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Can States Take Over and Turn Around School Districts? Evidence From Lawrence, Massachusetts

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The Every Student Succeeds Act (ESSA) requires states to identify and turn around struggling schools, with federal school improvement money required to fund evidence-based policies. Most research on turnarounds has focused on individual schools, whereas studies of district-wide turnarounds have come from relatively exceptional settings and interventions. We study a district-wide turnaround of a type that may become more common under ESSA, an accountability-driven state takeover of Massachusetts's Lawrence Public Schools (LPS). A differences-in-differences framework comparing LPS to demographically similar districts not subject to state takeover shows that the turnaround's first 2 years produced sizable achievement gains in math and modest gains in reading. We also find no evidence that the turnaround resulted in slippage on nontest score outcomes and suggestive evidence of positive effects on grade progression among high school students. Intensive small-group instruction over vacation breaks may have led to particularly large achievement gains for participating students.

Keywords: *state takeover, district turnaround, school improvement, school accountability*

School and District Turnaround

TURNING around chronically underperforming schools and districts has been an elusive goal, despite prioritization at the highest levels of government (Gewertz, 2009). In recent years, considerable federal resources have been devoted toward this end. The Obama administration's signature education initiative, Race to the Top, awarded over $4 billion in competitive grant funding to states in part based on states' plans for turning around their lowest achieving schools (Smarick, 2010). The 2009 American Recovery and Reinvestment Act also funded an additional $3 billion in School Improvement Grants (SIG) aimed at improving the lowest-performing 5% of public K–12 schools (Dee, 2012).

At the state level, there is considerable variation across accountability models in the policy response to chronic underperformance. Through its Elementary and Secondary Education Act Flexibility Program, the U.S. Department of Education (U.S. ED) has recently encouraged states to adopt tiered accountability systems targeting the lowest performers for intensive interventions. The U.S. ED has highlighted as an exemplar Massachusetts's accountability system, which is defined by the state's 2010 Achievement Gap Act (U.S. Department of Education, 2012). That system has three important features. First, the state classifies schools and districts into distinct performance levels. Second, the state requires low-performing schools and districts to implement rapid improvement plans. Third, the

State Board and Commissioner of Education have the authority to take control of schools and districts that fall into the lowest performance level.

In fall 2011, the state Department of Elementary and Secondary Education (DESE) exercised this authority and took over the Lawrence Public School district. The state appointed a Receiver who was granted extensive legal powers, including those previously assigned to the Superintendent and School Committee. The takeover was specified as the final step in a policy process that began with chronic underperformance and ended with the classification of the Lawrence Public Schools as a Level 5 district, the lowest rating in the state's accountability system. The turnaround reforms, which we describe in more detail below, involved efforts designed to increase expectations, increase school-level autonomy and accountability, extend learning time, improve human capital, and improve data use.

To estimate the impact of the turnaround, we use a differences-in-differences approach comparing changes over time in the outcomes of Lawrence Public School district students to those of students in demographically similar Massachusetts school districts. We find that Lawrence Public School district students exposed to the first 2 years of the state's takeover score about 0.3 standard deviations higher on math exams and about 0.1 standard deviations higher on English Language Art (ELA) exams. Our results are robust to controlling for a variety of demographic controls and student fixed effects, suggesting that compositional changes in the Lawrence Public School district student body cannot explain our findings. Furthermore, we find that the turnaround's math impact was roughly twice as large for students who participated in "Acceleration Academies," intensive, targeted instructional programs taught over vacation breaks by a carefully selected set of teachers. ELA gains were entirely concentrated among Acceleration Academy participants.

These findings are important for three reasons. First, much of the recent literature on school turnarounds in the era of standardized testing has focused on efforts directed at individual schools, with unclear implications about whether such efforts can scale to the district level. Dee (2012) finds, for example, that School Improvement Grants increased student outcomes in California schools, driven largely by those schools that chose turnaround models involving heavy staff turnover. Strunk, Marsh, Hashim, Bush, and Weinstein (2016) similarly find that Los Angeles turnaround schools with the most staff turnover experienced gains in ELA, whereas schools that implemented more moderate forms of turnaround experienced less improvement or even declines. Heissel and Ladd (2016) find that North Carolina's federally funded school turnaround program reduced math and reading achievement. The charter sector also provides models for turnaround. Abdulkadiroğlu, Angrist, Hull, and Pathak (2014) find large math and reading impacts from converting underperforming traditional public schools into charter schools in Boston and New Orleans. Fryer (2014) shows that injecting best practices from charter schools into traditional public schools boosts math, though not reading, achievement. All of these examples provide lessons for individual struggling schools but not necessarily entire districts that are underperforming.

Second, relatively little is known about the effects of district-level reforms, which may be better suited than individual school reform to create the conditions for the lowest-performing schools to have long-run success (Johnson, Marietta, Higgins, Mapp, & Grossman, 2015; Supovitz, 2006; Zavadsky, 2013). Recent evidence is consistent with the idea that districts play an important role in student achievement, beyond what school-level factors explain alone (Chingos, Whitehurst, & Gallaher, 2015). Pre-No Child Left Behind Act research on district takeovers found that states could, in some cases, improve district financial management but had less success with improving student academic outcomes (Wong & Shen, 2002, 2003).

More recent research into district-level turnarounds has focused on three relatively exceptional cases. Gill, Zimmer, Christman, and Blanc (2007) show that the state's takeover of the Philadelphia schools in 2002, which turned over control of many schools to private operators, had little impact on student achievement. Conversely, Harris and Larsen (2016) document substantial achievement gains across the New Orleans school district following wide-ranging reforms that transformed virtually all of the district's schools into charter schools. Finally, Zimmer, Kho, Henry, and Viano (2015) find mixed results for turnaround schools in Tennessee's unusual state-managed Achievement School District (ASD) model under which district governance is divorced from geography through the placement of low-performing schools from across the state into a single district.

In contrast, the Lawrence Public Schools (LPS) provide a valuable case of accountability-driven state takeover and district-wide turnaround of a chronically low-performing school system that, unlike Philadelphia and New Orleans, was not driven by a large shift to outside school operators. In the turnaround's first year, fewer than 5% of LPS students attended school grades run by outside operators. By the second year, that number was still below 20%. The Lawrence turnaround effort did not depend heavily on outside operators, as did Philadelphia; did not require an unusual triggering event like Hurricane Katrina, as did New Orleans; and did not abandon the traditional geographically based district structure, as did Tennessee's ASD.

Thus the third contribution of this research is to study a district turnaround case that represents a policy response stemming directly from state accountability law and is likely more typical of reforms to be repeated in other contexts. Since taking over LPS, for example, the Massachusetts Board of Elementary and Secondary Education has voted to take over two additional districts, Holyoke and Southbridge. Massachusetts is not alone in using or considering state intervention into underperforming districts. Since 2015, 11 states have passed or debated legislation to create state-run districts (Layton, 2016).

Furthermore, the recently passed Federal Every Student Succeeds Act (ESSA) requires states to develop policies that identify and turn around low-performing schools as part of a larger state accountability system. States therefore have substantial need for evidence about takeover and turnaround policy, and this article addresses that need.

The LPS Turnaround

Lawrence is a midsized industrial city about 30 miles north of Boston and is one of Massachusetts's most economically disadvantaged communities, with a median household income of below $33,000 and a poverty rate of nearly 30%. Only 11% of residents over the age of 25 hold at least a bachelor's degree. Nearly 40% of Lawrence's population is foreign born. The city is home to a large concentration of Latino residents, including many who came to Massachusetts from the Dominican Republic or Puerto Rico (U.S. Census, 2015). The public school system enrolled approximately 13,000 students in 28 schools as of 2011.

Table 1 presents descriptive statistics for the Lawrence student population. Relative to the rest of Massachusetts, LPS students are far more likely to be low-income and Hispanic, with 80% learning English as a second language. Prior to the takeover, LPS students scored about 0.75 standard deviations below the state average on ELA and math exams. LPS students also scored somewhat lower than students in other predominantly low-income districts.

The district has a long history of chronic underperformance, but the State took particular notice after reviewing results for the 2010–2011 school year. Lawrence was in the bottom five districts in the State based on the percentage of students considered proficient on the ELA and Math Massachusetts Comprehensive Assessment System (MCAS) exams. Three quarters of the schools in the district experienced declines in achievement between 2009–2010 and 2010–2011, and only about half of all students were graduating high school within 4 years.

In the fall of 2011, based on these performance measures, the Massachusetts Board of Elementary and Secondary Education classified LPS as a Level 5 district, the lowest rating in its one through five tiered accountability system, and placed the district into receivership. In January of 2012, the State appointed as Receiver Jeffrey Riley, a former Boston Public Schools teacher, principal and deputy superintendent. The Achievement Gap Act gave Riley all the authority of the previous Superintendent and School Committee, as well as broad discretion to alter the collective bargaining agreement, to require staff to reapply for their positions, and to unilaterally extend the school day or year district-wide. The Receiver spent the spring of 2012 gathering information, recruiting and hiring a central office team, visiting schools, interviewing principals, observing teachers, and planning for the 2013 academic year with the state, partner organizations, and community groups.

