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Evidence That In-Service Professional Learning for Educational Leaders Matters

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Abstract

Educator leadership requires continuous development, including extended professional learning opportunities for principals in the field. This is also true for district leaders who likely have even fewer robust opportunities to grow professionally. We conducted a comparative interrupted time series of publicly available student achievement data from New Mexico to analyze the impact of a university-based organization that partners with district leaders to provide intensive professional learning opportunities for district leaders and school principals. We found positive impacts on student achievement in math and for English learners in English language arts. Implications for educator preparation and in-service programs are considered.

Keywords

leadership for school improvement, leadership program design, leadership program evaluation, principal preparation, superintendent preparation

Despite evidence that principal quality is the second most important within-school factor on student achievement (Grissom et al., 2021; Louis et al., 2010), demonstrating the importance of continued, in-the-field leadership development on student outcomes has been difficult. Although the relationship of principal leadership and student achievement has been frequently studied, the findings have been mixed. Some studies

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suggest that principal influence on students and their achievement is mostly indirect (e.g., Grissom et al., 2021; Hallinger & Heck, 1998), which can create statistical challenges to measuring the impact of principal professional development. However, such professional development has become necessary in the reform-driven educational policy landscape that has increasingly turned to principal leadership as an important lever for school improvement (Davis & Darling-Hammond, 2012).

Rapid policy changes over the past two decades, particularly around school improvement and accountability, have created complex school leadership environments. Principals are often tasked to engage in leadership that is a combination of both technical and adaptive and driven by external and internal pressures (Drago-Severson et al., 2014). Pre-service principal education and licensure programs have increasingly refocused their programing on leadership for school improvement with an explicit focus on improving opportunities and outcomes in marginalized communities (Reames, 2010). These objectives have led principal preparation programs to increasingly incorporate active learning and internship experiences that require developing principals to apply knowledge in context (Cosner et al., 2018; Fusarelli et al., 2019). Yet, it is also critical to recognize that leadership requires continuous development; thus, it is necessary to extend professional development once principals enter the field (Lochmiller, 2014).

Several best practices in leadership development have emerged as these principal preparation program redesigns have been evaluated, including the use of practical, problem-based, and high-quality field experiences and the use of cohorts that can serve as learning networks (Davis & Darling-Hammond, 2012). However, principal leadership for school improvement is highly contextualized and requires the creation of synergy between fiscal, material, human, and community resources (Louis et al., 2010), and these efforts likely need to be supported in-the-field and well beyond the completion of a principal's pre-service preparation (Drago-Severson et al., 2012). As such, the evaluation of education leadership in-service programs seems critically important for at least a few reasons, including the need to identify programs with proven success, demonstrate that leadership development matters broadly, and consider the adoption or adaptation of strategies embedded in the program widely.

In this study, we analyzed the impact of the University of Virginia's Partnership for Leaders in Education (PLE) on student achievement outcomes in English language arts (ELA) and math. In a previous evaluation of a small sample of Ohio schools, the program was shown to have statistically significant positive effects on student achievement in both subjects, impacts which persisted and grew in the 2 years subsequent to the completion of the program (Player & Katz, 2016). According to Herman et al.'s (2018) review of school leadership interventions, the program is one of only two "school leadership-focused school improvement models" (p. 26) to have impact evidence substantial enough to meet Tier I or II levels of evidence, as defined in the *Every Student Succeeds Act* (ESSA). The report authors characterized comprehensive school improvement models as inclusive of multidimensional activities focused on improving underperforming schools. These publications underscore the potential viability of the program to develop educational leaders in a space where little evidence currently exists.

Given the dearth of evidence that in-service education leadership programs broadly and PLE specifically impact student achievement outcomes, this evaluation on a pooled sample of 47 traditional elementary and middle public schools in New Mexico is a significant contribution in the area of leadership development. To determine program impact, we employed a comparative interrupted time series model—a strong quasi-experimental design (Shadish et al., 2002)—to determine if the PLE impacted student proficiency scores in ELA or math over time.

The results of this study are important as expectations for evidence of program impact continue to be central to federal policy such as ESSA. Moreover, there is considerable relevancy for education leader preparation programs to consider aspects of in-service leadership programs that might be incorporated into or conceptualized differently within pre-service programs. Given PLE's commitment to systems leadership, there might be additional possibilities for pre-service leadership programs to consider "managing up" and other systems leadership issues that extend beyond traditionally focusing on the nuts and bolts of leading school buildings.

The remainder of this paper proceeds as follows. In the next section, we briefly describe a theoretical framework of coherence that underscores how leadership across education system levels is critical to advancing key organizational elements for schools. Then, we highlight strands of research literature on the importance of school leadership and district effectiveness, culminating with a review of some literature emphasizing the significance of systems thinking in education. After that, we provide an overview of the PLE to show its prioritization of systems leadership advancement, especially in response to underperforming schools. We next detail the methods used to answer the research questions, followed by the reporting of our results. We close with a discussion in which we consider some implications for leadership education.

Theoretical Framework

The PLE is an in-service educational leadership program focused on school system change. Its mission statement, list of organizational beliefs, and value proposition communicate a clear belief that systems achieve the results that they do—for better or worse—due to how they have been and are currently designed (Deming, 2000). Relatedly, Fullan and Quinn (2016) approach systems and designs issues in terms of coherence, or "the shared depth of understanding about the nature of the work" (p. 1). Within their coherence framework, they identify the following four key elements: Focusing direction, cultivating collaborative cultures, deepening learning, and securing accountability. Collectively, these elements require clarity of purpose and goals, as well as strategizing in the pursuit of them. They entail collaborating and capacity building in advance of common commitments and aspirations. Educators must shift practices across levels. Throughout all of this, internal and external systems of accountability to measure, understand, and respond to performance—the performance of educators across levels—remain central. These significant, interwoven elements of coherence can only truly be advanced, however, if leadership across levels share a common approach and commitment to systems change.

Conceptually, what Fullan and Quinn (2016) argue is not new, but the consideration of coherence in education research appears most regularly in relation to understanding and aligning curriculum (e.g., Schmidt & Houang, 2012; Sullanmaa et al., 2019), as well as supporting instructional improvement (e.g., Cobb et al., 2018; Newmann et al., 2001). These are critical aspects of providing alignment across systems to produce equitable student learning opportunities, but the coherence conceptualized within such studies does not robustly account for the system or systems leaders broadly. In a recent essay, scholars argued that instructional coaches can lead toward greater system coherence by developing shared understandings, modeling practices, and brokering ideas (Woulfin & Rigby, 2017). Yet, managing relationships between district and school leaders remains understudied despite there not seeming to be "one best way" to improve educational systems (Johnson et al., 2015).

