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Principal Leadership and School Performance: An Examination of Instructional Leadership and Organizational Management

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ABSTRACT

Recent research work in school leadership highlighting the importance of principals' organizational management skills has prompted scholars to consider their importance in relation to instructional leadership skills. However, there is limited empirical work that directly compares these leadership skills and their importance for school outcomes. In this study, we use principals' self-ratings to construct typologies of effectiveness in both domains and compare their relationship to student achievement. Our results show that principals view themselves as either strong or weak on instructional leadership and organizational management skills simultaneously. We also find that learning gains vary significantly across the principal profiles.

Scholars in general management and business studies have long been interested in differences between leadership and management (Kotter, 1982, 1990, 2006; Zaleznik, 1977). For example, Kotter (1990) noted that "management is about coping with complexity. Leadership, by contrast, is coping with change" (p. 86). Academic debates in business/management research on the distinction between leadership and management are very much alive and likely to continue for the near future (Kotter, 1990; Toor, 2011; Toor & Ofori, 2008). In education research, the central debate has not been about management versus leadership but instead on the relative importance of two leadership styles—instructional and transformational leadership. Instructional leadership includes school leaders' work that directly or indirectly supports good instructional practices (Hallinger, 2005), whereas transformational leadership emphasizes the role of leaders in motivating and inspiring followers to work for the common good of the organization (Bass, 1985, 1998; Burns, 1978; Leithwood & Jantzi, 1990).

In recent years, studies have raised the importance of organizational management for effective school leadership work (Grissom & Loeb, 2011; Grissom, Loeb, & Master, 2013; Horng, Klasik, & Loeb, 2010; Sebastian & Allensworth, 2012; Sebastian, Allensworth, & Stevens, 2014). A study by Grissom and Loeb (2011), in particular, received considerable attention as it directly compared how principal perceptions of effectiveness on instructional leadership versus organizational management were related to student achievement; they found significant effects only for principals' effectiveness in organizational management.

Researchers have interpreted these findings, emphasizing the importance of organizational management for student achievement as not necessarily incompatible with prior work focusing on

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instructional leadership (Grissom & Loeb, 2011; Hitt & Tucker, 2016; Urick, 2016b). Scholars have proposed that management responsibilities could fall under instructional leadership (e.g., Cuban, 1988), or that both functions are part of a broader definition of overall leadership effectiveness (Hitt & Tucker, 2016). However, there is very little empirical research supporting these ideas; only a few studies have directly investigated the relationship between organizational management and instructional leadership and how they compare in terms of influencing student achievement.[1] In this regard, educational research is similar to research in general management studies. There, too, despite the considerable body of theoretical work debating the importance of integrating leadership and management, empirical work supporting these ideas is limited (Toor, 2011).

In this study, we contribute to research comparing instructional leadership and organizational management by examining survey data on principals' effectiveness in these two domains. Our study is motivated by a similar study conducted by Marks and Printy (2003) that compared different styles of principal leadership. While that study examined the relationship between instructional leadership and transformational leadership, our aim is to compare instructional leadership and organizational management. Marks and Printy (2003) studied principals based on their relative strengths on instructional and transformational leadership. With this approach, they were able to show that some principals integrate multiple styles of leadership, and that those principals most positively influence their students' academic performance. We use a similar research design, adopting a model based classification approach—Latent Class Analysis (LCA; Goodman, 1974; Magidson & Vermunt, 2002; Muthén & Muthén, 2000; Nylund, Asparouhov, & Muthén, 2007), to classify principal practice based on measures of instructional leadership and organizational management. We further link these principal types to student achievement gains. In sum, our study seeks to examine the relationship between principal effectiveness in instructional leadership and organizational management. We also wish to know how principal effectiveness on instructional leadership and organizational management is related to student achievement gains. Since we are using LCA, or a classification model, to examine these aims, the specific research questions are:

(1) What latent principal classes (or types) can be differentiated on the basis of their self-ratings on effectiveness in instructional leadership and organizational management?
(2) How are these different principal latent classes related to student achievement gains?

Literature review

A prominent debate in general management/business studies was likely initiated by Zaleznik (1977) with his groundbreaking article, "Managers and Leaders: Are They Different?" Zaleznik argued that management and leadership are quite different constructs, and that leaders have much more in common with artists than they did with managers. He noted that "it takes neither genius not heroism to be a manager, but rather persistence, tough-mindedness, hard work, intelligence, analytical ability, and perhaps most important, tolerance and goodwill" (p. 3). Another classic in business studies by Kotter (1990b), "What Leaders Really Do," extended the ideas proposed by Zaleznik (1977) and contrasted management and leadership as distinct functions. In a more recent reflection titled "Management Is (Still) Not Leadership," Kotter (2013) clarifies the distinction between leadership and management in the following way:

> Management is a set of well-known processes, like planning, budgeting, structuring jobs, staffing jobs, measuring performance and problem-solving, which help an organization to predictably do what it knows how to do well. Management helps you to produce products and services as you have promised, of consistent quality, on budget, day after day, week after week. In organizations of any size and complexity, this is an enormously difficult task. We constantly underestimate how complex this task really is, especially if we are not in senior management jobs. So, management is crucial—but it's not leadership.

> Leadership is entirely different. It is associated with taking an organization into the future, finding opportunities that are coming at it faster and faster and successfully exploiting those opportunities. Leadership is about vision, about people buying in, about empowerment and, most of all, about producing useful change.

The growing number of studies and wide variety of perspectives on leadership and management reflect the increased prominence the debate on leadership versus management is generating in academic circles (Simonet & Tett, 2013; Toor, 2011; Toor & Ofori, 2008). In a review of studies examining leadership and management, Toor and Ofori (2008) noted that there are significant differences in the etymological development, definitional complexities, conceptual distinctions, and the specific behaviors associated with leadership and management. Despite these differences, on many levels, the terms are often used interchangeably. Many researchers think of these functions as essentially one construct, two sides of the same coin, or complementary functions (Simonet & Tett, 2013; Toor, 2011; Toor & Ofori, 2008). Simonet and Tett (2013) delineated five distinct perspectives on how management and leadership have been described in relation to each other: (a) bipolar—where leadership and management are conceptualized as opposites of each other, (b) unidimensional—where they are the same and interchangeable, (c) bi-dimensionality—where they are viewed as distinct but complementary, (d) hierarchical (management within leadership)—management functions fall under a broader leadership domain, and (e) hierarchical (leadership within management)—leadership functions fall under a broader management domain.

The majority of research in general management and business studies support clear theoretical distinctions between leadership and management (Toor, 2011; Toor & Ofori, 2008). The complementary or bi-dimensionality perspective has been the most dominant view in organizational research (Simonet & Tett, 2013). In this view, management and leadership are considered to be distinct but interrelated constructs; they may perform similar functions or pursue identical goals but they require distinct skills (Kotter, 1990; Toor, 2011; Toor & Ofori, 2008; Zaleznik, 1977). Researchers argue that maintaining leadership and management as distinct constructs is useful for conceptual clarity in organizational research, for the training and development of successful managers and leaders, and for maximizing organization performance based on complimentary functions of both skills (Kotter, 2006). At the same time, researchers also make the case that today's organizations need to develop leadership skills in managers and management skills in leadership (Toor, 2011; Toor & Ofori, 2008).

Instructional leadership, transformational leadership, and organizational management

In contrast to research in general management and business studies, in the field of educational leadership, the debate on leadership versus management has not been as prominent.[2] Instead, the central debate has been about two distinct models of leadership—instructional leadership and transformational leadership (Hallinger, 2003, 2005; Marks & Printy, 2003; Printy, Marks, & Bowers, 2009). The origins of instructional leadership can be traced back more than 30 years ago to research that examined what characteristics distinguished "effective schools" from other schools (Bossert, Dwyer, Rowan, & Lee, 1982; Hallinger, 2003; Neumerski, 2013). While principal work can cover many different domains (Camburn, Huff, Goldring, & May, 2010; Camburn, Spillane, & Sebastian, 2010; Goldring, Huff, May, & Camburn, 2008) and require a complex set of skills (Hitt & Tucker, 2016), most studies of principal leadership have focused on their role in directly or indirectly supporting good classroom instruction (Grissom & Loeb, 2011). This role, broadly defined as instructional leadership, has motivated the bulk of school leadership research for the last four decades (for reviews, see Hallinger, 2005; Hallinger & Heck, 1996a, 1996b, 1998; Witziers, Bosker, & Kruger, 2003). The study of instructional leadership has been so central to past research on school leaders' work that other aspects of principal work have been neglected or less well studied.