TABLE 1

Sample Characteristics

	Prereceivership (2008–2012)			Postreceivership (2013–2014)		
	Lawrence	Rest of MA	Low income	Lawrence	Rest of MA	Low income
Female	.47	.49	.48	.47	.49	.48
FRPL	.90	.33	.75	.92	.37	.78
White	.07	.70	.31	.06	.67	.28
Black	.02	.09	.22	.02	.09	.22
Hispanic	.89	.13	.34	.89	.15	.37
Asian	.02	.05	.07	.02	.06	.07
Other	.01	.03	.05	.02	.04	.06
FLNE	.82	.17	.40	.77	.19	.43
LEP	.38	.10	.24	.50	.13	.31
SPED	.26	.24	.26	.24	.24	.25
ELA score	−.74	.01	−.52	−.72	.01	−.49
Math score	−.76	.02	−.47	−.51	.01	−.43
Number of students	20,777	1,279,546	361,546	14,975	979,091	266,072
Number of districts	1	405	59	1	409	56

Note. All cells represent averages over multiple years. The number of students represents the number of unique students across multiple years. Demographic indicators are constant within student over time. The low-income sample includes students in districts outside of Lawrence that were majority low income in 2008. FRPL = Free or Reduced Price Lunch; FLNE = First Language Not English; LEP = Limited English Proficient; SPED = Special Education; ELA = English Language Arts.

Receivership did not come with large amounts of additional funding. Per pupil spending increased slightly over the first 2 years of the turnaround, from $13,272 in 2012 to $14,027 in 2014. The state average similarly increased from $13,637 in 2012 to $14,518 in 2014 (Massachusetts DESE, 2015). In the second year of the turnaround, LPS did receive more than $2 million in Race to the Top funding and more than $3 million in School Redesign Grants through the federal School Improvement Grant program (Education Research Services [ERS], 2015). In addition, LPS received some private funding from individual donors and foundations to support special programs such as the Acceleration Academies. LPS' overall state-reported per pupil spending increases did not, however, outpace statewide increases.

The Receiver began implementing turnaround efforts in the 2012–2013 school year and the turnaround intensified over time. In this article, we present results from the first 2 years of the turnaround implementation, 2013 and 2014. In the following section, we outline the five primary components of the turnaround strategy, specifying the changes that occurred by year. This description is also summarized in Figure 1.

Expectations

First, the district attempted to raise expectations for students and staff. In Spring 2012, the state and the Receiver jointly released a turnaround plan that laid out ambitious performance targets, including (a) doubling the number of schools with Student Growth Percentiles greater than 50 in year one, (b) moving from 22nd to one of the top five ranked Massachusetts Gateway districts (midsized urban centers with economic challenges) in ELA and math proficiency and graduation by year three, and (c) closing the gap with the rest of the state in ELA and math proficiency and graduation in 5 to 7 years (Massachusetts DESE, 2012).

Autonomy and Accountability

Second, to increase school autonomy and accountability, the district reduced spending on the central office by $6.6 million over the first 2 years, in an effort to push funds to the school

	Year 1 (2012–13)	Year 2 (2013–14)
Higher Expectations	Announced performance targets: 1) Double the number of schools with Student Growth Percentiles greater than 50 in year 1 2) Move from 22nd to top 5 MA Gateway districts in ELA and math proficiency and graduation by year 3 3) Close gap with the rest of the State in ELA and math proficiency and graduation within 5–7 years	
Autonomy & Accountability	Increased school autonomy, but differentiated levels based on prior performance	
	Gave management of one full grade level at 3 schools to independent operators	Independent operators expanded to serve additional grades and schools
	Independent operator opened new alternative high school focused on dropout recovery and prevention	
		Lawrence Teachers Union took over management of one elementary school
		Central office budget reduced by 25%
Learning Time	At "Acceleration Academies," select teachers provided 1,800 struggling students ELA or math instruction in small groups over week-long vacation breaks	Doubled participation in Acceleration Academies
	Built out extracurricular offerings	Built out extracurricular offerings further
		School year expanded at least 200 hours for grades 1–8
	MATCH Education provided math tutoring to 550 9th–10th graders at two schools	
Data Use	Achievement Network worked with 9 schools to train educators on using data to improve instruction	Achievement Network expanded to work with 85% of K–8 schools
Human Capital	Replaced 36% of principals, 20% of assistant principals and 10% of teachers	Replaced another 20% of principals
		New teacher compensation system with career ladder, performance pay, stipends for ELT and leadership.

FIGURE 1. *Components of the turnaround strategy by year.*
Note. ELA = English Language Arts; ELT = extended learning time.

level and shift to a more service-oriented approach to district–school relations (ERS, 2015). This is consistent with other improved districts that have moved from a compliance to a school-support focus (Supovitz, 2006) and have provided a differentiated menu of services based on individual schools' needs (Honig, 2013). The district then provided differentiated levels of autonomy and support based on each school's prior performance and perceived capacity. High-performing schools received the highest level of autonomy to continue operating as they saw fit, whereas management of the lowest-performing five schools was given to independent operators that operated with substantial autonomy. Schools in the middle of the performance distribution were provided with the least autonomy and the most intensive central office supports. The ultimate result was a portfolio management model of district organization, with the central office overseeing a diverse set of school operators ranging from charter management organizations to the Lawrence Teachers Union (Hill, Campbell, & Gross, 2012). Unlike many portfolio management districts, Lawrence Public Schools does not manage schools of choice, with even the charter operators running noncharter public schools with neighborhood-based enrollment policies and unionized teachers.

Human Capital

Third, the turnaround team attempted to improve the quality of the district's administrators and teachers. The Receiver took a particularly aggressive approach to improving the quality of school principals, replacing 36% in year one and another 20% in year two, while raising base salaries for both new and experienced principals (ERS, 2015). School administrators and staff members with the potential to serve as school leaders were also offered a year-long training program from the national organization Building Excellent Schools (Empower Schools, 2014).

Turnaround leaders also attempted to improve the quality of the teaching force. The Receiver did not exercise his authority to require all staff members to reapply for their positions but instead implemented a "Receiver's Review," conducting classroom observations of and gathering further information on the 10% of teachers deemed low performing based on student data, attendance records, and principal reports (Empower Schools, 2014). About 8% of teachers were ultimately removed prior to year one of the turnaround. These dismissals, along with resignations and retirements, meant that one third of teachers in 2013 were new to LPS. The district partnered with Teach for America to assist with recruitment as well as training for current and new teachers (Empower Schools, 2014).

In year two, the district made significant changes to its teacher compensation system, replacing the traditional salary scale based on experience and educational attainment with a five-rung performance-based career ladder. Advancement up the first three rungs is based on a teacher's annual evaluation, with further advancement based on an application that includes evidence of effective teaching, such as principal and peer recommendations and student growth data for those teaching in tested grades and subjects. LPS estimates that changes to the teacher compensation system, including additional stipends to support extended learning time, resulted in 92% of teachers receiving a pay increase beyond the increase they would have received under the old system (LPS, 2013). The average LPS teacher received a $3,000 raise for the 2014 school year (ERS, 2015). The district also created new leadership opportunities for teachers, establishing a Teacher Leader Cabinet that provided 100 teachers with a stipend of $5,000 to provide the Receiver with guidance on district-wide policy.

Learning Time

The fourth major turnaround component was increased learning time, including expanded school day, enrichment activities, tutoring, and special programs. A nonprofit organization, the National Center on Time and Learning, worked with several schools to craft school-level implementation plans for adding hours to the school day. In year one, schools led by outside operators added about 90 minutes to the school day. By year two, the school year was expanded by at least 200 hours for all first- through eighth-grade students (Empower Schools, 2014). The district also worked to build out after-school enrichment offerings such as theater, dance, arts, music, and sports. At the high school level, LPS partnered with Match Education, a nonprofit charter school operator and educational program provider, to offer intensive mathematics tutoring to a subset of the 9th- and 10th-grade students attending two of the district's lowest-performing high schools (ERS, 2015).

One particularly notable component of the Receiver's expanded learning time efforts were "Acceleration Academies" that provided struggling students with targeted, small-group instruction in a single subject, delivered by select teachers over week-long vacation breaks. Teachers were recruited from both within and outside of Lawrence, with the majority coming from the district. Teachers applied through a competitive process for the Sontag Prize in Urban Education, with selection based on evaluation ratings and principal recommendations. Those chosen to teach in the Acceleration Academies received a $3,000 honorarium and attended a weekend event at Harvard University that included an awards dinner, networking opportunities, planning time, team building activities, and professional development delivered by experienced education professionals.