Thus, Fullan and Quinn (2016; Quinn & Fullan, 2017) frame coherence more broadly. According to them, educational leaders across levels build on shared beliefs and values in pursuit of common purposes. They recognize that leadership connects and integrates the elements of the framework in practice. Furthermore, they are learners first and co-learners always, working interactively amongst each other and with those they lead through joint determination. This approach to learning should be internalized and systematized to endure change. That is, educational leaders across levels work to understand and then extend understanding to others with a goal of themselves becoming dispensable. We turn now to highlight how research literature underscores how important leadership is in schools and districts to ensure students have equitable opportunities to learn.

Literature Review

We now briefly review three related strands of literature to situate this study. First, we highlight some central aspects of high-quality school leadership across contexts, concluding that as expectations of principals intensify (i.e., leading effective schools vs. leading turnaround schools) the importance of district leadership increases. Then, we relay some ways that research suggests effective districts support schools and their leaders, although perhaps without the level of differentiation necessary to move to achieve coherence across the system. We conclude by highlighting research on districts prioritizing their most underperforming schools.

School Leadership

Many of the fundamentals of high-quality school leadership have persisted for decades. In a relatively recent review of high-quality school leadership frameworks, Hitt and Tucker (2016) identified five domains (with a number of dimensions providing nuance within each domain): Establishing and conveying the mission and vision; building professional capacity; creating a supportive organization for learning; facilitating a high-quality learning experience for students; and connecting with external partners.

These fundamental aspects of leading schools effectively have been and continue to be critically important regardless of school context.

Preparing principals to do more than manage—to actually lead school improvement—has resulted in transitions over the last 20 years that have required considerable shifts in expectations of principals and how they are prepared. Shared instructional leadership practices (Marks & Printy, 2003) necessitate the development of principals who can engage collaboratively with teachers to advance curriculum, instruction, and assessment in culturally relevant ways (Khalifa et al., 2016). They are now routinely expected to motivate and inspire teachers, students, and community (Ishimaru, 2020). To sustain school improvement, principals need to be able to develop leadership teams (Chrispeels et al., 2000), build collective capacities (Fancera & Bliss, 2011), and distribute leadership strategically (Spillane et al., 2001).

Recent policy initiatives have intensified what is expected of principals, however, especially in schools identified as underperforming (Murphy, 2009). The expectation for principals to lead rapid improvement, often defined as dramatic gains in test scores (e.g., Strunk, Marsh, Hashim, et al., 2016), has only intensified pressures. Despite calls stating that principals cannot enact sustained turnaround alone (Schueler, 2019), evidence in many districts suggest that principals in such contexts are, for the most part, on an island (Duke & Salmonowicz, 2010). State level support for in-the-field principals is also lacking even after federal Title II dollars for continued leadership development were made available under ESSA. An examination of state plans for these dollars found that no states had plans for developing veteran principals or leaders; only 10 states had plans to invest in developing assistant principals, and 21 states planned to invest in induction programs for new principals (DeVoto & Reedy, 2021). The lack of broad policy commitment to principal support and leadership development across states indicates that much of this support may need to be enacted at the district level as part of district effectiveness initiatives.

District Effectiveness

Research on effective districts has often focused on how they establish vision and policy for schools, determine curriculums, establish data infrastructure, and ensure professional development opportunities for principals and teachers (Anderson et al., 2010). They establish districtwide focus on quality instruction (Anderson, 2006), invest in developing instructional leaders (Leithwood, 2010), and ensure contextually and developmentally appropriate professional learning opportunities (Honig et al., 2010). Effective districts reduce bureaucratic structures to facilitate equitable distribution of resources and supports to schools (Honig, 2012). In large urban districts, principal supervisors are developed to coach principals into becoming better instructional leaders (Thessin, 2019). Many of the roles district leaders now play required shifts in ways analogous to those of the modern school principal, from management to leadership (Waters & Marzano, 2006). Researchers, policymakers, and practitioners increasingly contend that the nation's most underperforming schools can sustain improved performance only if district leaders commit to prioritizing them for the long haul (Zavadsky, 2012).

Systems Support and Prioritization

Fullan (2006) has argued that systems change requires commitment at all levels, and recent policy evaluations of district-level turnaround initiatives suggest there is merit to his point (Schueler, 2019; Strunk, Marsh, Hashim, et al., 2016). The Massachusetts Department of Elementary and Secondary Education recently took over districts, resulting in significant increases in student math and reading scores (LiCalsi et al., 2015; Papay, 2017). Studies of one of the districts taken over by the state noted an overarching emphasis on higher expectations, autonomy and accountability, learning time, data use, and human capital (Schueler et al., 2017). District leaders tended to differentiate relationships and interactions by school, diversify school management, make strategic staffing decisions, and minimize disruptions (Schueler, 2019).

These and other similar policy initiatives requiring transformation at the district level demonstrate that systems change can matter for underperforming schools. Yet, policy evaluations are seldom designed to dive deeply into the black box to explain which mechanisms resulted in achievement gains and those gains are typically reported in the aggregate, potentially indicating overall increases in the district but not necessarily substantial gains the underperforming schools themselves. Moreover, many studies of district-level systems change occur in large, urban settings (e.g., Los Angeles; Strunk, Marsh, Hashim, et al., 2016) with exceptional contexts (e.g., New Orleans; Harris & Larsen, 2016), complicating how we might transfer lessons more broadly. This literature mostly conveys that district-level initiatives to prioritize underperforming schools can be effective, but the details about how to actualize change are scant.

Studies of district change initiatives shed some light on how district leaders have attempted to build coherence for the system in service of underperforming schools. For example, Meyers (2020a, 2020b) conducted a case study of one district that had initial success prioritizing its most underperforming schools while partnering with PLE. With state takeover of the schools impending, district leaders took strategic action. They convinced a racially split schoolboard to alter historic patterns of resource and support distribution by providing underperforming schools with more. The underperforming schools were made into a zone within the district to increase autonomy, flexibility, and access to district leaders, including a principal supervisor dedicated only to those schools while also seated on the district cabinet. Principal and teacher talent were prioritized in terms of hiring and development, including coaching and comprehensive instructional development programing. In sum, leaders established a vision about how they could prioritize the district's most underperforming schools and worked relentlessly to reshape system operations. Although only one example, it seems as though motivated district leaders can tailor responses based on school context and school leader capacities (Yatsko et al., 2012).