Grissom and Loeb (2011) argue that: This dominance has resulted in a narrowing of research perspectives on what it means to be an effective school leader. As the literature has cultivated a focus on support for teaching and learning as the hallmark of good school leadership, other aspects of principals' work have received little attention. (p. 1092)

The extensive research on instructional leadership is matched by considerable variety in how the topic has been studied; researchers have conceptualized and defined instructional leadership in widely varying ways (Hallinger & Murphy, 1985; Murphy, 1988). The most common model of instructional leadership is the one developed by Hallinger and Murphy (1986), which proposed three dimensions of instructional leadership: defining the school mission, managing the instructional program, and promoting a positive school-learning climate. The measure of instructional leadership developed by Grissom and Loeb (2011) focused on three principal roles: developing teacher instructional capacities, evaluation of classroom instruction, and management of instruction via professional development and program evaluation. In contrast to most studies of principal leadership, Grissom and Loeb (2011) focused on principal self-ratings of their effectiveness in these domains rather than behavioral frequency.[3] They noted this as an important distinction from prior research, arguing that behavioral frequency and effectiveness need not be linked, and that effectiveness was more important for school success.

Transformational leadership, on the other hand, is the ability of leaders to motivate and inspire followers to go above and beyond their transactional expectations in order to promote the common good of the organization (for a review, see Northouse, 2016). Transformational leadership gained prominence as education researchers focused on models of principal practice that was needed to lead schools through reform (Marks & Printy, 2003). Classical definitions of transformational leadership focused on leaders' abilities to behave in charismatic ways and provide followers with inspirational motivation, intellectual stimulation, and individualized consideration (Bass, 1985; Burns, 1978). In education research, the work of Leithwood and colleagues has informed the development of a definition of transformational leadership that is specific to the organization of schools (see Leithwood & Jantzi, 1990, 2000, 2005, 2006; Leithwood & Sun, 2012). This definition highlights the following factors: "building school vision and goals, providing intellectual stimulation, offering individualized support, modeling professional practices and values, demonstrating high performance expectations, and developing structures to foster participation in school decisions" (Urick & Bowers, 2014, p. 100). The definitions of transformational leadership used in educational research are somewhat different from the classical definitions provided in general management and business research. Hallinger (2003) notes that transformational leadership emerged as a result of broader dissatisfaction with the instructional leadership model, which placed too much emphasis on a top-down, hierarchical model with the principal at the center, and little attention to other actors. In contrast to that model, transformational leadership was viewed as an organizational property rather than as belonging to the principal alone (Hallinger, 2003; Marks & Printy, 2003; Printy et al., 2009). Still, the similarities between both models are more striking than the distinctions (Urick & Bowers, 2014); both models emphasize creating shared vision/goals, developing a strong learning climate, incentivizing good instructional practices, and promoting the development of staff (Hallinger, 2003).

The literature on transformational leadership in education research has added relevance to the present study because it has also been presented as the opposite of "transactional leadership"—a style of leadership that emphasizes the fulfillment of transactional agreements between leaders and employees. Principals who are transactional leaders focus on the day-to-day operations of running the school building such as managing budgets, hiring and supervising employees, and maintaining facilities (Urick, 2016b). As this view of transactional principal leadership has similarities to organizational management, it could be argued that the debate on leadership versus management was also prominent in educational research, albeit indirectly.

A substantial body of research has tied instructional, transformational, and transactional leadership to important school outcomes (see, for example, Hallinger, 2005; Hallinger & Heck, 1996b, 1998; Hardman, 2011; Leithwood, Louis, Anderson, & Wahlstrom, 2004; Leithwood & Sun, 2012; Louis,

Leithwood, Wahlstrom, & Anderson, 2010; Marks & Printy, 2003; Robinson, Lloyd, & Rowe, 2008; Witziers et al., 2003). Robinson et al. (2008) compared findings from instructional leadership and transformational leadership studies to conclude that instructional leadership showed three to four times the effects shown by transformational leadership. Marks and Printy (2003) examined both instructional leadership and transformational leadership and found that in schools where principals integrated both styles of leadership, students performed at high levels. They also suggested that transformational leadership was a necessary but not sufficient condition for instructional leadership. Marks and Printy' s (2003) study received significant attention in school leadership research, as their findings opposed perspectives of instructional and transformational leadership as dichotomous styles; instead, their work found that leaders could integrate both styles. Other researchers have extended the work of Marks and Printy (2003) and examined integrated leadership—combining multiple styles and needs of leadership, while also stressing the importance of contextual conditions in influencing leadership practice and outcomes (Boberg & Bourgeois, 2016; Bruggencate, Luyten, Scheerens, & Sleegers, 2012; Day, Gu, & Sammons, 2016; Urick, 2016a, 2016b; Urick & Bowers, 2014).

In recent years, a number of studies have directly raised the importance of organizational management relative to instructional leadership. In particular, Grissom and Loeb (2011) conducted exploratory factor analysis (EFA) on a broad inventory of principal skills that uncovered five dimensions—instructional leadership, organizational management, internal relations, external relations, and administration. Grissom and Loeb (2011) found that of these five factors, only principals' skills on organizational management were related to measures of school success including student achievement gains; they did not find evidence that instructional leadership was related to learning gains. The items used to measure instructional leadership in the study conducted by Grissom and Loeb (2011) included domains such as the use of data and assessments, observing classrooms, planning and implementing professional development, evaluating, providing feedback, and coaching teachers, enhancing school goals and developing a coherent program. The items used to measure organizational management included domains such as school safety, finances and budgets, hiring practices, managing schedules, networking with other principals, and maintaining facilities. Horng, Klasik, & Loeb (2010) used observations to document time spent by principals on different types of activities and linked the time-use information to student achievement. They found that time spent by principals on organizational management skills positively predicted school outcomes, whereas time spent on instructional activities was not associated with student performance gains. Grissom, Loeb, & Master (2013) also used observational data on principals' time use across different functions and showed that time spent on instructional functions overall did not predict student achievement growth. However, time spent in some specific instructional sub-functions, such as coaching, evaluation, and developing the school program, positively predicted achievement gains, while walkthroughs negatively predicted student growth.

These recent studies showing evidence for the importance of organizational management have been interpreted as highlighting the importance of noninstructional aspects of principal work, but not de-emphasizing the importance of instructional leadership itself. Researchers have suggested studying instructional leadership with a broader definition that includes an organizational management dimension (Hallinger, 2005). Grissom and Loeb (2011) interpreted their findings as suggesting the following: "We might conceive of effective instructional leadership as combining an understanding of the instructional needs of the school with an ability to target resources where they are needed, hire the best available teachers, and keep the school running smoothly" (p. 1117). Horng et al. (2010) also interpret their findings as implying that organizational management is central to a broader definition of instructional leadership. Other researchers have proposed that organizational management and instructional leadership are both aspects of a more global leadership effectiveness construct (Bryk, Sebring, Allensworth, Luppescu, & Easton, 2010; Cuban, 1988).

However, there is not much empirical evidence supporting these ideas about an integral or complementary relationship between instructional leadership and organizational management; little research has directly investigated the relationship between these two aspects of leadership work. The

study by Grissom and Loeb (2011) used a factor analysis technique called orthogonal rotation that yielded instructional leadership and organizational management measures that were designed to be completely uncorrelated to each other; the relationship between these factors was not directly examined. As discussed earlier, the absence of empirical evidence on how leadership and management are related is also true with regard to general management studies. Although many researchers have contributed to theoretical debates on leadership and management, there is an absence of empirical evidence on the topic and most arguments are based on the personal opinions of scholars (Toor, 2011; Toor & Ofori, 2008).