Students were chosen to participate in Acceleration Academies by their principals. The central office recommended but did not mandate that principals select students who had particularly low prior MCAS scores, who appeared to be struggling based on interim assessment data, and whose attendance records and behavioral histories suggested they would attend the Acceleration Academies and not disrupt their peers. When pitching the program to parents and students, educators emphasized that the Receiver selected them for a special opportunity to get extra academic help. The program was not described as punishment or remediation.

Principals typically used homogenous ability groupings to create classes of 10 to 12 students, with teachers assigned to a single group for the week. Teachers were given substantial flexibility to create their own lesson plans. Academies held over the February vacation focused on ELA. The April Academies focused primarily on math, but also included some classes dedicated to science. The district asked Academy teachers to focus on frequently assessed MCAS standards and provided a list of these standards, sample objectives, and interim assessment data for all of the students in the teacher's class to identify the standards their students had and had not yet mastered. The daily schedule varied by school, but administrators were told to aim for a total of 25 hours of instruction over the week. Instruction in the core subject was broken up by two "specials" per day, which included theater, visual art, music, sports, technology, and cooking. Students received incentives for perfect attendance, such as $40 gift cards.

Data Use

The fifth and final priority for the turnaround effort was a greater emphasis on the effective use of data. In the first year, The Achievement Network (ANet), a national partner organization, began working with nine LPS schools to provide training on how to use data to drive instructional improvement. ANet helped administer formative assessments and supported schools in using data to target specialized programming for struggling students. In 2014, ANet expanded to work with a majority of Lawrence schools (Empower Schools, 2014).

Empirical Methods

We make use of student-level administrative data provided by the Massachusetts DESE. The data include students in the state from the 2006 to the 2015 school year, recording information on each student's grade, school, district, demographic characteristics, standardized test scores, attendance, and high school graduation status. We supplement the state data with records from LPS on participation in the Acceleration Academies in 2013 and 2014.

Our full sample includes over 500,000 unique students in each year. Our preferred analytic sample includes the roughly one fourth of students attending the 50 or so school districts in the state in which at least half of the students qualified for free or reduced-price lunch as of 2008. We refer to this as the majority low-income sample. Such districts provide a more relevant comparison to LPS given the well-known relationship between socioeconomic status and academic achievement. However, below we show that our findings are generally robust to a number of different sample restrictions, including those based on districts' concentration of First Language Not English (FLNE) students, district size, and districts' baseline accountability status.

Our primary measures of academic achievement are students' scores on the statewide mathematics and ELA MCAS exams, given in 3rd to 8th and 10th grades. We standardize these scores within year, subject, and grade using the full sample of Massachusetts students. We also examine additional outcomes including students' school attendance, grade progression, probability of remaining in the same district, probability of remaining enrolled in school, and probability of taking the MCAS in any given year.

LPS' data allow us to identify the students who participated in Acceleration Academies in 2013 and 2014. In 2013, 505 LPS students participated only in a math Acceleration Academy, 570 participated only in an ELA Acceleration Academy, and 495 participated in both types. In total, 1,570 students, or 21% of LPS students in tested grades, participated in at least one Acceleration Academy. In 2014, these numbers roughly doubled in each category, so that 42% of LPS students participated in at least one Acceleration Academy.

To study the overall effect of the turnaround, we conduct differences-in-differences analyses that compare achievement trends of Lawrence students to achievement trends of students in comparable districts that did not experience the turnaround. In all models, we treat the school years 2008 through 2012 as the preturnaround control period. We then use two primary regression specifications. Model 1, a school-by-grade fixed effects model, is as follows:

$$Y_{isgy} = \beta_0 + \beta_1 LPS_{isgy} \times 2013_y + \delta_{sg} + \gamma_{gy} + \beta_2 X_{isgy} + \varepsilon_{isgy}, \quad (1)$$

Here, Y is an outcome for student i in school s and grade g in year y. $LPS_{isgy} \times 2013_y$ is the interaction between a binary indicator for being enrolled in the LPS and an indicator for 2013, the first postturnaround year. This interaction provides an estimate of the extent to which changes in LPS' outcomes in the first year of the turnaround relative to prior years differ from such changes in other comparison districts. We exclude 2014 data to focus on first-year impacts.

Inclusion of school-by-grade fixed effects δ implies that estimates are generated by comparing the same school-grade combination to itself over time. Grade-by-year fixed effects γ control for any statewide shocks common to a given grade in a given year, such as changes in exam difficulty. Student-level demographic controls X account for any compositional changes within LPS or other districts over time. These controls include measures of gender, race, free or reduced-price lunch status, FLNE status, limited English proficiency status, and special education status. Standard errors are clustered at the school level to account for serial correlation in unobserved components of the error term within schools.

To estimate the cumulative effects of the turnaround in 2014, its second year, we estimate versions of Model 1 in which we include 2014 data but omit 2013 data and replace *2013* with a *2014* indicator. This allows us to compare the second year of the turnaround to the preturnaround period. Including both periods simultaneously would result in estimates of the impact of one year's turnaround conditional on the other year's, causal interpretation of which would be unclear. As a result, the 2013 estimates cannot simply be added to the 2014 estimates to calculate a cumulative effect. Instead, the 2014 estimates themselves provide the cumulative effects of the first two years of turnaround reform.

Although we control for a rich set of covariates in Model 1, it is possible that there are other preexisting differences across schools and districts that could bias our estimates of the turnaround effect. Furthermore, controlling for demographic characteristics may not sufficiently account for differential changes over time in the composition of the LPS student population relative to the population in other districts, particularly if such changes occur along unobservable dimensions. To account for both observed and unobserved differences in nontime-varying characteristics between our treatment and comparison groups and for compositional changes to these groups over time, we run Model 2, a student fixed effects model, of the form

$$Y_{isgy} = \beta_0 + \beta_1 LPS_{isgy} \times 2013_y + \delta_{sg} + \gamma_{gy} + \theta_i + \varepsilon_{isgy}. \quad (2)$$

There are two differences between this model and Model 1. The main difference is that we add student fixed effects (θ_i), ensuring that identification of turnaround impacts comes from within-student changes over time. Second, student fixed effects obviate the need for demographic controls, which are constant over time, and which the model implicitly employs for identification. Again, we cluster standard errors at the school level. This is our preferred model because, by comparing students to themselves over time, Model 2 allows us to eliminate two potential sources of omitted variable bias: compositional changes to LPS or comparison districts over time and all observed and unobserved nontime-varying student characteristics.

Findings

Turnaround Impacts on Math and ELA Achievement

We begin by using the raw data to explore achievement trends in Lawrence and other districts and to establish the existence of parallel preturnaround achievement trends for Lawrence and our comparison districts. Figure 2 illustrates Lawrence's chronic underperformance prior to

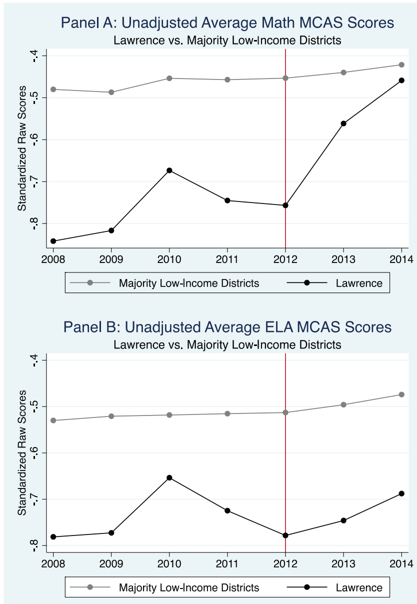

FIGURE 2. *Overall mean math and ELA MCAS scores.*

Note. ELA = English Language Arts; MCAS = Massachusetts Comprehensive Assessment System.

receivership. Panel A presents math MCAS scores for all tested students in LPS and other majority low-income districts. For the 5 years leading up to the turnaround, LPS students underperformed Massachusetts as a whole by roughly 0.70 standard deviations and underperformed other majority low-income districts by about 0.30 standard deviations. Math achievement remained relatively flat in both Lawrence and other majority low-income districts prior to the turnaround except for a bump in math achievement in 2010. This increase occurs both in LPS and comparison districts, but is somewhat larger in LPS than the rest of the state. In 2013, the first full year of the turnaround, math scores in LPS rose by roughly 0.20 standard deviations relative to the rest of the state, and then rose again by about 0.10 standard deviations in 2014. Math scores in other low-income districts remained relatively flat during this time. This clear break from trend, which is the largest change over this period, already suggests that the turnaround may have had large impacts on math achievement in Lawrence.

