The Influence of School Leadership on Classroom Participation: Examining Configurations of Organizational Supports

JAMES SEBASTIAN

University of Missouri, Columbia

ELAINE ALLENSWORTH

University of Chicago

DAVID STEVENS

University of Chicago

Background: *In this paper we call for studying school leadership and its relationship to instruction and learning through approaches that highlight the role of configurations of multiple organizational supports. A configuration-focused approach to studying leadership and other essential supports provides a valuable addition to existing tools in school organizational analysis and is particularly useful in examining equifinality and causal asymmetry. Equifinality is the idea that more than one pathway can result in a desired outcome whereas causal asymmetry suggests that the set of conditions that lead to the presence of an outcome need not be the same as the conditions that lead to its absence.*

Focus of Study: *This study uses a configurational approach to examine how school leadership and other organizational supports are related to an important aspect of instruction—students' classroom participation.*

Research Design: *We apply fuzzy set qualitative comparative analysis (QCA) to administrative and survey data of high schools from a large urban school district to examine combinations of organizational supports that are associated with classroom participation.*

Conclusions: *The study draws attention to the utility of applying configurational approaches to investigate the influence of complex combinations of organizational supports on school outcomes. We compare this approach to more traditional methods that focus on the effects of isolated factors, controlling for each other. Our results show that leadership is associated with students' classroom participation via multiple configurations of organizational supports. These configurations are different from the set of organizational supports that are related to an absence of classroom participation.*

Teachers College Record Volume 116, 080305, August 2014, 36 pages

0161-4681

> "There's no such thing as a high-performing school without a great principal. It is impossible. You simply can't overstate their importance in driving student achievement, in attracting and retaining great talent to the school." (U.S. Secretary of Education Arne Duncan as cited in Connelly, 2010, p. 35)

> "We claimed, based on a preliminary review of research, that leadership is second only to classroom instruction as an influence on student learning. After six additional years of research, we are even more confident about this claim. To date we have not found a single case of a school improving its student achievement record in the absence of talented leadership." (Louis, Leithwood, Wahlstrom, & Anderson, 2010, p. 9)

> "The preponderance of evidence indicates that school principals contribute to school effectiveness and student achievement indirectly through actions they take to influence school and classroom conditions (Hallinger & Heck, 1996a, 1996b). The size of the effects that principals indirectly contribute towards student learning, though statistically significant, is also quite small." (Hallinger, 2005, p. 229)

These quotes highlight a much debated contradiction in education research on the influence of school leadership on teaching and learning. An intuitive belief in the importance of leadership and a wealth of evidence from qualitative research suggest that school leadership has a substantial influence on classroom instruction and student learning in schools (Leithwood, Louis, Anderson, & Wahlstrom, 2004; Louis, Leithwood, et al., 2010). Yet evidence from quantitative studies suggests quite the contrary—that leadership effects are small and also largely indirect, working through an array of mediating organizational processes (Hallinger & Heck, 1996a, 1998). In a review of both quantitative and qualitative studies, Louis, Leithwood, et al. (2010) suggested two reasons for differing conclusions on the importance of leadership. First, qualitative case studies are often done in atypical settings, perhaps where leadership is exceptional or where leadership is required most. This could be one reason why qualitative studies report substantial leadership effects in contrast to quantitative studies that seek to estimate average effects over multiple settings. Second, even though quantitative studies suggest small and indirect effects of leadership, it explains 25% of the total variation between schools in student achievement. In this regard, only classroom instruction is more important than the role of leadership in influencing student achievement (Louis, Leithwood, et al., 2010).

In this paper we contend that another reason for apparent contradictions in the importance of leadership and other school processes arises from limitations of quantitative methods typically employed in school organizational analysis. For example, given that there is emerging consensus that school leaders indirectly influence teaching and learning via multiple mediating factors (Hallinger & Heck, 1996a, 1998), two different analytical approaches can be taken to clarify the role of leadership and mediating factors. The first approach would typically answer a question such as this: Of all the organizational processes that leaders work on, which of them has significant and meaningful effects on teaching and learning, while controlling for everything else? Linear regression-based methods are best suited for this approach but are of limited use to practitioners because organizational processes do not exist in isolation—they naturally impact each other. The second approach would seek to answer a different question: What are the combinations or configurations of organizational processes that leaders work on that lead to strong teaching and learning, and what configurations undermine teaching and learning? The second approach is perhaps far more useful for school practitioners and policy makers. Yet little attention has been devoted to examining configurations of organizational supports systematically, and traditional quantitative methods are not well suited to studying configurations (Ragin, 2008; Ragin & Fiss, 2008).