In this study, we build on the study conducted by Grissom and Loeb (2011) and measure instructional leadership and organizational management skills to examine how they are related to each other. We also examine if they predict student achievement. Our project is similar to the work done by Marks and Printy (2003), who examined the relationship between instructional and transformational leadership styles. Marks and Printy (2003) attempted to group principals based on their relative strengths in instructional and transformational leadership. Our methodology is similar; we use a model-based method to classify principals, using latent class analysis (LCA). LCA can be considered as an alternative approach to continuous latent variable methods such as factor analysis, to study variation in dependent variables (Muthén & Muthén, 2000; Nylund et al., 2007). Similar to factor analysis, LCA also identifies latent variables based on multiple dependent variables. However, in contrast to factor analysis, LCA identifies categorical latent variables; respondents (in this case, principals) are categorized into a small number of groups based on their responses to survey items (Magidson & Vermunt, 2002, 2003, 2004; Nylund et al., 2007). In comparison to more traditional latent variable methods such as factor analysis, LCA is a relatively newer and less used method in school leadership research. Recent years have seen increased adoption of LCA methods (see, for example, Barnes, Camburn, Sanders, & Sebastian, 2010; Bowers, Blitz, Modeste, Salisbury, & Halverson, 2017; Boyce & Bowers, 2016; Urick, 2016b; Urick & Bowers, 2014). For example, Urick and Bowers (2014) used LCA with nationally representative data to classify principals based on transformational, instructional, and managerial tasks. Here, we adopt the LCA approach to classify principal practice based on principals' effectiveness in instructional leadership and organizational management. We then compare these principal types on the achievement of students in their schools on standardized test scores.

Method

Sample and data

The data for this study comes from two sources: (a) administrative data from the Chicago Public Schools (CPS) that included student demographic information and achievement records, and (b) survey data from the University of Chicago Consortium on Chicago School Research. CPS is the fourth-largest school district in the Unites States, enrolling about 371,382 students in over 644 schools (2017–2018 data). The administrative data used in this study is based on elementary school students enrolled in CPS during the 2013–2014 school year. As per CPS records (see http://cps.edu/), 234,679 students were enrolled in Grades 1–8, whereas 112,029 students were enrolled in grades 9–12. Of all students, 16.2% were classified as students with limited English proficiency and 84.7% of the students were on free or reduced-price lunch. In terms of racial diversity, 42% of all students were Black, 46% were Hispanic, 9% were White, and 3% were Asian students. In 2012, 74.2% of all students were classified as meeting or exceeding standards set by the Illinois Standards Achievement Test (ISAT), which is the standardized test taken by students in CPS grades 3–8 in the spring semester of each year.

The Chicago Consortium administers student, teacher, and principal surveys that are population-based surveys—i.e., all students, teachers, and principals are offered the opportunity to take the surveys. The surveys collect information on a range of measures including aspects of classroom

instruction, student noncognitive factors, student and teacher background characteristics, and school organizational characteristics (for more information, see https://consortium.uchicago.edu/surveys). The information on school organizational characteristics is based on a framework of school organization develop by Bryk et al. (2010), which itself came out of empirical work done in CPS schools. The framework proposes that there are five essential aspects of school organization that are vital for effective school improvement: school leadership, professional capacity, school learning climate, parent and community ties, and classroom instruction. From the survey items, the Chicago Consortium develops Rasch measures that inform each aspect of the Bryk et al. framework. This information is also provided to schools to help guide school leadership to develop school improvement plans. The Rasch measures are anchored so that comparisons can be made between schools and across years (Bryk et al., 2010; Luppescu & Ehrlich, 2012).

Survey information on school organizational factors, including measures of leadership, is typically collected in CPS using teacher surveys. However, they also collect information from principals. In 2013–2014 the consortium principal surveys added items from the Grissom and Loeb (2011) study that measured principal instructional leadership and organizational management. The response rate for the 2013–2014 principal survey was 64%. To measure instructional leadership, the surveys asked principals to rate their own effectiveness in domains such as utilizing data to inform instruction, program planning and evaluation, coaching, etc. (see Table 1 for a full list of items). The survey items matched the items used by Grissom and Loeb (2011) except for a few differences. Three items from the original Grissom and Loeb (2011) study measuring instructional leadership—conducting classroom observations, using school meetings to enhance school goals, and evaluating curriculum—were not included as part of the Chicago Consortium surveys. There were separate items for planning and implementing professional development in the Grissom and Loeb (2011) study, and in the present study there was only one item—implementing effective professional development.

Similarly, to measure organizational management, principals were asked to rate their own effectiveness on responsibilities such as developing a safe environment, hiring, managing budgets, maintaining the campus, etc. (see Table 2 for a full list of items). Only one item from the set of items measuring organizational management from the Grissom and Loeb study, interacting/networking with other principals, was not asked in the Chicago Consortium principal survey. Grissom and Loeb (2011) noted that professional development and program evaluation anchored

Table 1. Survey items measuring organizational management (Cronbach's alpha = 0.84).

Question Stem: How effective do you consider yourself to be in the following tasks?	N	M	SD
Developing and monitoring a safe school environment	263	3.42	0.61
Dealing with staff concerns	263	3.33	0.62
Managing budgets and resources	263	3.39	0.66
Hiring personnel	263	3.31	0.63
Managing personal, school related schedule	263	3.25	0.71
Maintaining campus facilities	263	3.19	0.68
Managing noninstructional staff	261	3.18	0.67

Note. Scale categories: A. *not effective*; B. *moderately effective*; C. *effective*; D. *very effective*; Min = 1, Max = 4 for all survey items.

Table 2. Survey items measuring instructional leadership (Cronbach's alpha = 0.86).

Question Stem: How effective do you consider yourself to be in the following tasks?	N	M	SD
Using data to inform instruction	259	3.44	0.64
Developing a coherent education program	260	3.23	0.64
Using data for program evaluation	261	3.29	0.67
Improving teachers' practice through formal evaluations	261	3.15	0.68
Coaching teachers	260	3.15	0.68
Implementing effective professional development	262	3.15	0.64
Effectively integrating supplementary after-school or summer programs	260	3.04	0.75

Note. Scale categories: A. *not effective*; B. *moderately effective*; C. *effective*; D. *very effective*; Min = 1, Max = 4 for all survey items.

their assessments of principals as instructional leaders and these two dimensions were included in the Chicago Consortium surveys. Similarly, maintenance of campus facilities, budget and resource management, and developing a safe environment were the items that loaded most strongly on their organization management measure and these items were also included in the Chicago Consortium surveys.

A key difference of this study from that of Grissom and Loeb (2011) is that we chose to allow measures on management and instructional leadership to be correlated with each other. Grissom and Loeb used orthogonal rotation to force their measures of organizational management and instructional leadership to be uncorrelated. By estimating values to each dimension that were independent of the other, they captured principals' ratings of their relative strengths. Yet, a disadvantage of this strategy is that it does not allow us to examine whether principals are strong or weak in both. Here, we seek to know whether it is common for principals to be strong in one but weak in the other domain. For this purpose, we conducted a confirmatory factor analysis (CFA) using the model proposed by Grissom and Loeb (2011), linking the various survey items to latent measures of instructional leadership and organizational management. We used Mplus version 7 (L. K. Muthén & B. O. Muthén, 2007; Muthén & Muthén, 2013) to conduct the CFA analysis.

Classification of leaders: Latent class analysis

Ordered polytomous LCA was used to classify principals based on their responses to the 14 ordinal survey items[4] on the principal survey that measure instructional leadership and organizational management. LCA is similar to cluster analysis but has the advantage of being a model-based approach, so statistical tests can be conducted to examine model fit to the data; thus, selection of groups or classes is less arbitrary in comparison to cluster analysis (Magidson & Vermunt, 2002, 2004). The dependent variables for LCA analysis were the 14 surveys items measuring principals' ratings of their own effectiveness on various leadership duties (see Tables 1 and 2). In LCA, models of increasing complexity are iteratively analyzed to determine which model best fits the data. The first model is a 1-class model, which assumes that all principals can be classified into one group based on their responses to survey items. Next, a 2-class model is fit, and so on. As suggested by Marsh, Lüdtke, Trautwein, and Morin (2009), interpretability of LC coefficients is inspected for each solution and fit indices from each model are compared to determine the model with the best fit to the data. The Bayesian information criterion (BIC), Akaike information criterion (AIC), and the sample-adjusted BIC are commonly used fit-information indices used to determine relative model fit (Magidson & Vermunt, 2004; Nylund, 2007; Nylund et al., 2007). Among these indices, the BIC is most commonly used by researchers to select an optimum model (Tein, Coxe, & Cham, 2013), as it performs as the best among the various information criterion indices (Nylund et al., 2007); a lower BIC indicates better model fit to the data. We also examined entropy values reported in the output; values closer to 1.0 are desirable as they indicate greater precision in classifying the observations into the latent classes (L. K. Muthén & B. Muthén, 2007). Figure 1 illustrates the latent class model based on the survey items measuring instructional leadership and organizational management.