Program Overview

PLE describes its core program as a multi-year commitment that leverages research-based practices to strengthen both district and school leadership capacities by collaborating with superintendents, other district leaders, and school principals to re-examine their system to establish and develop conditions for sustainable, scalable improvements. In Year 0, PLE engages system leaders to identify the district's critical needs and highest-leverage opportunities. Then, with district leaders, PLE identifies long- and short-term strategies to address district-specific challenges, outline sustainable change, and prepare for a learning lab of partner schools. In Year 1, school and district leaders work collaboratively and with PLE to determine collective purpose, understand principles of change management, determine leadership commitments across levels, and increase leadership coaching and support for the lab schools, which are typically the most underperforming schools in the district. In Year 2, school and district leaders adapt their leadership approaches by iterating and innovating on the foundations of the previous year, spreading organizational learning, and building a community of leaders across levels.

The PLE focuses on two components critical to rapid school transformation: (a) district capacity and conditions necessary to initiate, support, and enhance transformational change; and (b) high-impact leadership at the school level that develops a change vision and acts with urgency to move the school toward achieving it. To do this, PLE engages district leaders in Year 0 in multiple meetings about crafting vision and scope of work, 4 days of professional learning on system design, at least one on-site support visit, and continuous on- and off-site collaborations to shape strategy. In Year 1, district and school leaders participate in 1 week of summer learning about change leadership and addressing root cause challenges; 3 days of winter learning to begin adaptations learned from the first semester; and at least four on-site support visits tailored to district focus areas and district and school leaders' learner needs, as well as one summit for principal supervisors to develop coaching and coaching opportunities. In Year 2, district and school leaders participate in 3 days of summer learning taking stock of the previous year's work and making adjustments; 3 days of winter learning to innovate on successes; and at least three on-site support visits tailored to district focus areas and district and school leaders' learner needs, as well as one summit for principal supervisors.

Unlike other educational leadership programs, PLE sets the professional learning at the systems level for district leaders (with principals) to establish and build on conditions critical to widespread transformation. See Table 1 for a brief description of the conditions the program endorses. The focus on conditions at the district level changes the professional learning paradigm for educational leaders in at least three substantive ways. First, it identifies district leaders as the source of change and requires their commitment and growth. This is critical because evidence suggests district leaders sometimes do not hold themselves accountable for school-level results (Peck & Reitzug, 2014). Second, it establishes that district-level change and improvement drives what happens in schools. Third, it necessitates that district leaders and principals learn

Table 1. Definitions of PLE District Conditions to Transform Schools.

Lever	Condition	Definition
System leadership	Systems for bold change and transformation	System leaders—including district executive cabinet, school board members and central office—establish the bandwidth to rapidly advance bold change by (1) prioritizing organizational transformation and equity, and (2) focusing on improving outcomes for each and every student.
	Integrated strategies to enable learning focus for every student	System leaders promote student success by collectively identifying and co-creating with schools ways to (1) identify and secure supports, (2) coordinate and deliver supports to enhance conditions for students to learn, and (3) facilitate equitable distribution of resources.*
Support and accountability	Structures for support and accountability	The district establishes a support and accountability framework (defined and adaptive structures with responsiveness, differentiation, and coordination) to advance the work of principals and school leadership teams.*
	Supervision and development that strengthens school leaders	District leaders establish an intensive yet adaptive supervision and professional learning approach for school leaders that tailors to individual needs, reflects overall needs, and grows leadership competencies and practice.*
	Tight/loose defined principal autonomy	District leaders define autonomy for priority school principals that empowers principals to (1) drive transformation in their particular schools while also (2) balancing the bounds of the district's structures and expectations.*
	Action planning strategy	District leaders provide ongoing support in the development and execution of short-cycle plans that (1) leverages data to identify the most significant organizational challenges, (2) articulates a clear path forward, (3) actively monitors progress, and (4) continuously learns and reflects to adjust.*

(continued)

Table 1. (continued)

Lever	Condition	Definition
Talent management	Systems to attract, hire, place, and onboard school leaders	District leaders implement intentional, rigorous, and prioritized key practices for hiring, placing, and onboarding school leaders in high-priority schools.
	Systems to attract, hire, and retain teachers and staff	District leaders advance conditions to increase the number and impact of effective teachers and instructional staff in high-priority schools through recruitment, placement, and retention.
	Strategy to develop transformative teachers	District leaders (1) develop teachers in high-priority schools and then (2) hold them accountable for instructional performance using key practices.
Instructional infrastructure	Assessment strategy	District leaders ensure a rigorous assessment strategy, including components to (1) understand learning against standards throughout the year and then (2) leverage multiple points of data to shape instruction.
	Curriculum strategy	District leaders provide a coherent, detailed, and high-quality K-12 scope and sequence of learning objectives and resources aligned to standards. District leaders facilitate teachers' understanding of standards and guide their planning.*
	Data-informed collaboration and planning strategy	District leaders ensure high-quality, data-driven collaboration, coaching, and culture intended to prepare teachers to meet student learning needs.*
	Instructional monitoring and support strategy	District leaders establish data-driven monitoring and systems to promote the hallmarks of high-quality instruction and support continuous development of instructional leadership.

Note. *indicates that the definition is abbreviated.

together and collaborate on how schools will be improved. Collectively, district and school leaders increase their capacity to lead change while engaging in leading change.

Method

In this study, we used a quasi-experimental design with a comparison group interrupted time series (CITS) quantitative analysis approach. Underperforming schools implementing the PLE program comprised the intervention group of this study. An intent-to-treat model was used in constructing the PLE intervention group where all schools enrolling students in grades 3 to 8 that partnered with PLE over the period of study were included regardless of whether they completed the partnership or experienced district leader or school principal turnover. A quasi-experimental design was appropriate given that randomized assignment of schools to the PLE was not possible. Rather, we utilized an interrupted time series to provide evidence of the effect of PLE implementation on overall school proficiency in math and ELA by examining a discontinuity in these proficiency measures before and after the initial PLE implementation year. For this study, we examined ELA and math proficiency trends for 4 years prior to the beginning of PLE implementation and 3 years following the initial implementation year. This time series design can be diagrammed as follows:

$$0_1 0_2 0_3 0_4 X 0_5 0_6 0_7$$

The major threats to internal validity of a single-group time series design are instrumentation, testing, and history. In this study, we minimized instrumentation and repeated testing effects by using state administered standardized assessments that address these issues as a part of their design each year. However, threats due to history could have been a potential problem. Thus, we added comparison schools that were identified through a propensity score matching approach in order to improve the internal validity with regards to the history threat (for a detailed explanation of this propensity score matching approach, see de la Torre et al., 2013). These comparison schools were similar in percentage of students proficient in ELA or math, trajectories in percent proficient, student demographics (e.g., school racial composition, percent English learners, percent free- and reduced-priced lunch, school level, and school locale). The addition of a comparison group improves the inferences that can be drawn about the effectiveness of a program or policy change using a quasi-experimental research design (Wong et al., 2015).