Panel B suggests that in ELA, prior to the turnaround, Lawrence substantially underperformed the rest of the state, by 0.70 standard deviations, and other low-income districts, by 0.20 standard deviations. ELA achievement is relatively flat in comparison districts prior to receivership. In contrast, LPS students saw an increase in ELA achievement in 2010. ELA scores do rise slightly in 2013 and again in 2014 but the pattern of those scores in Lawrence's preturnaround period and postturnaround trends in low-income districts makes it less clear whether such increases were due to the turnaround itself.

Table 2 contains estimates generated by our two regression models corresponding to Figure 2. We focus first on comparisons of LPS to students across the entire state. Estimates from the school-grade fixed effects model suggest that math scores rose by 0.20 standard deviations in year one of the turnaround and by 0.31 standard deviations by its second year. Our preferred student fixed effects model decreases the estimates only slightly, implying that the turnaround increased test scores by 0.18 standard deviations in year one and 0.30 standard deviations by year two. The last two columns of Table 2 show that limiting the sample to other low-income districts has virtually no effect on these estimates. In Appendix Table A1, available in the online version of the journal, we provide further evidence that these results are generally robust to the selection of comparison districts. We estimate both models after limiting our sample to majority FLNE districts, districts within 5,000 of the size of the LPS student population, and districts with the same 2010 Level 4 accountability rating as LPS. We also confirm these results are not driven by changes in the proportion of students taking these exams.

Importantly, our identification strategy relies on the assumption that students did not respond to the takeover by differentially leaving or entering the district. By making within-student comparisons, our student fixed effects models address this threat. We further rule out differential migration as a source of omitted variable bias by running versions of all models in which we fix students' districts as of 2012, regardless of where they subsequently moved. This has no impact on the estimates presented here.

To further examine our parallel trends identifying assumption, we run our school-by-grade model including interactions between the LPS dummy and each of the years in our time series, using 2008 as the omitted year, with the low-income sample.

TABLE 2

Turnaround Effect on Test Scores

	Full sample		Low-income sample	
	(1)	(2)	(1)	(2)
2013 math	.203** (.041)	.184** (.036)	.182** (.041)	.180** (.040)
Number of students	981,333	707,196	271,113	182,355
2014 math	.305** (.046)	.297** (.040)	.268** (.047)	.288** (.044)
Number of students	1,051,409	702,183	290,932	179,328
2013 ELA	.011 (.038)	.030 (.022)	−.009 (.039)	.008 (.022)
Number of students	982,722	707,598	271,841	182,337
2014 ELA	.060 (.047)	.097** (.033)	.022 (.046)	.068^ (.036)
Number of students	1,052,560	702,666	291,604	179,339
Demographic controls	x		x	
Student fixed effects		x		x

Note. Standard errors are clustered at the school level. All estimates come from a regression of the listed outcome on an interaction between the year and an indicator for enrollment in LPS. All models include grade-by-year and school-by-grade fixed effects. The sample for the 2013 estimates excludes 2014 observations and 2014 estimates exclude 2013 observations. The low-income sample includes students in districts outside of LPS that were majority low income in 2008. ELA = English Language Arts.
^$p < .10$. *$p < .05$. **$p < .01$.

In Figure 3, we plot the resulting coefficients for each year, showing in Panel A that our estimates of the turnaround math effects persist when utilizing this specification. There is only one preturnaround year—2010—in which LPS students consistently appeared to grow relative to students outside of LPS. However, the estimates for 2010 math are smaller than the 2013 and 2014 estimates, consistent with the idea that postturnaround gains break from the preturnaround trend.

None of our central results are sensitive to the choice of model we use to identify likely counterfactuals for our treated students. Appendix Table A2, available in the online version of the journal, shows additional specifications, using lagged test scores and attendance instead of student fixed effects, matching students to others based on demographics and preturnaround test scores, and a reestimation of Model 2 in which we cluster standard errors at the district-by-year level given that the turnaround was a district-wide intervention. Regardless of the model and sample used, all of our estimates suggest that the turnaround had sizable positive impacts on math achievement. Our preferred and conservative student fixed effects model suggests that, by its second year, the turnaround had improved LPS students' math scores by a sizable and statistically significant 0.29 standard deviations when compared with other majority low-income districts. In ELA, there is no consistent evidence of progress in year one. By the second year, the two primary models suggest modest gains of 0.06 to 0.10 standard deviations. Limiting the sample to low-income districts makes the estimates smaller across specifications, ranging from 0.02 to 0.07 standard deviations. The main takeaway is that the turnaround had no apparent impact on ELA scores in its first year and at best small positive impacts in its second year, on the order of 0.07 standard deviations based on our preferred student fixed effects model and low-income sample.

Turnaround Impacts by Subgroup

Because Lawrence has a high proportion of students learning English as a second language and because such students traditionally underperform their peers who learned English as a first language, we explore differences in the effect of the turnaround by first language status. Figure 4 graphs math test scores over time by language status. We follow the Massachusetts DESE convention and identify students whose first language was anything but English as "First Language Not English" regardless of the English as a Second Language (ESL) services students received. Panel A shows a massive rise in the math scores of Lawrence's FLNE students, so much so that they appear to have closed the gap

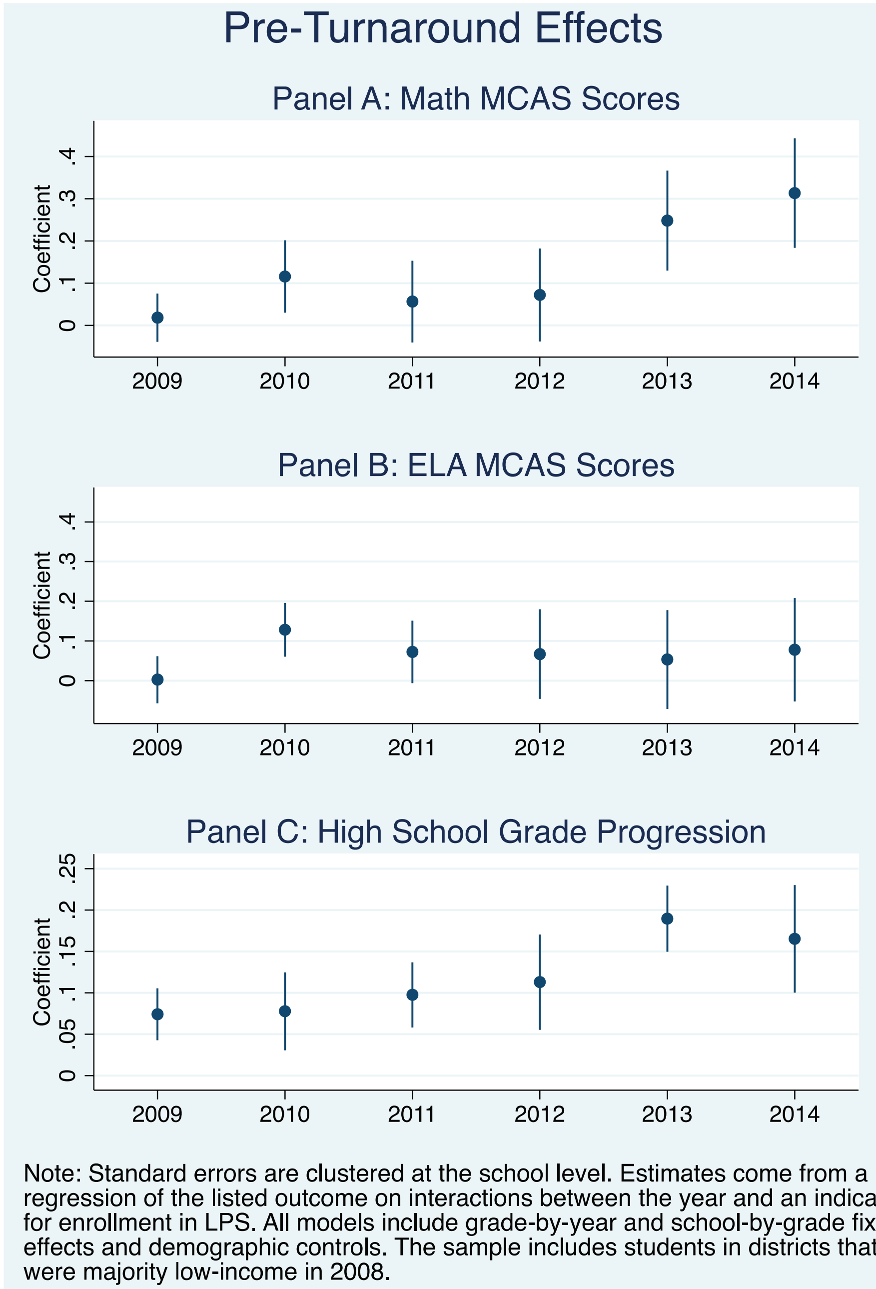

FIGURE 3. *Preturnaround effects on test scores and high school grade progression.*
Note. ELA = English Language Arts; LPS = Lawrence Public Schools; MCAS = Massachusetts Comprehensive Assessment System.

with FLNE students in other low-income districts. Panel B shows large math gains for non-FLNE students as well, although breaks from prior trends are somewhat less clear. We formalize these estimates in Table 3 by interacting the differences-in-differences specifications in

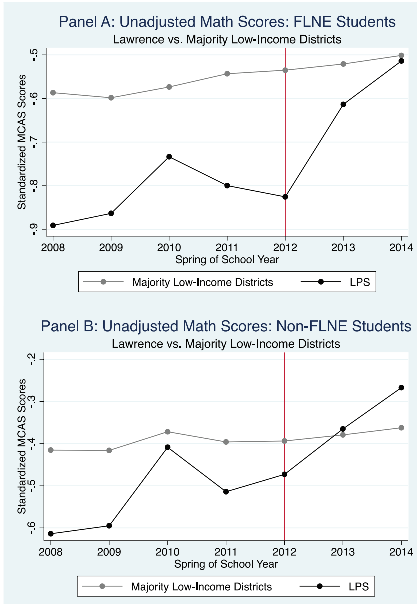

FIGURE 4. *Mean math MCAS scores by first language status.*

Note. MCAS = Massachusetts Comprehensive Assessment System.