We used Mplus version 7 (Muthén & Muthén, 2007b; Muthén & Muthén, 2013) to conduct the LCA analysis. In each LCA model solution, the model estimates include the overall class size of each group and membership probabilities of observations in each group. The means of the survey items can be plotted for the different classes to interpret the LCA solutions and understand how classes are different from one another. Based on the results shown by Grissom and Loeb (2011), we might expect the LCA solutions for this study to produce unordered solutions, with classes distinguishing principals who are good at both instructional leadership and organizational management from principals who are good at one but not the other type of leadership.

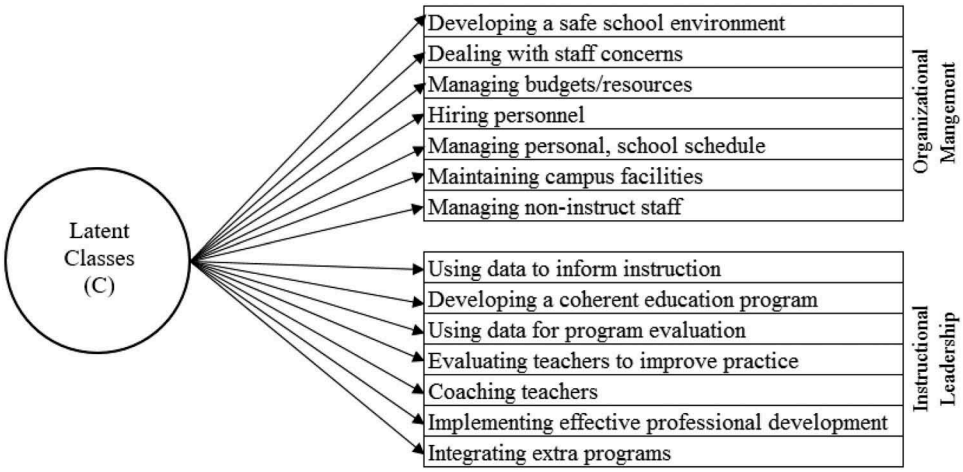

Figure 1. LCA model of principal ratings of effectiveness in instructional leadership and organizational management.

Comparison to student achievement: Hierarchical linear models (HLM)

The classes or groups of principals obtained from the LCA solution were compared based on student academic performance using HLM models. The dependent variable for examining the relationship of leadership and management with student achievement was students' standardized achievement test scores as measured by the Illinois Standards Achievement Test (ISAT). ISAT scores of students in Grades 3–8 from the 2013–2014 year in reading and mathematics were combined to form a composite score. Student-level variables were included to control for differences in the types of students attending different schools, including students' gender, race, special education status, and two indicators of socioeconomic status. The SES variables were developed by the Chicago Consortium based on census data to measure concentration of poverty and social status based on employment in the students' census block. Students' ISAT scores from the previous year were also included to control for prior achievement. At the school level, the independent variables included school size (enrollment in the 2013–2014 year), average measures of student poverty and social status, and a measure of average prior achievement based on the third-grade ISAT scores of all students enrolled in the school.

Since the ISAT test-score data has a nested data structure, with students nested within schools, HLM is appropriate in order to estimate standard errors of regression coefficients correctly (Bryk & Raudenbush, 1992). We utilized the software HLM 7 (Raudenbush, Bryk, & Congdon, 2011). The dependent variable was students' composite score on ISAT obtained from averaging scores on the reading and mathematics assessments of the ISAT, and controlling for their score from the prior year. With this specification, the level 1 intercept, β_{0j}, represents the gain that students made at school j during the school year 2013–2014, relative to students with similar prior test scores and similar background characteristics. The following equations describe the HLM models used to compare ISAT performance:[5]
Level 1 (Student):

$$ISAT\ Score_{ij} = \beta_{0j} + \beta_{1j} * \left(Prior\ ISAT\ Score_{ij}\right) + \sum_{k=2}^{K} \beta_{kj} * \left(\mathbf{X}_{ij}\right) + r_{ij} \quad (1)$$

Level 2 (School):

$$\beta_{0j} = \gamma_{00} + \sum_{l=2}^{L} \gamma_{0l} * \left(\mathbf{Y}_{ij}\right) + \sum_{m=L+1}^{M} \gamma_{0l} * \left(\mathbf{Z}_{ij}\right) + u_{0j;} \quad (2)$$

$$\beta_{1j} = \gamma_{10};\ \beta_{kj} = \gamma_{k0}; \quad (3)$$

where **X** is a vector of student demographic variables including the students' gender, ethnicity, two measures of socioeconomic status, dummies representing student grade, and the age of the student. **Y** represents a vector of dummy variables capturing principals' latent class classifications from the LCA solution; one of the classes was left out of the regression. **Z** represents a vector of school-level covariates, which include school average socioeconomic status based on the averages of measures derived from census data, and school size (or enrollment), as well as the average ISAT achievement of students in the school when those students were in third grade (the first year that all students are tested in CPS). We analyzed multilevel models of increasing complexity, beginning with models that included no predictors to models that controlled for student and school-level covariates simultaneously. The model that includes the school variables may be overly conservative for estimating principal effects on test scores, as principals may have influenced students' prior achievement if they were principals in the school during students' earlier years. By including this variable, we are estimating principal effects net of the influence of which types of students are in the school and net of any influence the principal had on their current students in the primary years. All student and school-level covariates except the dummy variables representing leadership types were grand mean centered.

Results

The responses of CPS elementary school principles on the survey items measuring instructional leadership and organizational management are described in Tables 1 and 2. The response categories of these survey items captured degrees of effectiveness on leadership responsibilities on an ordinal scale (1 = *not effective*, 2 = *moderately effective*, 3 = *effective*, 4 = *very effective*). The means of most items are in between 3.0 and 3.5; on average, principals rated themselves in between the categories of *effective* and *very effective* on the responsibilities for both instructional leadership and organizational management. In contrast, the responses from the sample of principals that participated in the Grissom and Loeb (2011) study had slightly higher averages.

Conducting a CFA with two factors measuring instructional leadership (seven survey items) and organizational management (eight survey items) only showed moderate fit (CFI = 0.95; TLI = 0.94). The survey item. "Effective at Releasing/Counseling out Teachers showed the lowest factor loading onto the instructional leadership measure (0.57). Repeating the CFA after dropping that item showed better factor loadings and slightly better fit for information criterion indices (CFI = 0.95; TLI = 0.95), which fall within the benchmarks of good model fit (Hu & Bentler, 1999). The factors of instructional leadership and organizational management were correlated at 0.74 (see Appendix A). We also conducted a CFA with all items loading onto just one factor; this model did not show good fit (CFI = 0.80; TLI = 0.85). This suggests that the instructional leadership and organizational management measures are distinct constructs. The high correlation between instructional leadership and organizational management meant that the LCA solutions would likely produce ordered solutions rather than unordered solutions, as initially expected.

The fit indices from various LCA solutions are shown in Table 3a. The four-class solution provided the optimal fit for the data, since it produced the lowest BIC and the highest entropy value. The classification probabilities for the four class solution are shown in Table 3b. Class-specific response probabilities are given in Appendix C. LCA results in the assignment of each principal to the most likely latent class; these posterior classifications can be combined with the original survey data to compare means of principal responses to the survey items (Urick & Bowers, 2014). Figure 2 shows the means of the principals from each latent class on the survey items based on modal class assignment. The four-class LCA solution produced an ordered solution, i.e., there were no classes which were high on some indicators but low on other indicators. Instead, differences emerge based on principals' perceptions of their relative strengths—with some perceiving themselves to be more effective in management than instructional leadership—as well as their overall general perceptions of their effectiveness in both areas.