Site of Study and Sample

From 2010 through 2015, PLE began partnerships with 10 New Mexico districts, four of which partnered (or enlisted new schools) multiple times (see Table 2). In total, 47 elementary and middle schools participated in the partnership during the 6-year window, ranging from only one school in District A to 16 schools in District B. In Year 0,

Table 2. Sample of New Mexico District and School Partners of PLE.

Year of partnership	Generic district name	Number of PLE schools in the partnership
2010	District A	1
2011	District B	4
	District C	2
2012	District B	6
	District D	1
	District E	1
2013	District B	3
	District D	2
	District F	6
	District G	1
	District H	1
2014	District F	7
2015	District B	3
	District D	1
	District I	2
	District J	6
Totals	10 Districts	47

which is 0_4 in the time series design above, the district agreed to partner with PLE. At time Year 0, PLE school enrollments averaged 82% to 84% students eligible for free or reduced-priced lunch, 27% to 29% American Indian students, less than 1% Asian students, 56% to 57% Hispanic students, 1% Black students, 14% to 15% White students, and 32% to 33% English Language Learners (ELL). All schools had been identified by the state as in need of turnaround, which was the impetus for districts to partner with PLE.

Proficiency data for both subjects, as well as student demographic percentages, were retrieved from the Public Education Department (PED) of New Mexico.[1] Relevant years of data files for this study were from 2007 through 2018. Data reporting formats varied by year, but the number of students tested in total and by demographics and proficiency data disaggregated by student demographics were always present. Thus, we could always calculate overall percent proficient, as well as percent proficient by student demographics, for each school for students in grades 3 to 8. Organizational data (e.g., school locale) were retrieved from the National Center for Education Statistics (NCES)[2] and matched to the year of assessment by school code. At the time of data collection, NCES had not posted data for 2018. Changes from year to year were minimal for organizational variables, so 2017 NCES data were used for 2018 as well.

In 2014 to 2015, PED replaced the New Mexico Standards Based Assessment (NMSBA) with the Partnership for Assessment of Readiness for College and Careers

(PARCC), developed in alignment with Common Core State Standards. Although content between the two assessments appears relatively consistent, PED claimed that PARCC would be more rigorous.[3] Regardless, scales changed. To account for this change in tests, we standardized all assessment results to *z*-scores so test results would be comparable over time (de la Torre et al., 2013).

For each school, the 3 years of data preceding Year 0 were used for trend trajectory and prior achievement before partnering with PLE. Year 0 was the year the district began its partnership and work with PLE. About 3 years of post-PLE implementation data were also collected, although Year 1 and Year 2 data were from spring assessments while schools were still in the partnership (i.e., Year 2 testing would have been conducted before a school's partnership with PLE ended). Year 3 was nearly one full academic year removed from the partnership.

Identification of comparison schools. We conducted propensity score matching to identify comparison schools. Matching was conducted separately for each cohort of PLE schools. The matching process was also conducted separately by subject. All variables included in the CITS were used for the matching process, limited to the first 3 years of comparison (i.e., prior to the district partnering with PLE). We also blocked matching by grades enrolled, so an elementary school could only match to an elementary school and so on. Matching was also limited to schools that did not partner with PLE during the range of years included in this analysis. After conducting propensity score matching, we plotted and compared achievement trends of the PLE school prior to partnership with the closest three to five matched schools. We did this to ensure that the treatment and control school trajectories were comparable. In cases where achievement trajectories prior to treatment were not comparable, we rejected the match until we reached the closest match that did have an achievement trajectory comparable to the PLE school prior to treatment. The similarity in pre-PLE ELA and math proficiency trajectories was further confirmed in the CITS models through a non-significant interaction effect between PLE school participation and the pre-PLE slopes of ELA and math proficiency (see Model 2 in Tables 4 and 5).

Finally, we utilized independent sample *t*-tests to assess differences in demographics and ELA and math proficiency between PLE and comparison schools in the year immediately preceding PLE implementation (0_4). There were no significant differences in percent enrollment of students receiving free and/or reduced lunch, students identified as ELL, Black students, Hispanic students, American Indian students, or White students between PLE schools and comparison schools selected for math CITS models. There was a significant difference between math comparison schools and PLE schools in percent Asian student enrollment, although mean Asian student enrollment in both PLE and comparison schools was 1% or less (see Table 3). When examining differences in demographics and ELA achievement in the initial year between PLE and comparison schools, we found no significant differences in percent enrollment of students receiving free and/or reduced lunch, students classified as ELL, enrollment by student race/ethnicity, or standardized ELA proficiency (see Table 3).

Table 3. Comparison of Initial Year Covariate Descriptive Statistics Between PLE and Comparison Group Schools for Time Series Models.

		Mathematics				English/language arts			
	PLE or comparison	*N*	Mean	*SD*	*t*	*N*	Mean	*SD*	*t*
Free/reduced lunch percent	Comparison	47	0.85	0.17	−1.06	47	0.87	0.17	−0.57
	PLE	47	0.89	0.15		47	0.89	0.15	
American Indian student percent	Comparison	47	0.25	0.37	−0.37	47	0.23	0.38	−0.55
	PLE	47	0.28	0.40		47	0.28	0.40	
Asian student percent	Comparison	47	0.01	0.01	2.95**	47	0.01	0.01	2.04*
	PLE	47	0.00	0.00		47	0.00	0.00	
Hispanic student percent	Comparison	47	0.60	0.33	0.33	47	0.63	0.34	0.81
	PLE	47	0.58	0.35		47	0.58	0.35	
Black student percent	Comparison	47	0.01	0.01	−0.88	47	0.01	0.01	−0.73
	PLE	47	0.01	0.01		47	0.01	0.01	
White student percent	Comparison	47	0.14	0.13	0.15	47	0.12	0.12	−0.56
	PLE	47	0.13	0.13		47	0.13	0.13	
ELL student percent	Comparison	47	0.22	0.14	−0.97	47	0.25	0.15	0.05
	PLE	45	0.25	0.15		45	0.25	0.15	
Standardized percent proficiency	Comparison	47	−0.06	0.77	1.76	47	−0.28	0.85	1.10
	PLE	47	−0.33	0.72		47	−0.47	0.82	

Data Analysis

We conducted a time series analysis using the mixed models in SPSS to examine a piecewise growth model of PLE schools' ELA and math proficiency before and following program implementation. This piecewise approach allowed us to determine if there was a discontinuity or change in growth slopes of ELA and math proficiency between the periods before and after PLE implementation. Using a null model, we compared scaled identity, first-order autoregressive, heterogeneous autoregressive, and autoregressive moving average covariance structures for the level one model which describes the within schools change in ELA and math proficiency (equation (1)). We selected a first-order autoregressive covariance structure for the repeated measures, or level one, model based on AIC, BIC, and −2 log likelihood criteria. The level one model has an intercept that represents the initial ELA and math proficiency intercept (π_{0i}) for a school (i) and the growth slopes of the years prior to implementation (π_{1i} PLE0) and the growth slopes of the years after initiation (π_{2i} PLE1) with errors in estimation of these growth slopes (ε). At level one for school i at time t, we used the following model (Model 1):

$$ELA\,/\,Math_{ti} = \pi_{0i} + \pi_{1i}\text{PLE0}_{ti} + \pi_{2i}\ \text{PLE0}_{ti} + \varepsilon_{ti} \tag{1}$$