Here, we call for advancing empirical research on school leadership and school organizational analysis more broadly by demonstrating the importance of examining configurations of supports that influence important school outcomes. Such an approach adopts a holistic principle of research where the focus is on patterns related to outcomes rather than on individual variables in isolation (Delery & Doty, 1996; Fiss, 2007, 2011). While configuration-based approaches have recently gained increased attention in fields such as business and marketing management, industrial organization, and studies of welfare states (see e.g., Crawford, 2012; Fiss, 2011; Kent & Argouslidis, 2005; Kvist, 2007; Ordanini & Maglio, 2009; Sager & Andereggen, 2012), they have not been widely applied in educational leadership and school organizational research.

Adopting a configuration-based approach contributes to the research on school leadership and school organization in several ways. First, it examines combinations of mediating school organizational supports that are important for school effectiveness rather than isolating the importance of individual factors. Second, it extends theories of equifinality to the study of school effectiveness. Equifinality suggests that "a system can reach the same final state from differing initial conditions and by a variety of paths" (Katz & Kahn, 1978, p. 30). Gresov and Drazin (1997) clarify that "equifinality occurs when, in a sample of organizations, different structural alternatives yield the same functional effect" (p. 408). The concept of equifinality is receiving considerable attention in organizational research because it provides a theoretical basis for why several different organizational design choices can all lead to effective outcomes (Fiss, 2011; Gresov & Drazin, 1997). Third, a configurational approach advances the notion of causal asymmetry—that the set of factors associated with the presence of an outcome need not be the same as those associated with the absence of an outcome (Ragin, 2008). As we show here, these advances allow for a more complete understanding of the relationships between school leadership, school organizational supports, and instruction and learning.

While many methods can be used to examine configurations among school organizational supports (e.g., cluster analysis, latent class analysis, and multidimensional scaling), in this paper we use fuzzy set qualitative comparative analysis (QCA; Ragin, 2008). This method uses set theory to uncover necessary and sufficient sets of conditions as they relate to an outcome (Ragin, 2000, 2008). The approach offers several advantages over correlation-based quantitative methods such as multiple regression and structural equation modeling (SEM); we describe these advantages in detail later in the paper. The empirical data for this study comes from the Chicago Public Schools, using administrative data and teacher survey data from biannual surveys administered by the University of Chicago Consortium on Chicago School Research (CCSR).

We examine the same data used in a recent study of school leadership (Sebastian & Allensworth, 2012) that examined the influence of school leadership on teaching and learning via an array of mediating organizational supports using multilevel structural equation modeling (SEM). Using the same data allows us to compare the findings from the present study (using a configuration-based approach) to the Sebastian and Allensworth (2012) study that uses a correlation-based approach. One difference from that study is that we do not examine student achievement as an outcome but focus on classroom instruction. Adopting a multifaceted conceptualization of classroom instruction that focuses on interactions among teachers and students around educational material (Cohen & Ball, 1999), the CCSR teacher surveys collect information on multiple dimensions of instruction (Bryk, Sebring, Allensworth, Luppescu, & Easton, 2010). These include academic demands, critical thinking, quality of student discussions, classroom disorder, time on homework, and student participation (Bryk et al., 2010; Sebastian & Allensworth, 2012). In the current study, we limit the analysis to examining one aspect of classroom instruction—student participation, which measures the extent to which students perform tasks expected of them, come to class on time, attend class regularly, turn in their assigned homework, come adequately prepared and pay attention in class, and actively participate in class.[1] While student participation is just one feature of the quality of classroom instructional environments (Cohen & Ball, 1999), the Sebastian and Allensworth (2012) study found this aspect to be a particularly strong mediator of student achievement in high schools. It also closely corresponds to the element of instruction that the Bill and Melinda Gates (2011) Measures of Effective Teaching (MET) study found to be most strongly associated with student learning gains, classroom control, that was measured through surveys of middle grade students.

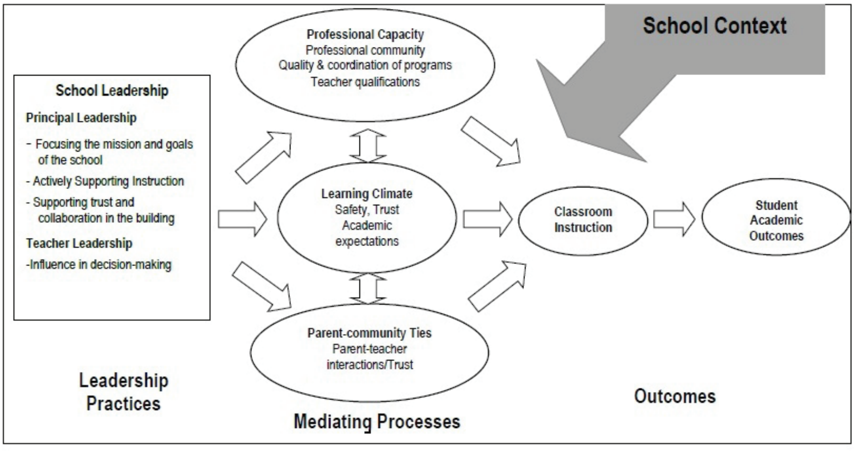
Using fuzzy set QCA, we show that leadership is associated with student participation through different configurations of essential organizational supports. The set of organizational supports that are associated with high levels of student participation are quite different from the set of supports that are related to an absence of student participation, which are again different from supports associated with very high student participation. We conclude by discussing the implications of the study for school leadership and organizational research. In discussing the limitations of the study we also outline a series of next steps for empirical research in studying leadership and school organizational supports using a configuration-based approach.