Table 3a. Model fit indices for LCA solutions of principal effectiveness.

	AIC	BIC	Adjusted BIC	Entropy	Lo-Mendell Rubin Test (*p* value)	BLRT Test (*p* value)
1 Class solution	9498.03	9640.02	9522.65	—		
2 Class solution	8288.49	8576.32	8338.40	0.91	0.00	0.00
3 Class solution	8047.79	8481.45	8122.98	0.89	0.00	0.00
4 Class solution	**7876.62**	**8456.12**	**7977.11**	**0.92**	**0.68**	**0.00**
5 Class solution	7761.52	8486.85	7887.30	0.91	0.76	0.00

Table 3b. Average latent class probabilities for most likely latent class membership (Row) by latent class (Column).

	1	2	3	4
1	**0.964**	0.000	0.036	0.000
2	0.000	**0.939**	0.041	0.020
3	0.005	0.017	**0.963**	0.015
4	0.000	0.044	0.015	**0.942**

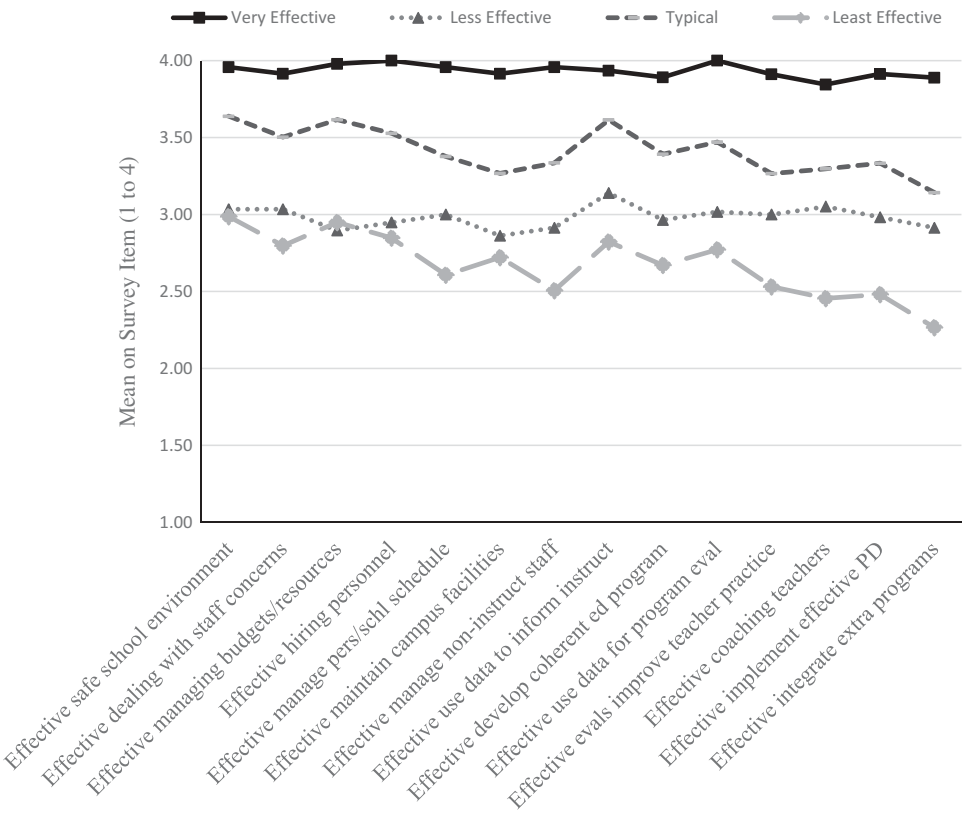

Figure 2. Principal latent classes of instructional leadership and organizational management.

Figure 2 helps in interpreting the LCA solutions and giving labels to the classes. Class 1 was classified as *very effective* principals (13.43%), given that the average on self-ratings of effectiveness for all survey items was close to 4.0 (4.0 = *very effective*). This group of principals rated themselves as very effective in all areas of management and instructional leadership, with very little variation across the survey items. Class 2 was labeled as *typical* principals (46.17%), since almost half of all principals fall into this group; these principals rated themselves as in between *effective* and *very effective* on all of the survey items. However, they were more likely to rate themselves at the highest level (*very*

effective) on a number of the management items (the first three items) than most of the other items (averaging close to 3.6), and they were least likely to rate themselves as very effective for some of the instructional leadership items (the last four items, averaging close to a 3.2) The next was labeled as *less effective* principals (17.68%); their averages on survey items were close to 3 (*effective*), with some of the items averaging below 3.0. As with Class 1, their ratings were fairly similar across all of the items. Class 4 was labeled as *least effective* (22.72%) principals, since the averages for these principals on the 14 survey items fell below 3 on most of the questions about organizational management, and were particularly low on questions about instructional leadership. Besides their ordered nature, there are a few subtle differences between the principal classes. The *very effective* (Class 1) and *less effective* (Class 3) principals considered themselves as more integrated principals; there was little variation in their ratings across all items. Typical (Class 2) and *least effective* principals (Class 4) could be considered more management-oriented principals, as they rated themselves higher on the management questions in comparison to the instructional leadership questions. About half or more of the principals in this group rated themselves as less than effective on questions about coaching teachers, implementing effective professional development, and effectively integrating extra programs. At the same time, their ratings on a number of the management items were similar to those in Class 3, the *less effective* principals. There are no groups of principals who view themselves to be more effective at instructional leadership than organizational management.

The descriptive statistics of variables included at the student and school levels for the HLM analyses are shown in Table 4a. Table 4bshows the correlations among school-level variables. The results of the HLM analysis comparing the latent classes of principals to student achievement are shown in. Dummy variables representing the *least effective, less effective*, and *very effective* principals were entered into the regression model. Therefore, the intercept represents the expected average ISAT score for principals in the *typical* group, controlling for the student and school background characteristics entered in a particular model. Without controlling for student and school covariates (Model 1), students at schools with principals in the *less effective* and *least effective* groups show ISAT gains that are significantly lower than the gains made by students whose principals are in the *typical* or *very effective* groups. The differences in test scores in these schools compared to others is fairly large; equivalent to over 40 % of the standard deviation in ISAT achievement between schools.[6]

Including student and school-level control variables reduces these differences; student background and school context seem to account for much of the differences in student achievement observed between the latent classes of principals. At the same time, even after controlling for student and school-level covariates, the principals that rated themselves as the *least effective* were significantly different from *typical* principals on ISAT performance. This difference is small (corresponds to a Cohen's *d* effect size of 0.05). Additional hypotheses tests conducted within HLM to test for differences between principal groups showed that the *least effective* group of principals showed significant differences from all other groups on ISAT performance. There were no differences on ISAT performance between any of the other groups.

Discussion and conclusion

Given the theoretical debates that exist about whether management is independent of, or an integral aspect of leadership, the purpose of this study was to compare principal perceptions of their instructional leadership relative to their organizational management skills, and to determine whether these perceptions were related to student achievement. LCA analysis showed that instructional leadership and organizational management are highly related; there were no principals who viewed themselves as strong on instructional leadership but weak on organizational management, or vice versa. Furthermore, latent measures of instructional leadership and organizational management were correlated at 0.74. Therefore, our work

Table 4a. Student-level and school-level descriptive statistics.

Variable	*n*	*M*	*SD*	*Min*	*Max*
Level 1: student					
Achievement					
ISAT score	70370	240.32	29.14	129.00	394.50
Prior ISAT score	70374	229.56	31.06	120.00	737.00
Grade (dummy variables)					
Grade 5	70384	0.21	0.41	0.00	1.00
Grade 6	70384	0.20	0.40	0.00	1.00
Grade 7	70384	0.19	0.39	0.00	1.00
Grade 8	70384	0.19	0.40	0.00	1.00
Socioeconomic status					
Measure of poverty concentration	70311	0.22	0.81	−2.72	5.05
Measure of social status	70311	−0.48	0.81	−3.33	2.46
Special education status	70384	0.13	0.34	0.00	1.00
Race (dummy variables)					
Black	70341	0.34	0.47	0.00	1.00
Native American	70341	0.00	0.07	0.00	1.00
Asian	70341	0.03	0.18	0.00	1.00
Hispanic	70341	0.52	0.50	0.00	1.00
Male	70384	0.50	0.50	0.00	1.00
Old for grade	70384	0.11	0.31	0.00	1.00
Level 2: school					
Average school incoming achievement	260	0.07	0.43	−0.72	2.28
Average school poverty concentration	260	0.32	0.59	−2.16	1.17
Average school social status	260	−0.39	0.64	−1.62	1.45
School size	260	270.71	153.47	31.00	969.00

Note. Poverty concentration and social status are measures calculated from U.S census data.