We utilized a scaled identity covariance structure for the level two model which represents the between schools variation. In this level two model, the initial intercept (π_{0i}) can now be represented as $\beta_{00} + \mu_{0i}$ where μ_{0i} represents a random initial status intercept; the pre-PLE and post-PLE intercepts between schools can be represented as β_{10} and β_{20}, respectively. Substitution of these between schools values into equation (1) gives the combined level one and level two equation as:

$$ELA\,/\,Math_{ti} = \beta_{00i} + \beta_{10i}\text{PLE0}_{ti} + \beta_{20i}\text{PLE1}_{ti} + \mu_{0i} + \varepsilon_{ti} \tag{2}$$

Stepwise final models include a PLE or comparison school variable (PLESCHOOL) (Model 2) and school level demographic covariates (Model 3) (e.g., percent American Indian, Asian, etc.). Each of the variables and covariates was included in the intercept model (equation (3)) and nonrandomly varying slope model (equation (4)). The PLESCHOOL variable is shown as an example of this, but covariates (DEMO) would each be represented in a similar fashion:

$$\begin{aligned} ELA\,/\,Math_{ti} = {} & \beta_{00i} + \beta_{10i}\text{PLE0}_{ti} + \beta_{20i}\text{PLE1}_{ti} \\ & + \beta_{01}\text{PLESCHOOL}_{i} + \beta_{0n}\text{DEMO}_{i} + \mu_{0i} + \varepsilon_{ti} \end{aligned} \tag{3}$$

$$\begin{aligned} ELA\,/\,Math_{ti} = {} & \beta_{00i} + \beta_{10i}\text{PLE0}_{ti} + \beta_{20i}\text{PLE1}_{ti} + \beta_{01}\text{PLESCHOOL}_{i} \\ & + \beta_{11}\text{PLESCHOOL}_{i} + \beta_{21}\text{PLESCHOOL}_{i} \\ & + \beta_{1n}\text{DEMO}_{i} + \beta_{2n}\text{DEMO}_{i} + \mu_{1i} + \mu_{2i} + \mu_{0i} + \varepsilon_{ti} \end{aligned} \tag{4}$$

In a final model (Model 4), the nonrandomly varying slopes of standardized ELA and math achievement was compared pre- and post-PLE program implementation between PLE participating and comparison schools (PLESCHOOL) while also accounting for demographic covariates (DEMO). This was accomplished by adding an interaction term between these variables (PLESCHOOL*DEMO) as represented in equation (5).

$$\begin{aligned} ELA/Math_{ti} = {} & \beta_{00i} + \beta_{10i}\mathrm{PLE0}_{ti} + \beta_{20i}\mathrm{PLE1}_{ti} + \beta_{01}\mathrm{PLESCHOOL}_i \\ & + \beta_{11}\mathrm{PLESCHOOL}_i + \beta_{21}\mathrm{PLESCHOOL}_i + \beta_{1n}\mathrm{DEMO}_i \\ & + \beta_{2n}\mathrm{DEMO}_i + \beta_{1n}\left(\mathrm{PLESCHOOL} * \mathrm{DEMO}\right)i \\ & + \beta_{2n}\left(\mathrm{PLESCHOOL} * \mathrm{DEMO}\right)_i + \mu_{1i} + \mu_{2i} + \mu_{0i} + \varepsilon_{ti} \end{aligned} \tag{5}$$

Limitations of the Study

There are a few limitations worth highlighting. First, Ho (2008) identified a number of limitations with proficiency data, noting that such metrics offer limited and unrepresentative depictions of wider trends. Still, percent proficient remains at least an initial indicator of student achievement levels. Additionally, proficiency on state assessments, while a narrowly-defined measure of learning, shares a pragmatic connection to school improvement initiatives in a broad political sense. For districts and schools identified as underperforming using standardized assessment proficiency as an indicator during the accountability policy era, school improvement becomes an imperative. School improvement planning efforts, human capital resources, curriculum and instruction, and professional development are directed toward increasing proficiency on state assessments (see Mintrop et al., 2001; Strunk, Marsh, Bush-Mecenas, et al., 2016). Proficiency ratings can even become the dominant language of leadership (Mintrop & Trujillo, 2007). Thus, even given the limitations of working with proficiency data, there is conceptual validity of the measure as a primary focus of school improvement. However, as an additional robustness check for the use of percent proficiency as an appropriate outcome for this work, we also conducted a descriptive analysis of change in school letter grade rating across the years of PLE implementation for which school A-F letter grades were available. While assessment proficiency rates comprised about 30% of the New Mexico school letter grade calculation, year to year growth of students comprised about 50% of the letter grade, and other indicators like attendance rates, student and parent surveys, and graduation rates (for high schools), comprised the remaining portion of the calculation (NM Statute § 22-2E-4, 2016). Thus, if the proficiency indicator is a reasonable outcome for the original models, we should observe a similar pattern of PLE schools improving at a higher rate in letter grade rating compared to comparison schools. We observed such a pattern, and those results can be found in Supplemental Appendix A.

A second limitation is that,the change in assessments almost invariably means that the content tested also changed. We responded by standardizing results but remain unable to account for changes in content. Third, four districts participated in multiple cohorts. Given that the program prioritizes district leaders' leading systems change, there are possible issues of contamination with subsequent cohorts of treatment schools (Shadish et al., 2002). Lastly, most treatment schools were identified by their districts for the partnership because they were among the most underperforming schools. It could be the case that these schools' scores would increase as a naturally occurring regression to the mean process (Barnett et al., 2005).

Results

Our time series models provide information about two key measures. First, we examined the relationship of PLE status and school demographic characteristics to the initial school math and ELA overall percent proficiency measures or intercept in the models. Second, we examined the relationship of these variables and covariates to the change, or slope, of school math and ELA proficiency measures before and after program implementation.

The Relationship of Participation in PLE to Math Proficiency

Using a null model with no variables or covariates, we determined that for this sample of schools, 49.34% of the variance in initial school math proficiency is at the school level. Schools identified for participation in the PLE program had significantly lower initial math (Year 0_1) than the comparison group schools, which was not surprising given that schools identified for the PLE program were also typically identified for turnaround due to lower academic performance. However, by Year 0_4, this difference was not significant (see Table 3). Although we used a propensity score matching approach to identify comparison schools, some school demographic characteristics were also related to initial year math proficiency. Higher percent enrollment of American Indian and Hispanic students was significantly related to lower initial school math proficiency (see Table 4, Model 3).