Models 1 and 2 with indicators for whether a student's first language was English. Though the subgroup estimates here differ somewhat by the model used, both models confirm that FLNE students saw large gains in math in both years of the turnaround. The estimates, as well as Panel A of Appendix Figure A1, available in the online version of the journal, also suggest that FLNE students made moderate ELA gains as a result of the turnaround. As Panel B of Appendix Figure A1 shows, non-FLNE students appear to have made little progress in ELA. The turnaround is clearly benefitting Lawrence's FLNE students, a population of particular concern to the district and to the wider education policy community.

We also explore heterogeneity in turnaround impacts by grade level. Figure 5 graphs math test scores over time by grade level. Panels A and B show sizable, sharp rises in math scores for Lawrence elementary school and middle school students, so much so that the district has closed the achievement gap with other low-income districts. Panel C shows some evidence of gains in high school, though not nearly enough to close massive achievement gaps relative to other low-income districts. Table 4 shows estimates of these impacts using our school-by-grade fixed effects Model 1. Student fixed effects models do not allow us to explore heterogeneity by a fixed grade level, which changes each year for most students. However, we run a version of Model 1 in which we include lagged math and ELA test scores and attendance to account for potential preexisting achievement differences. Model 1's results in the first column match the figures closely, showing gains across all grade levels but particularly large gains in middle school. Controlling for lagged achievement and attendance measures makes the gains appear more evenly distributed across grade levels. Estimated impacts on ELA by grade level, as seen in Appendix Figure A2, available in the online version of the journal, and the last column of Table 4, show little clear and consistent heterogeneity.

Acceleration Academies

Acceleration Academies Modeling. To examine possible differences in achievement gains depending on whether Lawrence students participated in an Acceleration Academy, we rely on a modified version of Model 2. The resulting Model 3, a student fixed effects model, is as follows:

$$\begin{aligned} Y_{isgy} = {} & \beta_0 + \beta_1 LPS_{isgy} \times 2013_y \\ & \times AAMATH_{isgy} + \\ & \beta_2 LPS_{isgy} \times 2013_y \times \\ & AAELA_{isgy} + \beta_3 LPS_{isgy} \times \\ & 2013_y + \delta_{sg} + \gamma_{gy} + \theta_i + \varepsilon_{igt}. \end{aligned} \tag{3}$$

This model includes 2 three-way interaction terms to indicate whether student *i* participated in an Acceleration Academy in a particular subject and year. Therefore, β_1 is an estimate of the difference in academic achievement between Lawrence students who were and were not chosen to participate in a math Acceleration Academy in 2013. Here, the interaction between the *LPS* and *2013* indicators allows us to isolate the effect of the rest of the turnaround bundle in year one. We again include school-by-grade and grade-by-year fixed effects. Student fixed effects allow us to control for all nontime-varying observed and unobserved student characteristics,

TABLE 3

Turnaround Effect on Test Scores, by First Language Status

	Math		ELA	
	(1)	(2)	(1)	(2)
2013 non-FLNE	.130** (.043)	.103* (.041)	−.067^ (.039)	−.076* (.030)
2013 FLNE	.196** (.042)	.198** (.041)	.007 (.041)	.029 (.022)
Number of students	271,113	182,355	271,841	182,337
2014 non-FLNE	.210** (.048)	.171** (.049)	−.066 (.046)	−.057^ (.034)
2014 FLNE	.286** (.048)	.317** (.044)	.049 (.049)	.100** (.038)
Number of students	290,932	179,328	291,604	179,339
Demographic controls	x		x	
Student fixed effects		x		x

Note. Standard errors are clustered at the school level. All estimates come from a regression of the listed outcome on 2 three-way interactions between the year, an indicator for enrollment in the Lawrence Public Schools, and an indicator for FLNE status. All models include grade-by-year and school-by-grade fixed effects. The sample for the 2013 estimates excludes 2014 observations and 2014 estimates exclude 2013 observations. All samples include only students in districts outside of Lawrence that were majority low income in 2008. ELA = English Language Arts; FLNE = First Language Not English.
^$p < .10$. *$p < .05$. **$p < .01$.

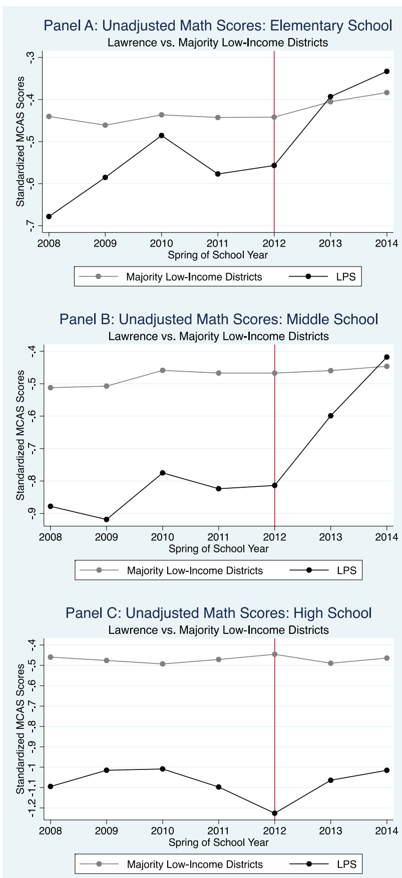

FIGURE 5. *Mean math MCAS scores by grade level.*
Note. MCAS = Massachusetts Comprehensive Assessment System.

which is necessary given that students were likely selected into Acceleration Academy participation based on unobserved criteria. Again, we exclude 2014 data when estimating the first-year effects. We run a separate version of Model 3 in which we include 2014 data but omit 2013 data to compare the second year of Acceleration Academies to the preturnaround period.

Finally, we modify Model 3 to explore the extent to which the achievement differences between Acceleration Academy participants and nonparticipants persisted beyond the year of the intervention. We refer to this model as Model 4, which takes the following form:

$$\begin{aligned} Y_{isgy} = {} & \beta_0 + \beta_1 LPS_{isgy} \times 2013_y \times \\ & AAMATH_{isgy} + \beta_2 LPS_{isgy} \times \\ & 2013_y \times AAELA_{isgy} + \beta_3 LPS_{isgy} \times \\ & 2014_y + \delta_{sg} + \gamma_{gy} + \theta_i + \varepsilon_{igt}. \end{aligned} \quad (4)$$

There are two differences between Models 3 and 4. First, we run Model 4 excluding 2013 data to estimate the relationship between 2013 Acceleration Academy participation and 2014 achievement. Second, we replace the interaction between the *LPS* and *2013* indicators with an interaction between an *LPS* and *2014* indicator to isolate the 2013 Acceleration Academy effects from the effects of the non-Acceleration Academy components of the turnaround in year two.

TABLE 4

Turnaround Effect on Test Scores, by Grade Level

	Math		ELA	
	(1)	(2)	(1)	(2)
2013 elementary	.129* (.051)	.163** (.035)	−.055 (.043)	−.024 (.036)
2013 middle	.251** (.057)	.184** (.044)	.062 (.054)	.008 (.029)
2013 high	.113 (.078)	.247** (.079)	−.110 (.131)	.093* (.045)
Number of students	271,113	219,962	271,841	220,589
2014 elementary	.141** (.051)	.077 (.053)	−.082^ (.050)	−.002 (.043)
2014 middle	.421** (.043)	.236** (.045)	.146** (.044)	.037 (.031)
2014 high	.180* (.086)	.198^ (.099)	−.047 (.152)	.039 (.042)
Number of students	290,932	238,029	291,604	238,642
Lagged scores and attendance		x		x

Note. Standard errors are clustered at the school level. All estimates come from a regression of the listed outcome on 3 three-way interactions between the year, an indicator for enrollment in the Lawrence Public Schools, and an indicator for grade level (elementary = Grade <6; middle = Grades 6–8; high = Grade 10). All models include school-by-grade and grade-by-year fixed effects and demographic controls. The sample for the 2013 estimates excludes 2014 observations and 2014 estimates exclude 2013 observations. All samples include only students in districts outside of Lawrence that were majority low income in 2008. ELA = English Language Arts.