Table 4b. Correlation among school-level variables.

	Variable	1	2	3	4	5
1	Average Achievement (outcome)					
2	Average incoming achievement	0.86				
3	Average school poverty concentration	−0.64	−0.60			
4	Average school social status	0.47	0.54	−0.38		
5	School size (enrollment)	0.22	0.08	−0.30	−0.25	

Note. Poverty concentration and social status are measures calculated from U.S census data.

confirms expectations raised in previous literature that instructional leadership may include organizational responsibilities (Hallinger & Murphy, 1985, 1986) or that they may both be part of a broader measure of overall leadership effectiveness (Hallinger, 2003; Hitt & Tucker, 2016), at least when viewed from the perspective of principals themselves. The results are also largely consistent with prior school-leadership work that focused on developing typologies of principal practice (Marks & Printy, 2003; Urick & Bowers, 2014); these studies also found evidence for groups of principals that were strong on multiple leadership aspects simultaneously. Unlike the leadership types developed by Marks and Printy (2003) that found a group of principals that were strong on transformational leadership but not on instructional leadership, the present study did not find a principal type that was high on organizational management but not on instructional leadership, or vice versa.

Grissom and Loeb (2011) interpreted their findings on the positive effects of organizational management to be still consistent with prior literature on instructional leadership, but made a case against exclusively focusing on instructional leadership to the detriment of organizational skills. Their work raised the importance of organizational management skills to more prominence, as they have previously received far less attention than instructional leadership. Grissom

Table 5. Results from HLM models predicting student achievement.

	Model 0		Model 1		Model 2		Model 3	
Intercept	238.79	(0.77)	238.79	(0.76)	240.25	(0.20)	240.25	(0.19)
Level 1: student								
Incoming ISAT score					0.78***	(0.00)	0.78***	(0.00)
Grade 5					3.82***	(0.15)	3.84***	(0.15)
Grade 6					4.25***	(0.16)	4.27***	(0.16)
Grade 7					1.06***	(0.17)	1.10***	(0.17)
Grade 8					5.84***	(0.18)	5.89***	(0.18)
Measure of poverty concentration					-0.09	(0.08)	-0.06	(0.08)
Measure of social status					0.13	(0.08)	0.07	(0.09)
Special education status					-5.18***	(0.15)	-5.22***	(0.15)
Black					-3.40***	(0.24)	-3.25***	(0.25)
Native American					-1.55*	(0.72)	-1.47*	(0.72)
Asian					2.00***	(0.31)	2.02***	(0.31)
Hispanic					-1.70***	(0.20)	-1.61***	(0.20)
Male					-0.43***	(0.09)	-0.43***	(0.09)
Old for grade					-2.20***	(0.16)	-2.18***	(0.16)
Level 2: school								
Average school incoming achievement							2.01*	(0.62)
Average school poverty concentration							-0.34	(0.46)
Average school social status							0.24	(0.40)
School size							-0.05	(0.14)
Latent Class: Least Effective			-5.66**	(1.98)	-1.67**	(0.52)	-1.34**	(0.50)
Latent Class: Less Effective			-5.28*	(2.08)	-0.65	(0.54)	-0.23	(0.53)
Latent Class: Very Effective			0.50	(2.27)	0.38	(0.59)	0.40	(0.57)
Variance Components								
Level 1	720.17		720.17		147.47		147.47	
Level 2	150.40		144.60		9.37		8.51	
Variance Explained								
Level 1			0.00		79.52		79.52	
Level 2			3.86		93.76		94.34	

Note. Poverty concentration and social status are measures calculated from U.S census data.

and Loeb (2011) argued that "principals devoting significant energy to becoming instructional leaders—in the narrow sense—are unlikely to see school improvement unless they increase their capacity for Organization Management as well" (p. 1119). This caution is salient to practice, as the emphasis on training principals to be instructional leaders has raised concerns in some principal preparation programs that candidates are not receiving sufficient training in management (Hallinger, 2005). The LCA results showed that there were no principals that were strong instructional leaders that were not also strong managers. Instead, principals are unlikely to consider themselves strong instructional leaders unless they also view themselves as strong organizational managers. Grissom and Loeb (2011) pointed to problems in principal preparation and preservice training reducing attention to management topics and maintenance of facilities in preference of emphasis on theory and instructional leadership. This work provides support for that concern, and further suggests that there is no option but for principals to be effective organizational managers if they are to be effective as instructional leaders. Calls for principals to become strong instructional leaders have not supplanted their work as building managers, but instead come on top of the demands for them to be effective managers.

Grissom and Loeb (2011) also suggested that districts could consider moving principals with higher organization skills to low-achieving schools; they found that schools with high levels of poverty tend to be led by principals who are less effective in organizational management. However, our results showed that principals who were weak on one domain also tended to be weak on the other domain. Furthermore, our HLM analyses showed a strong relationship between principals' effectiveness and the context of the school in which they were leading. It is possible that leaders who are successful in one context might struggle when placed into schools where it is more difficult to be

an effective organizational manager, particularly if they were successful only in a more advantaged context. An alternative would be to provide better supports for principals in schools with high levels of poverty around organizational management.

From the perspective of a practicing principal, the results of this study suggest that if improvements in principal practice can be made to influence student achievement, they need to be devoted to both instructional leadership and organizational management. The emphasis on principal training and professional development on instructional leadership alone may be misguided, as organizational management is highly correlated with instructional leadership. Organizational management skills could be a necessary foundation for developing instructional leadership skills. However, the cross-sectional analysis conducted here does not allow us to make firm conclusions regarding the direction of the relationship between instructional leadership and organizational management. Recently, researchers have proposed the use of direction dependence analysis (DDA; Wiedermann & Von Eye, 2015) as a diagnostic to evaluate the causal direction of effects in cross-sectional (nonexperimental) data. In brief, DDA uses higher-moments information (skewness and kurtosis) of observed variables and OLS regression residuals to evaluate the superiority of one causal model over the causally reversed model (for more detailed descriptions of DDA see, e.g., Wiedermann, Hagmann, & Von Eye, 2015; Wiedermann & Von Eye, 2015). For example, we can examine whether a model where organizational management leads to instructional leadership (OM → IL) or the reversed model where instructional leadership leads to organizational management (IL → OM) better represents the observed data. The results of the LCA analyses motivated us to subsequently conduct post-hoc DDA analysis to explore the ordering of organizational and instructional leadership skills. Due to space limitations, we substantially summarize the DDA results in Appendix B (detailed statistical results can be obtained from the first author upon request). Overall, our analysis of the CFA factors scores with DDA found empirical evidence that OM → IL is better suited to characterize the observed association than the reversed model IL → OM. Further work is needed with longitudinal measures of both instructional leadership and organizational management to verify how these skills evolve over time.

The findings of the present study make it difficult to isolate specific activities that constitute effective leadership practice. Instead we find that when principals rate themselves as effective, they are reflecting on a range of activities that at a minimum include instructional and organizational management activities. However, this is the case only from the principal's own point of view. Survey analysis of similar questions asked of assistant principals, teachers, and students could well yield different findings. Recent work in education policy and classroom instruction (Camburn, Han, & Sebastian, 2015; Desimone, 2006; Desimone, Smith, & Frisvold, 2010) shows that just changing the source of information on survey questions worded exactly the same can alter the findings of a study. Grissom and Loeb (2011), for example, found that assistant principal ratings of principal efficacy in instructional leadership were positively related to math achievement gains. Desimone (2006) argues that such discrepancies do not diminish the validity of survey studies, but are instead useful for the purposes of triangulation—developing a complex picture of how different stakeholders experience policy and organizational events differently, and how those experiences translate to different outcomes.