The slope of the change in the pre-PLE math achievement proficiency for all schools, PLE program and comparison, was negative but not significant in a time only model (Table 4, Model 1), however, this slope was significant and negative when including the PLE school variable as an independent variable. PLE or comparison school classification had no relationship to the pre-PLE implementation slope, indicating that while the comparison schools had higher initial math proficiency, their decreasing slope prior to the PLE implementation years was not significantly different from the future PLE schools. This provides some evidence that the comparison schools selected based on the matching procedure were reasonable.

When comparing the change in math proficiency trajectory, we observe a significant difference between PLE and comparison schools. PLE schools had a significant, positive increase in math proficiency relative to the comparison schools ($\beta = .11$, $SE = .04$, $p < .05$; see Table 4, Model 2 and Figure 1). We added school demographic covariates to this model to create model three, and we still observe this same trend even when controlling for school demographics. Collectively, PLE

Table 4. Time Series Models of Changes in Math Achievement Before and Following Implementation of the Program in PLE Schools Compared to Matched Comparison Schools.

	Model 1	Model 2	Model 3	Model 4
	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)
Intercept	−0.10 (0.07)	0.11 (0.10)	1.74 (0.43)***	1.71 (0.43)***
Pre-PLE ELA change in proficiency	−0.03 (0.02)	−0.06 (0.03)*	0.02 (0.16)	−0.03 (0.20)
Post-PLE ELA change in proficiency	0.04 (0.02)*	−0.01 (0.03)	0.07 (0.18)	0.28 (0.24)
PLE school		−0.43 (0.15)**	−0.43 (0.13)***	−0.43 (0.13)***
Pre-PLE*PLE school		0.05 (0.04)	0.08 (0.04)*	0.22 (0.28)
Post-PLE*PLE school		0.11 (0.04)*	0.08 (0.05)~	−0.35 (0.37)
Demographic covariates				
Free/reduced lunch percent			−.08 (0.27)	−0.08 (0.28)
American Indian student percent			−2.13 (0.50)***	−2.12 (0.51)***
Asian student percent			−0.39 (5.38)	1.03 (5.59)
Hispanic student percent			−1.86 (0.54)***	−1.84 (0.54)***
Black student percent			−0.37 (4.16)	−0.60 (4.19)
ELL student percent			0.26 (0.28)	0.26 (0.28)
Pre-PLE slope*covariates				
*Free/reduced lunch percent			0.07 (0.12)	0.12 (0.14)
*American Indian student percent			−0.10 (0.19)	−0.08 (0.25)
*Asian student percent			2.41 (2.47)	3.32 (2.70)
*Hispanic student percent			−0.04 (0.20)	−0.05 (0.26)
*Black student percent			−3.12 (1.76)~	−2.98 (2.26)~
*ELL student percent			−0.29 (0.13)*	−0.31 (0.17)~

(continued)

Table 4. (continued)

	Model 1	Model 2	Model 3	Model 4
	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)
*PLE school*free/reduced lunch percent				−0.08 (0.16)
*PLE school*American Indian student percent				−0.11 (0.31)
*PLE school*Asian student percent				−3.78 (3.76)
*PLE school*Hispanic student percent				−0.06 (0.34)
*PLE school*Black student percent				−0.45 (2.68)
*PLE school*ELL student percent				0.06 (0.20)
Post-PLE slope*covariates				
*Free/reduced lunch percent			0.09 (0.12)	0.06 (0.16)
*American Indian student percent			−0.14 (0.21)	−0.43 (0.29)
*Asian student percent			0.37 (3.00)	−0.44 (4.01)
*Hispanic student percent			−0.28 (0.22)	−0.51 (0.30)~
*Black student percent			1.80 (1.71)	1.50 (2.22)
*ELL student percent			0.14 (0.18)	0.27 (0.28)
*PLE school*free/reduced lunch percent				−0.07 (0.25)
*PLE school*American Indian student percent				0.71 (0.43)
*PLE school*Asian student percent				3.07 (6.48)
*PLE school*Hispanic student percent				0.60 (0.46)
*PLE school*Black student percent				0.21 (4.00)
*PLE school*ELL student percent				−0.28 (0.37)
−2 log likelihood	779.15	776.07	659.33	679.81
AIC	785.15	782.07	665.33	685.81
Percent within schools variance explained	2.70%	13.90%	18.94%	20.97%
Percent variance in ELA achievement between schools (null = 49.34%)	49.37%	55.01%	38.61%	44.20%

~$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$.

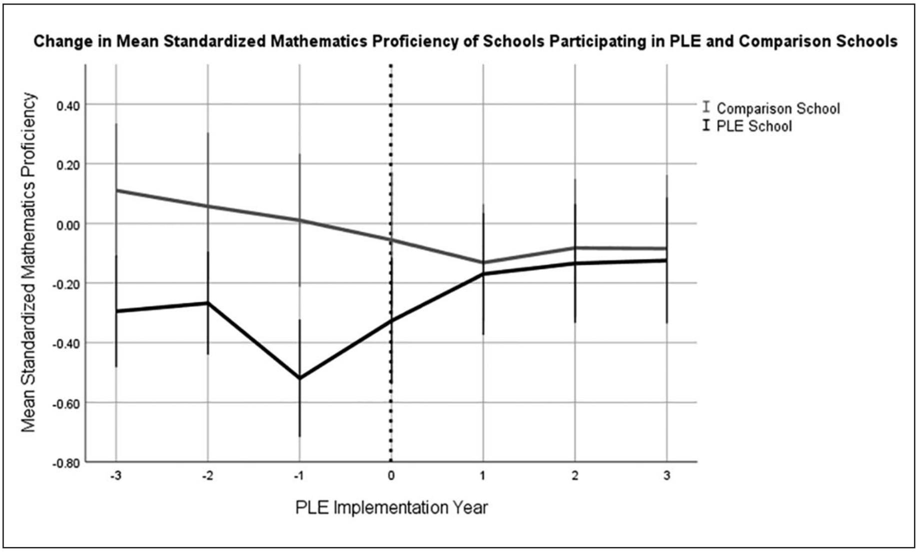

Figure 1. Comparison of mean standardized mathematics proficiency of PLE and comparison schools before and following PLE implementation.
Note. Error bars represent 95% confidence intervals.

school participation and school demographic characteristics explain 18.94% of the within school, or across time, variance in math proficiency.