$^\wedge p < .10$. $^*p < .05$. $^{**}p < .01$.

Acceleration Academy Findings. We first explore the unadjusted achievement trends for Lawrence Acceleration Academy participants compared to nonparticipants within and outside of Lawrence. Figure 6 displays MCAS scores for 2013 Academy participants and nonparticipants, with the LPS sample limited to those in LPS at some point in the postturnaround period. Panel A illustrates that prior to the Acceleration Academies, participants outperformed nonparticipants in Lawrence by roughly 0.1 standard deviations. However, participants were still behind other Massachusetts students by about 0.2 standard deviations and their achievement trend leading up to the Academy seems to roughly track that of Lawrence nonparticipants. Although participants appear to underperform nonparticipants in 2008, this is due partly to the fact that relatively few students observed in Academies were present in LPS that far back in time. In 2013, the first year of the Acceleration Academies, participants appear to have caught up to, if not surpassed, students in other majority low-income districts in Massachusetts. Specifically, their math scores rose by about 0.3 standard deviations relative to the rest of the state whereas nonparticipants' math scores rose by a smaller, but still substantial 0.2 standard deviations. In 2014, gains appear to continue for both groups, with gains for participants somewhat larger than for nonparticipants.

Table 5 displays estimates generated by our student fixed effects models. Estimates in the first column, generated using Model 3, suggest that nonparticipants' 2013 math scores rose by 0.15 standard deviations, whereas Acceleration Academy participants' scores rose by an additional 0.16 standard deviations, for a total first-year improvement of 0.31 standard deviations. In the second column, we present estimates based on Model 4 in which we predict 2014 outcomes based on 2013 Academy participation and include an indicator for 2014 turnaround implementation. These estimates suggest that roughly a quarter of the 2013 Acceleration Academy effect faded out by 2014, although overall turnaround effects continued to increase. LPS students who did not participate in the 2013 math Acceleration Academy thus showed substantial gains over the first 2 years of the turnaround but those who did participate showed even larger gains.

The story is somewhat different for reading achievement. As Panel B of Figure 6 shows, participants in 2013 ELA Acceleration Academies

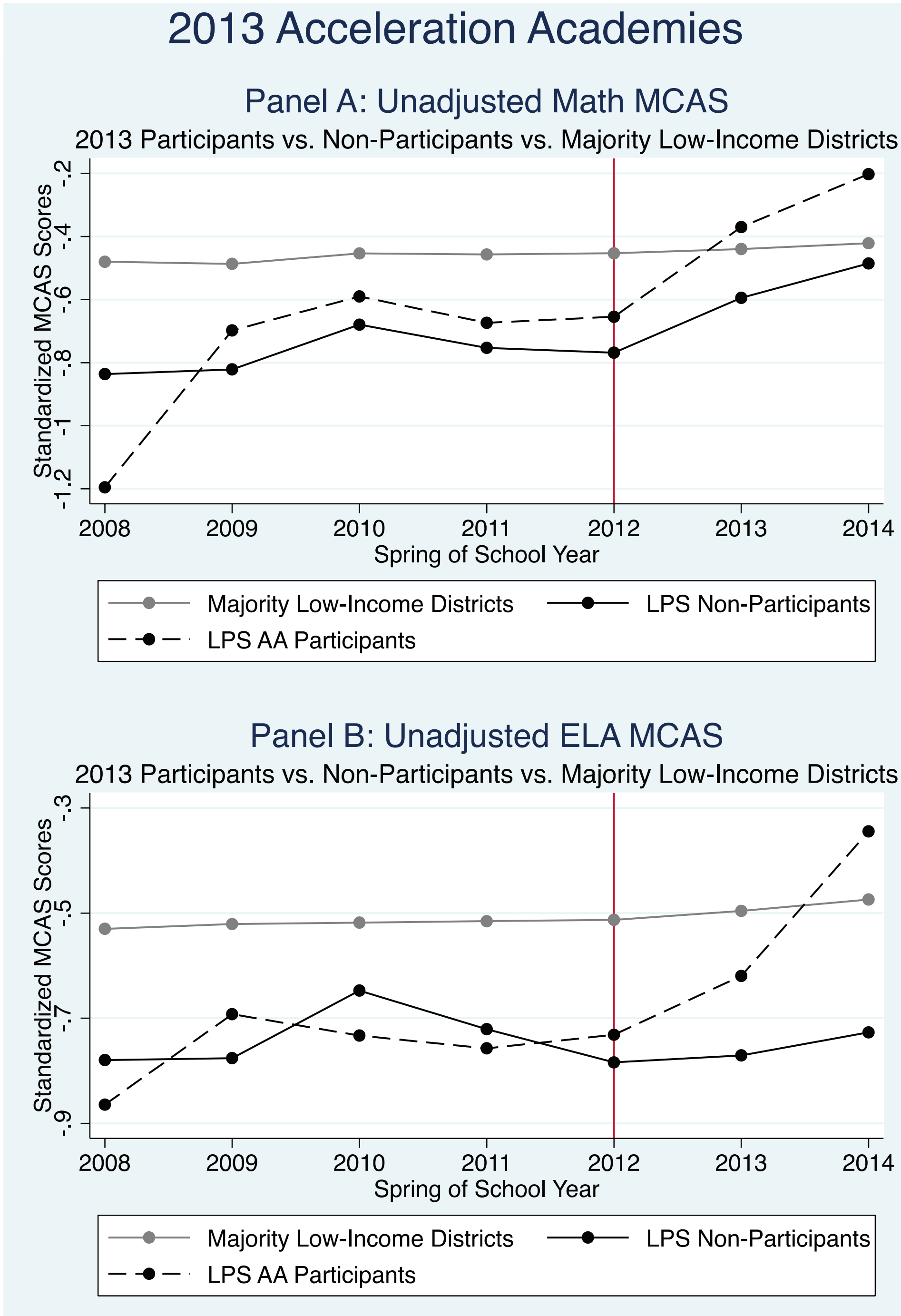

FIGURE 6. *Mean MCAS scores by 2013 Acceleration Academy participation.*
Note. MCAS = Massachusetts Comprehensive Assessment System.

TABLE 5

Acceleration Academy Participation Effect on Test Scores

	Math		ELA	
	2013	2014	2013	2014
2013 Math Acceleration Academy	.161** (.040)	.124* (.057)	.051* (.022)	.124** (.042)
2013 ELA Acceleration Academy	.058* (.027)	.066 (.042)	.108** (.033)	.068 (.064)
Rest of Lawrence turnaround	.145** (.042)	.267** (.046)	−.018 (.024)	.047 (.037)
Number of students	182,355	179,328	182,337	179,339
2014 Math Acceleration Academy		.168** (9.023)		.105** (.037)
2014 ELA Acceleration Academy		.115** (.023)		.169** (.020)
Rest of Lawrence turnaround		.196** (.042)		−.022 (.038)
Number of students		179,328		179,339

Note. Standard errors are clustered at the school level. All estimates come from a regression of the listed outcome on 2 three-way interactions between the year, an indicator for enrollment in the Lawrence Public Schools, and an indicator for participation in an Acceleration Academy by subject, as well as a two-way interaction between the year and enrollment in the Lawrence Public Schools. All models include grade-by-year, school-by-grade, and student fixed effects. The sample for the 2013 estimates excludes 2014 observations and 2014 estimates exclude 2013 observations. All samples include only students in districts outside of Lawrence that were majority low income in 2008. ELA = English Language Arts.
$^{\wedge}p < .10$. $^{*}p < .05$. $^{**}p < .01$.

look generally similar in achievement to nonparticipants prior to the turnaround. In the first 2 years of the turnaround, nonparticipants show little or no gains in ELA achievement, whereas participants show clear gains that are even larger in 2014. Regression estimates in the third column of Table 5 suggest that nonparticipants slightly lost ground but this effect is small, nonsignificant, and somewhat sensitive to the choice of preperiod. Academy participants gained about 0.11 standard deviations relative to those nonparticipants, for an overall first-year gain of 0.09 standard deviations. The fourth column, based on Model 4, suggests that about half of these gains for participants persisted into 2014. Our estimates of the persistence of 2013 Academy effects are similar when controlling for 2014 Academy participation and after excluding all 2014 Academy participants from our sample, suggesting that the relationship between 2013 Academy participation and 2014 outcomes is not driven by 2014 Academy participation.