A potential next step from this study could be to include the perspectives of teachers, students, and other stakeholders to develop comparative typologies of leadership practice. The classification of leadership practice could also be extended to leaders in the building other than the school principal. Recent theoretical developments in the school-leadership research argues that the principal-focused view of school leadership is outdated and not reflected in practice; in reality leadership is distributed more broadly among teachers and other school staff in formal and informal interactions (Camburn, Rowan, & Taylor, 2003; Harris, Leithwood, Day, Sammons, & Hopkins, 2007; Heck & Hallinger, 2009; Leithwood & Jantzi, 1998; Spillane, 2006; Spillane, Camburn, & Pareja, 2007; Spillane, Halverson, & Diamond, 2004). A distributed leadership–focused study could also use LCA for the purpose of developing typologies of overall school leadership rather than leadership from principals

alone. This likely would involve obtaining leadership ratings of principals and others in the building. The modeling involved for such projects would be more sophisticated than that used in the present study, likely involving multilevel extensions. A few studies have already explored this line of inquiry, applying multilevel LCA to principal and teacher survey information (Bowers et al., 2017; Urick, 2016b). Future studies could also integrate psychological factors such as principals' and teachers' sense of self-efficacy, coping and stress, and job satisfaction to get more descriptive classification models of leadership.

There are several other limitations to the study. As described earlier, the survey data collected only two aspects of leadership work. Had the survey items measured other dimensions referenced by Grissom and Loeb (2011)—internal relations, administration, and external relations—a second-order factor analysis could have been conducted to examine if instructional leadership and organization management could inform a single latent factor. The data from the surveys are cross-sectional; therefore, the results cannot be interpreted to establish causal relationships. It could be the case that certain school contextual factors lead principals to feel less effective in their leadership skills, and these characteristics are also related to school performance. For example, principals who see their schools performing well in student achievement metrics may rate themselves as effective instructional leaders. Although we did control for students' individual prior test score at the student level and average incoming test scores at the school level, our study might not have adequately controlled for other important contextual and organizational conditions. Another limitation in the data is the reliance on self-report surveys to measure principal effectiveness in instructional leadership and organizational management. These surveys are shown to be prone to errors due to various sorts of biases such as social desirability, recall, and subjective evaluations (see Camburn et al., 2015, 2010). Since our study was a replication and extension of the Grissom and Loeb (2011) study, it was important to retain the same items and respondent type in order to compare results.

We also did not study the ways in which principal background characteristics, such as experience and training, and school contextual characteristics predict principal typologies and principal effectiveness in instructional leadership or organizational management; we simply inferred that these relationships existed based on the change in the HLM coefficients once school-context variables were included in the models predicting student achievement. The influence of context on principal practice is explored in the work of Urick and Bowers (2014), who did find that leaders exhibited different styles based on their school context (e.g., urbanicity, size). Further, there is emerging consensus that school leadership effects are largely indirect, mediated through many school organizational factors such as teacher professional community and the learning climate. Our analyses did not examine mediational relationships. While we showed that students in schools led by *least effective* principals performed significantly lower than their peers in other schools, we did not examine what school organizational features mediate this difference. The results of the present study are also from a unique urban school district, Chicago; therefore, the results may not be generalizable to other contexts. Future studies can extend this research by including more leadership domains and examining principal practice in more diverse contexts.

Notes

1. Measures of instructional leadership and organizational management used by Grissom and Loeb (2011) were designed to orthogonal (unrelated) to each other. Thus, their relationship to each other could not be studied.
2. We argue later that the debate between management and leadership effectiveness has been indirectly addressed in education research.
3. Studies on principal instructional leadership typically rely on teacher ratings of leadership; there is less research that examines principals' own ratings (Urick & Bowers, 2014).
4. Alternative approaches would have been to conduct a latent profile analysis on the continuous indicators of instructional leadership and organizational management.
5. We examined the dependent variable distribution, variance homogeneity, and residual files to check assumptions underlying the HLM analysis; these results are available from the authors upon request.

6. The standard deviation in achievement across schools can be calculated from the Level 2 variance component in Model 0 (150.40). The difference in achievement for schools in the less- and least-effective leadership groups is at least 5.28 points, which is 43% of the standard deviation in achievement across schools, calculated as the square root of 150.40).

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Appendix A

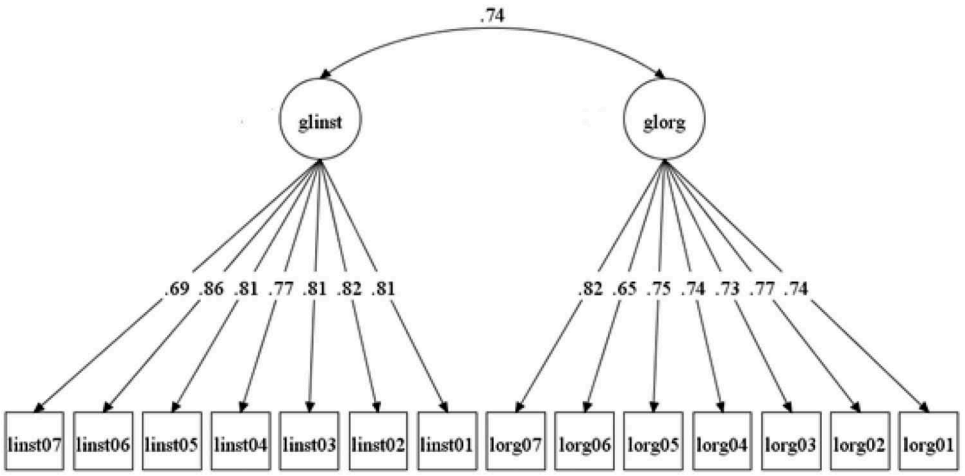


Figure A1. Results of CFA of instructional leadership and organizational management. Model fit indices (CFI = 0.95; TLI = 0.95); linst01 = using data to inform instruction; linst02 = developing a coherent education program; linst03 = using data for program evaluation; linst04 = improving teachers' practice through formal evaluations; linst05 = coaching teachers; linst06 = implementing effective professional development; linst07=effectively integrating supplementary after-school or summer programs; lorg01 = developing and monitoring a safe school environment; lorg02 = dealing with staff concerns; lorg03 = managing budgets and resources; lorg04 = hiring personnel; lorg05 = managing personal, school-related schedule; lorg06 = maintaining campus facilities; lorg07 = managing non-instructional staff.