While schools with higher percent ELL had significantly decreasing math achievement pre-PLE implementation, no school demographic covariates had a significant relationship to math proficiency trajectory following PLE implementation. In fact, higher percent Black student enrollment and higher percent ELL student enrollment were associated with a positive rather than negative change in math achievement post-PLE implementation. We also examined the difference in math achievement trajectories between PLE and comparison schools while controlling for changes in school demographic characteristics (see Table 4, Model 4). None of the slopes of math achievement significantly differed between PLE and comparison schools either before or after PLE implementation. However, pre-PLE implementation, PLE schools had a lower math achievement trajectory than comparison schools when controlling for all demographic changes except percent ELL student enrollment. Conversely, post-PLE enrollment, PLE schools had a higher math achievement trajectory than comparison schools when controlling for changes in all minoritized racial/ethnic groups. However, when controlling for percent ELL student enrollment, PLE schools had a declining math achievement trajectory compared to comparison schools. Pre-PLE implementation, PLE schools had a higher trajectory when accounting for ELL student enrollment than comparison schools (see Figure 1).

The Relationship of Participation in PLE to ELA Proficiency

Using a null model without variables, we determined that 24.89% of the variance in initial ELA proficiency is at the school level. Similar to math proficiency, PLE schools had significantly lower initial ELA proficiency than did comparison group schools. Although we used a propensity score matching approach to identify comparison schools, some school demographic characteristics were also related to initial year (Year 0_1) ELA proficiency. Higher percent enrollment of American Indian, Hispanic, and ELL students was significantly related to lower initial school ELA proficiency (see Table 5, Models 3-4). However, by Year 0_4, these differences in ELA achievement were not significant (see Table 3).

The slope of the change in pre-PLE ELA proficiency for all schools was not significant in the time only, PLE variable, or full models including school demographic covariates. School classification had no relationship to either the pre-PLE or post-PLE implementation slopes. Again, this indicates that the comparison schools selected based on the matching procedure were reasonable. It also indicates, however, that although PLE schools had more ELA improvement following participation in the PLE program compared to non-PLE schools, this difference in slopes was not significant (see Table 5, Model 2 and Figure 2). We note this difference in slopes following PLE implementation was nearly significant after controlling for school demographic characteristics ($\beta = .09$, $p < .10$). In model three with school demographics covariates added, post-PLE implementation schools with higher percent ELL student enrollment had significantly larger increases in ELA proficiency (see Table 5, Model 3). This was a shift from a significantly decreasing trend for schools with higher ELL student enrollment prior to PLE implementation. However, model three gives changes in slopes for both PLE and comparison schools combined.

Thus, we added an interaction term with PLE or comparison school classification in model four to determine if these differences in change in ELA achievement for specific subgroups of students were different in PLE versus comparison schools. After including these interaction terms we observed a greater spread in overall ELA achievement slopes between PLE and comparison schools pre-PLE implementation and post-PLE implementation (see Table 5, model 4, "Pre-PLE Proficiency Change*PLE School" and "Post-PLE Proficiency Change*PLE School"). By comparing the ELA achievement slopes pre- and post-PLE implementation with an included PLE school classification and demographic covariate interaction term, we were able to assess if the PLE schools showed improvement in ELA outcomes for specific subgroups of students. Similar to the results for math achievement, PLE schools were not able to shift the slope of ELA achievement when controlling for many key subgroups, including students who receive free and/or reduced lunch, American Indian, Asian, or Hispanic students. However, pre-PLE implementation, PLE schools showed declining ELA achievement if they served larger numbers of Black students and ELL students, but post-PLE implementation, these trends in ELA achievement shifted to an increasing trajectory as the numbers of these student subgroups were higher. PLE schools with higher percent enrollment of ELL students went from having significantly declining

Table 5. Time Series Models of Changes in ELA Achievement Before and Following Implementation of the Program in PLE Schools Compared to Matched Comparison Schools.

	Model 1	Model 2	Model 3	Model 4
	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)
Intercept	−0.37 (0.08)***	−0.24 (0.11)*	1.77 (0.49)***	1.72 (0.49)***
Pre-PLE ELA change in proficiency	−0.00 (0.03)	−0.01 (0.04)	0.04 (0.20)	0.08 (0.26)
Post-PLE ELA change in proficiency	0.08 (0.03)***	0.05 (0.04)	−0.39 (0.22)~	−0.48 (0.32)
PLE school		−0.28 (0.16)~	−0.32 (0.13)*	−0.30 (0.13)*
Pre-PLE proficiency change*PLE school		0.02 (0.05)	0.03 (0.05)	−0.08 (0.33)
Post-PLE proficiency change*PLE school		0.07 (0.05)	0.09 (0.05)~	0.34 (0.45)
Demographic covariates				
Free/reduced lunch percent			−0.27 (0.29)	−0.23 (0.29)
American Indian student percent			−2.38 (0.56)***	−2.39 (0.56)***
Asian student percent			4.74 (6.03)	6.82 (6.17)
Hispanic student percent			−1.58 (0.59)**	−1.58 (0.59)**
Black student percent			−1.69 (4.47)	−1.94 (4.49)
ELL student percent			−0.61 (0.29)*	−0.60 (0.29)*
Pre-PLE slope*covariates				
*Free/reduced lunch percent			0.12 (0.13)	0.17 (0.15)
*American Indian student percent			0.07 (0.23)	−0.06 (0.29)
*Asian student percent			−0.81 (2.99)	0.22 (3.39)
*Hispanic student percent			−0.15 (0.24)	−0.34 (0.31)
*Black student percent			0.43 (1.94)	1.77 (2.55)
*ELL student percent			−0.39 (0.14)**	−0.18 (0.17)

(continued)

Table 5. (continued)

	Model 1	Model 2	Model 3	Model 4
	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)
*PLE school*free/reduced lunch percent				−0.09 (0.16)
*PLE school*American Indian student percent				0.31 (0.35)
*PLE school*Asian student percent				−3.99 (4.31)
*PLE school*Hispanic student percent				0.42 (0.38)
*PLE school*Black student percent				−3.01 (2.97)
*PLE school*ELL student percent				−0.41 (0.20)*
Post-PLE slope*covariates				
*Free/reduced lunch percent			−0.09 (0.13)	−0.11 (0.17)
*American Indian student percent			0.43 (0.25)~	0.68 (0.37)~
*Asian student percent			−0.14 (3.60)	0.47 (5.05)
*Hispanic student percent			0.39 (0.27)	0.69 (0.38)~
*Black student percent			2.01 (1.94)	1.47 (2.57)
*ELL student percent			0.56 (0.19)**	−0.00 (0.26)
*PLE school*free/reduced lunch percent				−0.01 (0.26)
*PLE school*American Indian student percent				−0.52 (0.51)
*PLE school*Asian student percent				−1.55 (7.48)
*PLE school*Hispanic student percent				−0.61 (0.54)
*PLE school*Black student percent				0.06 (4.45)
*PLE school*ELL student percent				1.07 (0.38)**
−2 log likelihood	929.93	936.12	780.67	756.47
AIC	935.93	942.12	786.67	762.47
Percent within schools variance explained	11.02%	14.33%	36.75%	35.72%
Percent variance in ELA achievement between schools (null=24.89%)	32.28%	34.30%	26.57%	25.57%

~$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$.