We note here that our estimates of the effects of the 2013 Acceleration Academies could in theory be biased by differential selection into participation, hence our inclusion of student fixed effects. One indication that such controls are sufficient to largely eliminate bias in our estimates is the fact that we observe clear positive impacts of each Acceleration Academy on its own subject and only very small effects of each Academy on the other subject. If differential selection were an issue here, we would expect to see similar impacts of a given Academy across both subjects. However, we recognize that students could have been nominated based on their propensity for growth in a single subject and therefore are not able to rule out differential selection entirely.

There are two central takeaways from these figures and tables. First, Acceleration Academies appear to have had large positive impacts on achievement in the subjects they focused on. Second, the other components of the LPS turnaround had large positive impacts in math but no impact in ELA. As a result, any positive impacts in ELA appear to be driven largely by Acceleration Academies, whereas improvements in math are generated both by the Academies and by other district initiatives.

We repeat this analysis for the 2014 Acceleration Academies in the bottom Panel of Table 5, with corresponding figures in Appendix Figure A1, available in the online version of the journal. We estimate the 2014 effects using a version of Model 3 in which we omit 2013 observations. Estimating these impacts is complicated by the fact that 2014 participation status may be correlated with 2013 participation status and other unobservable shocks to students in 2013. We therefore present these estimates but are somewhat less confident in their causal interpretation. We present them in part because LPS doubled the number of students participating, so that these estimates provide suggestive evidence about the potential scalability of this intervention.

Participation in the 2014 math Acceleration Academy appears to boost 2014 math scores by 0.17 standard deviations relative to the 0.20 standard deviation gain of nonparticipants, for an overall gain of 0.36 standard deviations. Participation in the 2014 ELA Acceleration Academy also appears to boost math achievement by an additional 0.12 standard deviations, a moderate effect that could be spuriously driven by selection bias or could represent true spillovers from the ELA preparation that precedes the math test in time. As such, we find the estimated impacts of the 2014 math Acceleration Academy on math scores to be plausible. Oddly, both math and ELA Acceleration Academies appear to boost ELA scores in 2014 by 0.11 and 0.17 standard deviations, respectively. Given that ELA testing preceded math Acceleration Academies in time, this suggests that at least some fraction of these estimated effects is driven by selection bias. As such, we put less stock in these ELA achievement gain estimates.

The bulk of the evidence thus suggests that Acceleration Academies were an important component of LPS' turnaround success. Though selection issues likely create some bias in our estimates, results from 2014 are suggestive that the positive Acceleration Academy impacts may be scalable to a wider range of students than LPS selected in its first year of the turnaround.

Impacts on Other Academic Outcomes

We also look for possible turnaround effects on additional outcomes of interest, but find little evidence of impact. Figure 7 shows the unadjusted days of school attendance by year for Lawrence students compared with students in other majority low-income districts. Interestingly, student attendance shows a large jump in the year prior to the turnaround. However, there is no visual evidence of major differences between Lawrence and comparison districts in the post-turnaround period. Nevertheless, we utilize Model 2, our student fixed effects model, to estimate the turnaround effect on attendance. In Table 6 we report that Lawrence students under

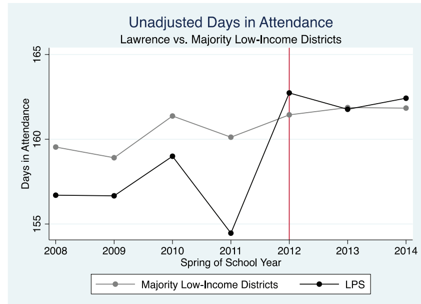

FIGURE 7. *Overall mean days in attendance.*

the turnaround appeared to gain between 3 and 4 days in school compared with comparison students. However, the Lawrence break from trend in 2012, prior to the turnaround, complicates our ability to interpret this coefficient.

Similarly, in Panel A of Figure 8, we show that overall grade progression in Lawrence does not appear to break from the upward trend in other low-income districts after turnaround implementation. We also examine student mobility. Figure 9 shows that the probability of remaining in the same district was already growing in Lawrence relative to other districts prior to the turnaround, and the magnitude of change in any given year was relatively small (never larger than 0.02 percentage points). This provides further evidence in support of our identifying assumption that students did not respond to the takeover announcement by transferring districts. We also test for whether the turnaround had an effect on whether a student enrolled in school would remain in school. Figure 10 shows that the probability of remaining enrolled seemed to have increased slightly in the year leading up to the turnaround, both overall and for the high school subsample shown in Panel B. In Figure 11, we display the percent of 12th-grade students who graduate, conditional on having progressed to 12th grade. There does not appear to be visual evidence of a shift in 12th-grade graduation in Lawrence over the first 2 years of the turnaround relative to comparison districts. In sum, we do not find convincing evidence that the turnaround appeared to have a positive or negative effect on any of the alternative academic outcomes we explored.

The one possible exception is grade progression among high school students. Panel B of Figure 9 shows that prior to the turnaround,

TABLE 6

Turnaround Effect on Nontest Score Outcomes

		Grade progression			Remain enrolled in school		Graduation
	Days in attendance	High school		Remain in district	High school		12th graders
	(2)	(2)	(1)	(2)	(2)	(1)	(1)
2013 turnaround	2.32** (.798)	.012 (.011)	.115** (.009)	.019* (.009)	.012^ (.006)	.039** (.011)	.080** (.018)
Number of students	319,923	327,783	200,107	311,803	327,783	200,107	100,392
Comparison mean	161.87	0.89	0.80	0.87	0.94	0.89	0.76
2014 turnaround	3.937** (.849)	.011 (.013)	.099** (.021)	.026* (.011)	.010 (.008)	.027^ (.015)	.047 (.043)
Number of students	317,546	325,084	220,234	309,074	325,084	220,234	101,775
Comparison mean	161.84	0.90	0.81	0.87	0.94	0.90	0.76
Demographic controls			x			x	x
Student fixed effects	x	x		x	x		

Note. Standard errors are clustered at the school level. All estimates come from a regression of the listed outcome on an interaction between the year and an indicator for enrollment in the Lawrence Public Schools. All models include school-by-grade and grade-by-year fixed effects. The sample for the 2013 estimates excludes 2014 observations and 2014 estimates exclude 2013 observations. All samples include only students in districts outside of Lawrence that were majority low income in 2008.
$^{\wedge}p < .10$. $^{*}p < .05$. $^{**}p < .01$.

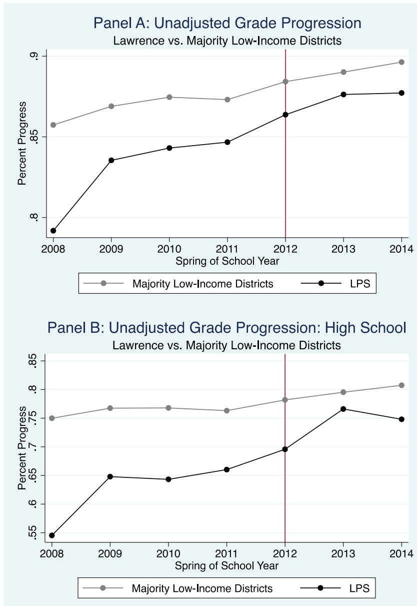

FIGURE 8. *Percent of students making grade progress, overall and among high school students.*

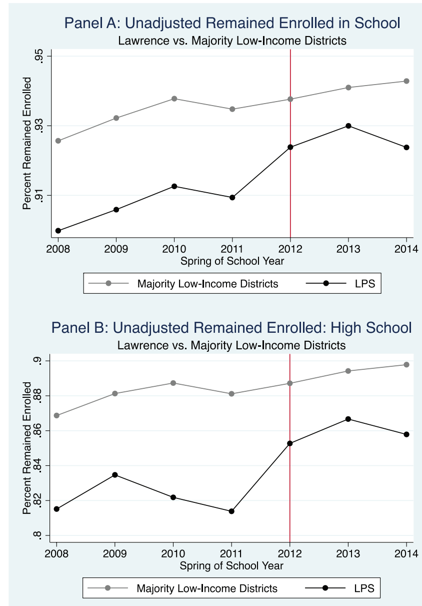

FIGURE 10. *Overall percent of students remaining enrolled in school.*

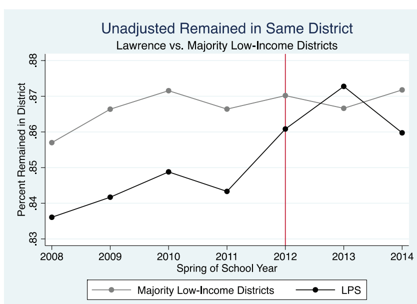

FIGURE 9. *Overall percent of students remaining in the same district.*

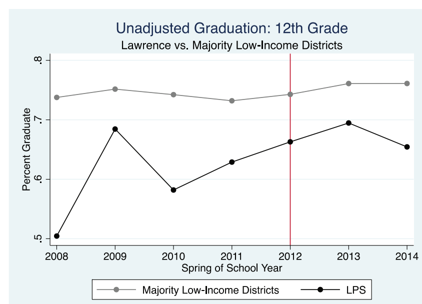

FIGURE 11. *Overall graduate rate among 12th-grade students.*

Lawrence high school students were less likely to progress to the next grade than students in comparison districts, by a magnitude of between 10 to 20 percentage points depending on the time point. In the 4 years leading up to the turnaround, the trend for Lawrence students appears to track the trend for non-Lawrence students. In 2013, the probability that Lawrence high school students progressed to the next grade increased by about 8 percentage points whereas the same figure increased by about 2 percentage points for comparison students. This probability dipped by about 2 percentage points for Lawrence students in year two of the turnaround, but they remained about 5 percentage points more likely to progress than they did in 2012. We report our estimate of the turnaround effect on grade progression with the high school sample in Table 6. These estimates are based on Model 1, our school-by-grade model, given we are unable to utilize student fixed effects with the high school sample alone. The first year of the turnaround appears to have