RESEARCH ON SCHOOL LEADERSHIP

Most studies of school leadership, regardless of whether they use qualitative, quantitative, or mixed methods, typically acknowledge the complexity inherent in the work of school leaders. Myriad practices and multiple modes of school leadership have been associated with student achievement (Hallinger & Heck, 1996a, 1998; Marks & Printy, 2003; Marzano, Waters, & McNulty, 2005). One of the most salient roles of a school principal for improving student achievement is as an instructional leader. This includes a direct role through their expertise in content and pedagogy and indirectly through supporting good instructional practices (Hallinger, 2005; Hallinger, Bickman, & Davis, 1996; Hallinger & Heck, 1998; Halverson, Grigg, Prichett, & Thomas, 2007; Louis, Dretzke, & Wahlstrom, 2010; Stein & D'Amico, 2000; Stein & Nelson, 2003). To show improvements in achievement over time, they also need to be transformative leaders—building capacity, inspiring and motivating employees, and developing commitment to organizational goals (Bass, 1998; Leithwood & Jantzi, 1999, 2005; Marks & Printy, 2003). Making the study of leadership more complex, there is increasing recognition that there are sources of leadership situated outside the principal and distributed among teachers and other key school personnel (Camburn, Rowan, & Taylor, 2003; Spillane, 2006; Spillane, Camburn, & Pareja, 2007). Thus, the conceptualization of what leadership is, and what leaders should do to improve instruction and student learning, is multidimensional.

Besides being a complex role, it is difficult to measure leadership effects on student achievement as these effects are largely indirect, working via mediating processes such as school climate, culture, and capacity (Hallinger & Heck, 1996a, 1996b, 1998, 2010a, 2010b; Witziers, Bosker, & Kruger, 2003). Bryk et al. (2010), for example, contend that school leadership works via three key mediating processes to influence teaching and learning: the professional capacity of the staff, parent-community ties, and the school climate.[2] They combine to influence instruction in classrooms, which in turn influences student learning (see Figure 1).

Figure 1. Conceptual model of school leadership, mediating processes, instruction, and student learning



Thus, a key methodological challenge in studying the relationship between school leadership and school outcomes is using appropriate methods to clarify the role of organizational factors/supports that mediate the influence of leadership on teaching and learning. Structural equation modeling (SEM) has been useful in examining the strength of direct and indirect relationships of leadership with school outcomes via multiple mediating factors (Hallinger & Heck, 1996a, 1996b, 2010a, 2010b; Supovitz, Sirinides, & May, 2010). However, most studies of leadership focus on a limited set of factors that are often unique to the study, making comparisons across studies difficult (Louis, Dretzke, et al., 2010). A limited number of studies have considered the influence of leadership via multiple mediating processes simultaneously (see e.g., Hallinger et al., 1996a; Louis, Leithwood, et al., 2010). These studies use a net effects approach (Ragin, 2008; Ragin & Fiss, 2008) that treats variables as competing with each other for explaining variation in an outcome; the focus is to estimate the effects of individual variables in isolation, net of, or controlling for, other variables (Fiss, 2007, 2011; Ragin, 2000, 2008; Ragin & Fiss, 2008). For example, Sebastian and Allensworth (2012) found learning climate to be the only significant mediating factor "holding constant" other mediating processes such as parent/community ties, professional development, professional community, and school contextual factors.

Methods such as multiple regression and SEM are suitable for isolating the relative importance of independent variables net of each other, but as Louis, Dretzke, et al. (2010) note, "most school variables considered separately, have only small effects on student learning. To obtain large effects, educators need to create synergy across relevant variables" (p. 10). Leadership studies face methodological constraints in uncovering this synergy or in studying optimal combinations of relevant organizational variables. Theoretically, the effects of combinations of variables or configurations can be studied in regression through interaction effects. However, modeling configurations through interaction effects in regression can be challenging for at least three reasons. First, the number of interactions that can be included in a regression model is limited by the sample size, making it difficult to implement in studies that do not have a large sample of schools. Second, when interactions go beyond two-way or three-way interactions, the results become hard to interpret (Fiss, 2007). Last, when there are multiple mediating factors, it is difficult to determine which combinations and how many higher order interactions to include in the regression model. Because of these inherent methodological limitations, school leadership studies typically acknowledge the importance of configurations of organizational supports but do not systematically examine relevant and optimal configurations.