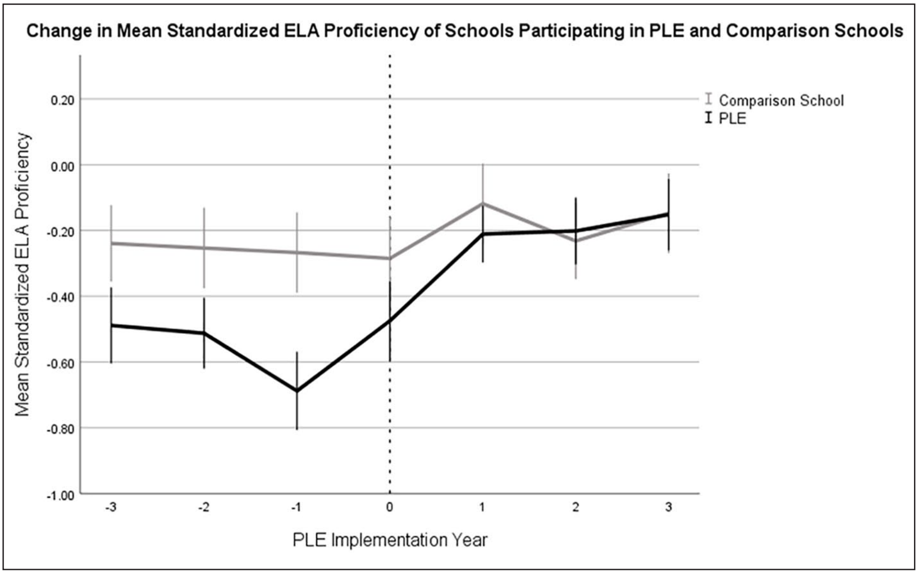

Figure 2. Comparison of mean standardized ELA proficiency of PLE and comparison schools before and following PLE implementation.
Note. Error bars represent 95% confidence intervals.

ELA achievement pre-PLE implementation to significantly increasing ELA achievement post-PLE implementation compared to the comparison schools. Certainly, this provides an interesting and critical line of future investigation. Collectively, PLE school participation and school demographic characteristics explain 36.75% of the within school, or across time, variance in ELA proficiency.

Discussion

In this study, we analyzed the impact of PLE on the percentage of students attaining at least proficiency on state assessments in underperforming New Mexico elementary and middle schools. We found that the PLE significantly affected achievement in math. Although there was not significant impact on ELA scores, our results indicated that English learners made gains. Overall, these results are encouraging as they provide an additional proof point to a previous evaluation of the program's impact (Player & Katz, 2016), which resulted in the PLE being designated in a review by RAND (Herman et al., 2018) as having evidence of impact that meets the second tier of evidence as defined within ESSA.

These results underscore the importance of ongoing leadership development, especially to galvanize and manage change initiatives for and in underperforming schools. Such training for principals and other building leaders is especially relevant given how little development they receive overall. Principal pre-service programs typically cover so vast an amount of material across various topics that few leadership issues are studied in depth (Hess & Kelly, 2005). Subsequently, only about 5% of funds nationally (and in some states, much less) provided to schools is spent on school principal professional development (Manna, 2015). Both pre-service and in-service principal development are likely even less substantial in rural areas where high-quality programs and opportunities are more difficult to access (Beesley & Clark, 2015). More broadly, there is little evidence of opportunities for district leaders to receive strategic developmental opportunities. The limited intentional development of the school principal and other educational leaders is especially perplexing when research is clear that instructional and inclusive leadership drives change across other essential system supports, including professional capacity and instructional guidance (Bryk et al., 2010).

The PLE's systems leadership focus aligns well with the elements and strategies within Fullan and Quinn's (2016) coherence framework. Depending on district context, leaders responsible for supervising and mentoring school principals, making human resources decisions, determining curriculums, and ensuring the quality of data and other systems do not only have a vested interest in the professional learning. They are part of the learning, working side by side and with teams of principals to determine vision, goals, and pathways to pursue them. The form of the professional learning activities, collective participation of leaders across levels, and duration of the in-service program (Garet et al., 2001)—duration of activities, meetings, and overall program—affords district and school leaders with an unusual opportunity: It empowers them to recreate their systems of education (Fullan, 2010). The overarching concept of coherence—in leadership development offered but also across leadership levels and responsibilities—appears to be a critically central way to make the learning more relevant.

Despite the encouraging results, there are clear strands for future research. For example, PLE schools had statistically significant positive results in math achievement when considered alongside comparison schools. None of their slopes, however, was significant, suggesting that PLE schools may not have adequately addressed math opportunity gaps for some student subgroups. Furthermore, the math achievement of PLE schools began to plateau after the first year of PLE implementation. Differences in ELA achievement were not statistically significant between PLE and comparison schools, but gains for ELL students in PLE schools were. Collectively, these results suggest avenues for future research that include understanding system and school leadership moves that result in equitable student learning opportunities for students, identifying professional learning strategies in pre- and in-service programs that facilitate greater leadership capacities throughout educational systems, and exploring how leaders sustain transformational changes in districts and schools.

The results of this study also suggest there might be some considerations for the future of programs of educational leadership preparation. First, there is an opportunity to reflect on current design and practice through the lens of coherence in order to make some determinations about how programmatic elements establish a clear developmental path for educational leaders. In that vein, more consideration to foregrounding aspects of systems leadership in programs is likely warranted as a way to understand how educational leader hierarchies operate traditionally, ways in which to "manage up" and navigate broader systems, and how to operate more collectively in the best interests of students. Subsequently, as we reflect on the coherence framework and PLE's system leadership focus, we wonder if too much emphasis is given in leadership programs to theory at the cost of practice. PLE does advocate change leadership theory as part of its program, but the vast majority of time has district and school leaders collaborating on relevant, practical challenges. We close by observing that leadership programs might also consider pursuing collaborations with district leaders for ongoing professional learning opportunities for both district and school leaders given how critical they are to the success of students but how little development they receive.

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Supplemental Material

Supplemental material for this article is available online.

Notes

1. https://webnew.ped.state.nm.us/bureaus/accountability/achievement-data/
2. https://nces.ed.gov/ccd/elsi/
3. https://www.aps.edu/assessment/parcc-documents-folder/21-facts-about-parcc

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