TABLE 7

Comparing Lawrence 2013 Turnaround Effect Magnitudes to Other Educational Interventions

Study authors				Fryer (2014)	Abdulkadiroğlu, Angrist, Hull, and Pathak (2014)	
Intervention	Acceleration Academies	Rest of turnaround	Total effect of Acceleration Academies and rest of turnaround	Injecting charter practices into traditional public schools	Grandfathering traditional public school students into charter schools	
Location	Lawrence			Houston	New Orleans	Boston
Math effects	.16 *SD*	.15 *SD*	.31 *SD*	.15 to .18 *SD*	0.21	0.32
ELA effects	.11 *SD*	−.02 *SD*	.09 *SD*	.02 *SD*	0.14	0.39

Note. Lawrence effects are based on 2013 estimates provided in Table 5. ELA = English Language Arts.

made Lawrence students about 12 percentage points more likely to progress to the next grade. By year two, this effect was reduced slightly to 10 percentage points. We further test our parallel trends assumption by estimating turnaround effects in prereceivership years and display the results in Panel C of Figure 3. We do find evidence that the likelihood of progressing from one grade to the next was already improving for Lawrence students relative to students in other majority low-income districts in the years leading up to the turnaround. However, the magnitude of the effects is larger in both of the postturnaround years than in any of the years prior to receivership. Therefore, we find suggestive evidence that the turnaround had a positive effect on Lawrence high school students' grade progression.

Discussion and Conclusion

Our findings illustrate that the state takeover and turnaround of the Lawrence Public Schools has demonstrated promising early results, particularly in terms of students' math achievement and among the district's large population of students with a first language other than English. Students exposed to the first 2 years of the turnaround appear to have made substantially larger math achievement gains than demographically similar students in other majority low-income school districts across Massachusetts. In ELA, we find some evidence of small positive effects by year two. We find suggestive evidence that the turnaround may have increased the probability that Lawrence high school students progress from one grade to the next and no evidence of slippage on any of the other outcomes we explored, including school attendance, overall grade progression, the likelihood of remaining enrolled in school, the likelihood of remaining in the same district, and graduation among 12th-grade students.

In both the first and second year of the turnaround, students who participated in Acceleration Academy programs over vacation breaks made larger gains in both ELA and math than did nonparticipants within and outside of Lawrence. In both years, math gains are larger among Academy participants, but the overall math effects cannot be fully explained by Academy participation. Gains in ELA are more fully concentrated among ELA Academy participants.

In year one, the combined average effect of Acceleration Academy participation plus the remaining bundle of turnaround reforms was 0.31 standard deviations in math and 0.09 standard deviations in reading. Table 7 puts the magnitude of these effects into context by comparing them to the size of the effects found in two other studies of related interventions. The combined effects of Acceleration Academy participation plus the rest of the Lawrence turnaround are larger than the effects of injecting high-performing charter school practices including high expectations, improved human capital, increased instructional time, high-dosage tutoring, and data-driven instruction, into low-performing, traditional public schools in Houston, Texas (Fryer, 2014). Lawrence effects are somewhat smaller in ELA but still comparable in both subjects to the effects of grandfathering traditional public school students into charter schools in New Orleans and Boston (Abdulkadiroğlu et al., 2014). It is also worth noting that, only 3% of Lawrence's 2013 test-takers were in schools and grades taken over by outside operators. Therefore, only a small fraction of the widespread achievement gains we observe in year one are attributable to such outside operators.

Based on our year one results alone, the Acceleration Academies seem especially effective, particularly given that they involve only 1 week of instruction. The district argues that participating students receive at least 25 hours of additional instruction in a given subject over a week, which adds up to more hours of instruction in a core subject than a student gets in a typical month of school. Our results are therefore consistent with findings from Cook et al. (2014), Fryer (2016), and Kraft (2015) that high-dosage tutoring appears to be a particularly effective form of intervention with struggling students. However, Acceleration Academies may provide a more scalable option given they involve a higher student–teacher ratio than typical high-dosage tutoring. LPS estimates that this program costs approximately $800 per student per week. The bulk of these funds go to teacher stipends, and the remainder pays for teacher professional development, student incentives, and student transportation. These Acceleration Academy programs might be a useful strategy for schools looking to improve the performance of struggling students in core content areas, regardless of whether or not their districts are pursuing an aggressive district-wide turnaround effort.

The large body of research showing that teacher quality accounts for a larger portion of the variation in student achievement than any other school-based factor, as well as Dee's (2012) and Strunk et al.'s (2016) findings that turnaround schools that adopted reform models compelling the most dramatic staff turnover produced the largest gains, may make it initially surprising that Lawrence achieved sizable gains while actively replacing no more than 10% of teachers in year one. However, Acceleration Academies could be thought of, in part, as a human capital intervention as teachers were selected based on merit.

At the same time, it is possible that Acceleration Academy participants differed on important unobserved dimensions that could explain, at least in part, their larger response to the turnaround reforms. For example, we cannot rule out the possibility that these students could have been targeted for other interventions in addition to Acceleration Academies throughout the turnaround period. If so, our estimates would overstate the Acceleration Academy effect and our estimate of the rest of the turnaround bundle would represent a lower bound on the impact of the other turnaround reforms. Given the potential utility and scalability of the Acceleration Academies, the field could benefit from new research that is able to more definitively estimate the program's causal effect.

It is also important to keep in mind that our results focus solely on the first 2 years of the turnaround. The Receiver made additional changes in the 2015 school year including piloting full-day Kindergarten for 4-year-olds, implementing a new teacher contract that mandates school-based teacher leadership teams (ERS, 2015), attempting to equalize funding between schools (ERS, 2015), and creating a district-wide family engagement office (LPS, 2013). Our focus on the early stages of the turnaround may also help to explain why we find larger effects on some outcomes than others. For instance, it may be easier to improve math scores in 1 to 2 years, but take longer to substantially move the needle on graduation rates.

We also find much larger effects in math than in reading, consistent with earlier research on the impact of implementing high-performing charter school practices in low-performing traditional public schools (Fryer, 2016) and of attending an oversubscribed charter school (Abdulkadiroğlu, Angrist, Dynarski, Kane, & Pathak, 2011; Angrist, Dynarski, Kane, Pathak, & Walters, 2010; Dobbie & Fryer, 2011; Gleason, Clark, Clark Tuttle, & Dwoyer, 2010; Hoxby & Murarka, 2009). A number of factors could explain this pattern. First, it may be that relative to math, reading outcomes are influenced more by the home environment than school-based interventions. Second, reading skills may take longer to develop than math skills, consistent with our finding of no overall ELA effects until after the turnaround's second year. Third, improved literacy might have spill-over effects on a student's ability to effectively complete math assessments, whereas the reverse is unlikely. Fourth, some observers have suggested that it is uniquely difficult to make short-term progress on reading achievement with a large population of English language learners. However, this theory is inconsistent with our finding that Lawrence's gains in reading were entirely concentrated among the district's FLNE students. Finally, it is possible that state math exams better capture growth than state reading assessments.

Finally, we see three major questions prompted by these results. First, can subsequent research further clarify which aspects of the turnaround efforts are responsible for the observed positive impacts? Second, will the short-term gains we observe be sustained over time and translate to longer-term outcomes such as college enrollment and persistence, particularly as the receivership is phased out and local control is reinstated? Third, to what extent can the successes in Lawrence be replicated in other districts, both in Massachusetts and the wider set of states developing tiered accountability systems? This last question is of particular importance given that the capacity of individual state departments of education and the characteristics of other districts' student populations may play a role in determining the generalizability of our findings. Despite these open questions, this study provides an encouraging proof point that accountability-driven improvement of chronically underperforming districts is indeed possible.

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