Effective Teachers with Imperfect Information." *Journal of Economic Perspectives* 24 (3): 97–118.
- Tayak, D., and L. Cuban. 1997. *Tinkering Toward Utopia: A Century of Public School Reform*. Cambridge: Harvard University Press.
- Wahlstrom, K. L., M. Davison, J. Choi, and J. Ross. 2001. "School Start Time Study, Technical Report, Volume II: Analysis of Student Survey Data." Center for Applied Research and Educational Improvement (CAREI), University of Minnesota. Retrieved from <http://education.umn.edu/carei/Reports/default.html>.
- Weiss, C. C., and L. Kipnes. 2006. "Reexamining Middle School Effects: A Comparison of Middle Grades Students in Middle Schools and K–8 Schools." *American Journal of Education* 112 (2): 239–272.
- Wolfson, A., and M. Carskadon. 1998. "Sleep Schedules and Daily Functioning in Adolescents." *Child Development* 69 (4).
- Wolfson, A., and M. Carskadon. 2003. "Understanding Adolescents' Sleep Patterns and School Performance: A Critical Appraisal." *Sleep Medicine Reviews* 7: 491–506.
- Wolfson, A., and M. Carskadon. 2005. "A Survey of Factors Affecting High School Start Times." *NASSP Bulletin* 89: 47–66.





## ADVISORY COUNCIL

GEORGE A. AKERLOF  
Koshland Professor of Economics  
University of California at Berkeley

ROGER C. ALTMAN  
Founder & Chairman  
Evercore Partners

HOWARD P. BERKOWITZ  
Managing Director  
BlackRock

ALAN S. BLINDER  
Gordon S. Rentschler Memorial Professor  
of Economics & Public Affairs  
Princeton University

TIMOTHY C. COLLINS  
Senior Managing Director  
& Chief Executive Officer  
Ripplewood Holding, LLC

ROBERT CUMBY  
Professor of Economics  
Georgetown University

JOHN DEUTCH  
Institute Professor  
Massachusetts Institute of Technology

KAREN DYNAN  
Vice President & Co-Director  
of Economic Studies  
Senior Fellow, The Brookings Institution

CHRISTOPHER EDLEY, JR.  
Dean and Professor, Boalt School of Law  
University of California, Berkeley

MEEGHAN PRUNTY EDELSTEIN  
Senior Advisor  
The Hamilton Project

BLAIR W. EFFRON  
Founding Partner  
Centerview Partners LLC

JUDY FEDER  
Professor of Public Policy  
Georgetown University  
Senior Fellow, Center for American Progress

ROLAND FRYER  
Robert M. Beren Professor of Economics  
Harvard University and CEO, EdLabs

MARK GALLOGLY  
Managing Principal  
Centerbridge Partners

TED GAYER  
Senior Fellow & Co-Director  
of Economic Studies  
The Brookings Institution

RICHARD GEPHARDT  
President & Chief Executive Officer  
Gephardt Government Affairs

MICHAEL D. GRANOFF  
Chief Executive Officer  
Pomona Capital

ROBERT GREENSTEIN  
Executive Director  
Center on Budget and Policy Priorities

CHUCK HAGEL  
Distinguished Professor  
Georgetown University  
Former U.S. Senator

GLENN H. HUTCHINS  
Co-Founder and Co-Chief Executive  
Silver Lake

JIM JOHNSON  
Vice Chairman  
Perseus LLC

LAWRENCE KATZ  
Elisabeth Allison Professor of Economics  
Harvard University

MARK MCKINNON  
Vice Chairman  
Public Strategies, Inc.

ERIC MINDICH  
Chief Executive Officer  
Eton Park Capital Management

SUZANNE NORA JOHNSON  
Former Vice Chairman  
Goldman Sachs Group, Inc.

PETER ORSZAG  
Vice Chairman of Global Banking  
Citigroup, Inc.

RICHARD PERRY  
Chief Executive Officer  
Perry Capital

PENNY PRITZKER  
Chairman of the Board  
TransUnion

ROBERT REISCHAUER  
President  
The Urban Institute

ALICE RIVLIN  
Senior Fellow & Director  
Greater Washington Research at Brookings  
Professor of Public Policy  
Georgetown University

ROBERT E. RUBIN  
Co-Chair, Council on Foreign Relations  
Former U.S. Treasury Secretary

DAVID RUBENSTEIN  
Co-Founder & Managing Director  
The Carlyle Group

LESLIE B. SAMUELS  
Partner  
Cleary Gottlieb Steen & Hamilton LLP

RALPH L. SCHLOSSTEIN  
President & Chief Executive Officer  
Evercore Partners

ERIC SCHMIDT  
Chairman & CEO  
Google Inc.

ERIC SCHWARTZ  
76 West Holdings

THOMAS F. STEYER  
Senior Managing Member  
Farallon Capital Management, L.L.C.

LAWRENCE H. SUMMERS  
Charles W. Eliot University Professor  
Harvard University

LAURA D'ANDREA TYSON  
S.K. and Angela Chan Professor of  
Global Management, Haas School of  
Business University of California, Berkeley

---

MICHAEL GREENSTONE  
Director

## Highlights

To improve student performance, Jonah Rockoff of Columbia Business School and Brian Jacob of the University of Michigan highlight three cost-effective organizational changes that school systems could implement:

### The Proposal

**Proposal A: Later school start times for students in middle schools (Grades 6 to 8) and high schools (Grades 9 to 12).** Early school start times substantially reduce performance among all students, and especially among disadvantaged students. In school districts with greater flexibility to adjust start times, starting school even an hour later could substantially boost student achievement with almost no cost. In other schools, transportation systems might need to be reorganized, but even then the benefits to students more than justify the organizational costs.

**Proposal B: Addressing deleterious effects of current school grade configurations.** Adolescent students attending middle schools (Grades 6 to 8) appear to underperform their peers in K–8 schools. Evidence suggests encouraging K–8 configurations or taking measures to address the difficult transition from elementary to middle school would boost student achievement.

**Proposal C: Better management of teacher assignments with an eye toward maximizing student achievement.**

A growing body of research suggests substantial benefits from teachers remaining at the same grade level for multiple years and documents that elementary teachers are often noticeably more effective in teaching one subject than another (e.g., more effective teaching math than reading, or vice versa), suggesting significant benefits from teacher specialization.

### Benefits

The authors estimate benefit-to-cost ratios of between 9 to 1 and 200 to 1 for later start times and increasing the number of K–8 schools relative to middle schools, respectively. These organizational changes, unlike more sweeping reforms, could be implemented at the school level. The cost and benefits of these changes compare favorably to other educational policies.



1775 Massachusetts Ave., NW  
Washington, DC 20036

(202) 797-6279

BROOKINGS



Printed on recycled paper.

[WWW.HAMILTONPROJECT.ORG](http://WWW.HAMILTONPROJECT.ORG)