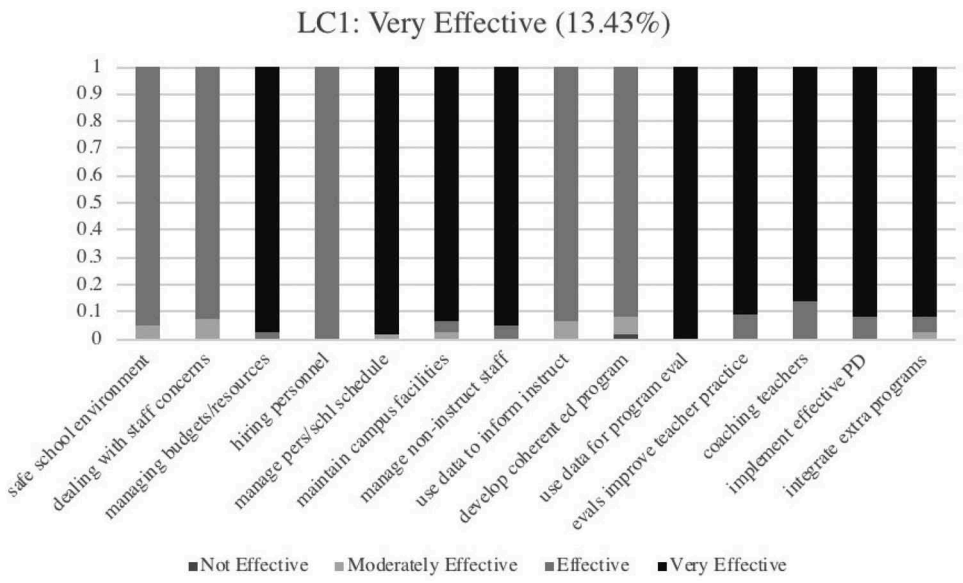
Appendix B

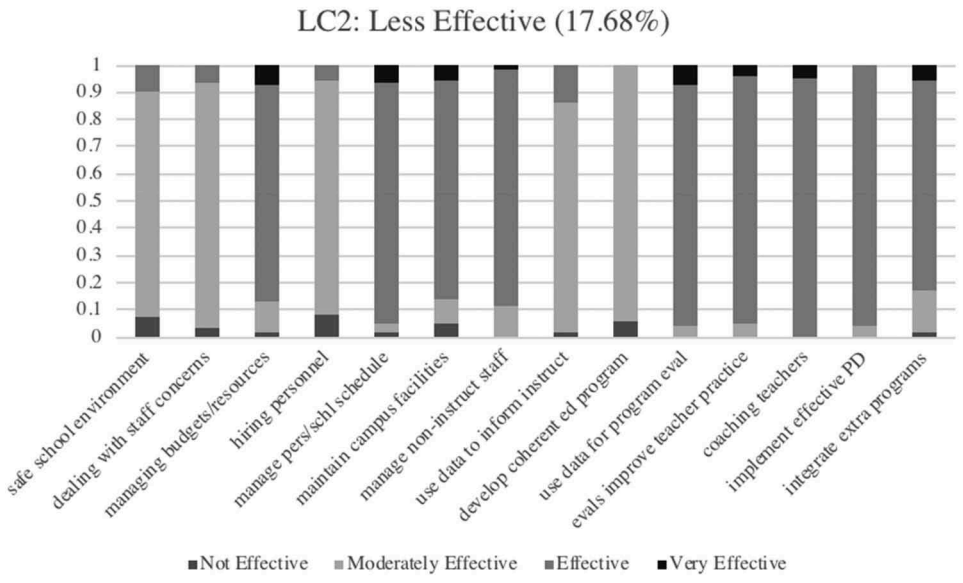
Direction Dependence Analysis (DDA) Results

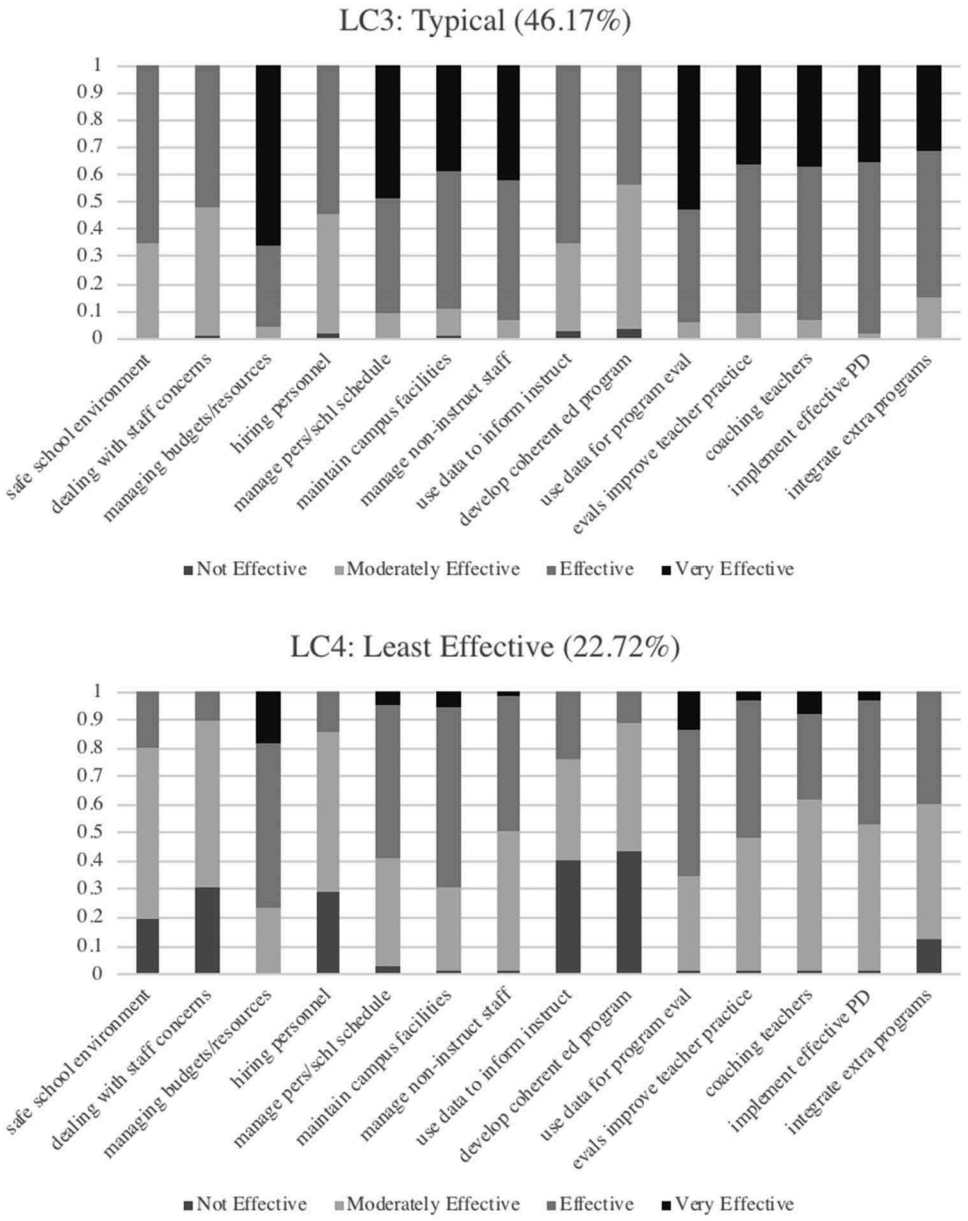
In essence, DDA examines three components of tentative OLS regression models: (1) distributional properties of observed variables, (2) distributional properties of residuals obtained from competing models, and (3) independence properties of predictor(s) and error term. According to DDA, in the true model (1) the outcome variable is closer to the normal distribution than the predictor, (2) the error term of the true model is closer to normal distribution than the error term of the competing model, and (3) the independence assumption of predictor and error is fulfilled in the true model (for details, see Wiedermann & Von Eye, 2015). Both variables—organizational management (OM) and instructional leadership (IL)—were symmetrically distributed. Thus, we base directionality decisions on excess kurtosis criteria (see. Wiedermann & Li, 2018). While the excess kurtosis of OM significantly deviated from zero, no significant deviations were observed for the excess kurtosis of IL. In addition, the excess kurtosis of OM was found to be significantly higher (in absolute value) than the excess kurtosis of IL.

The results are, thus, in line with requirements of the first DDA component. Further, no significant deviations from normality were observed for the residuals obtained from both models. Thus, no distinct decision is possible based on the second DDA component. The third DDA component was evaluated using six different nonlinear correlation tests to assess the independence of model-specific predictors and residuals (nonzero correlations indicate that violations of the independence assumption). All six tests were non-significant in the model OM → IL, while two significant nonlinear correlations were observed for the IL → OM model. Overall, we have found empirical evidence that OM → IL is better suited to characterize the observed association than the reversed model IL → OM.

Appendix C


LC1: Very Effective (13.43%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
safe school environment
dealing with staff concerns
managing budgets/resources
hiring personnel
manage pers/schl schedule
maintain campus facilities
manage non-instruct staff
use data to inform instruct
develop coherent ed program
use data for program eval
evals improve teacher practice
coaching teachers
implement effective PD
integrate extra programs
Not Effective
Moderately Effective
Effective
Very Effective


LC2: Less Effective (17.68%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
safe school environment
dealing with staff concerns
managing budgets/resources
hiring personnel
manage pers/schl schedule
maintain campus facilities
manage non-instruct staff
use data to inform instruct
develop coherent ed program
use data for program eval
evals improve teacher practice
coaching teachers
implement effective PD
integrate extra programs
Not Effective
Moderately Effective
Effective
Very Effective



Response probabilities for each indicator.