Another limitation of traditional quantitative methods such as multiple regression is that they often assume unifinality—which suggests one optimal configuration for all cases for achieving success in the outcome (Fiss, 2007). This methodological constraint stands in stark contrast to leadership and school organizational theory that often cautions against a "one size fits all approach" (Louis, Leithwood, et al., 2010, p. 101) to school leadership effectiveness or a single panacea for organizing schools for effective reform (Brooks, Scribner, & Eferakorho, 2004). Furthermore, the importance of context is invariably highlighted in most leadership and school organizational research. Yet, the importance of match between context and organizational strategy is not adequately addressed in empirical research (Hallinger et al., 1996a). Lastly, organizational studies using quantitative methods often assume that if there is an association between the presence of a factor and an outcome, then absence of that factor must be associated with absence of the outcome. It is safe to say that concepts such as equifinality and causal asymmetry have not been empirically examined in education leadership and school organization research, even though they offer great promise in explaining how different leadership styles and organizational strategies can all lead to school performance and how different sets of conditions can be important in determining success versus contributing to failure in outcomes.

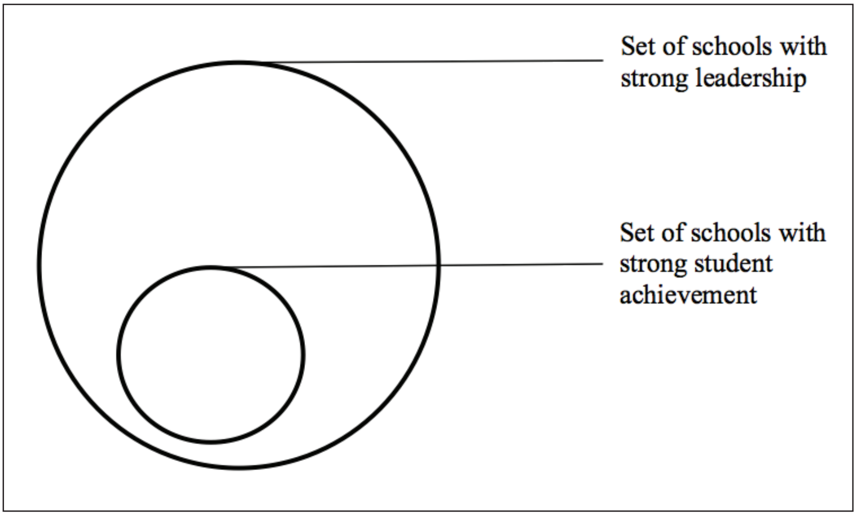
CONFIGURATIONAL APPROACHES TO STUDYING SCHOOL LEADERSHIP AND ORGANIZATION

The present study proposes an alternate approach to studying leadership by examining configurations of essential school supports that leaders focus their work on and that are associated with teaching and learning. A configurational approach acknowledges the context dependent and complex nature of organizations (Delery & Doty, 1996; Doty & Glick, 1994) where "parts of a social entity take their meaning from the whole and cannot be understood in isolation" (Meyer, Tsui, & Hinings, 1993, p. 1178). This approach is more consistent with theory on school leadership and school organization that typically acknowledges that leaders have to structure an array of organizational supports to influence the core activity of schools—classroom instruction. As Knapp, Copland, and Talbert (2003) note, in order to improve student learning, successful leaders act purposefully along multiple pathways that strategically "take advantage of events, relationships, conditions, and resources within a particular setting and time" (p. 23). The configurational approach proposed here can ultimately result in holistic theories of school leadership that connect leadership, school organizational structures, leadership strategies, and the school context to important outcomes such as student achievement.

We use a set-theoretic method, qualitative comparative analysis (QCA) to study schools from a configurational approach; these methods are well suited for this purpose as they conceptualize observations as combinations of attributes as they relate to important outcomes (Fiss, 2007; Ragin, 2000, 2008). The QCA method was developed by Ragin (1987) to analyze binary data and later developed to work with nonbinary data as well (Ragin, 2000, 2008; Rihoux & Ragin, 2009). Boolean algebra is used to examine which combinations of attributes result in an outcome (Fiss, 2011; Ragin, 2000, 2008). The following section provides a brief overview of set-theoretic methods. Readers are referred to literature specific to set-theoretic methods (see e.g., Fiss, 2011; Ragin, 2000, 2008; Ragin & Fiss, 2008) for more detailed descriptions of these procedures.

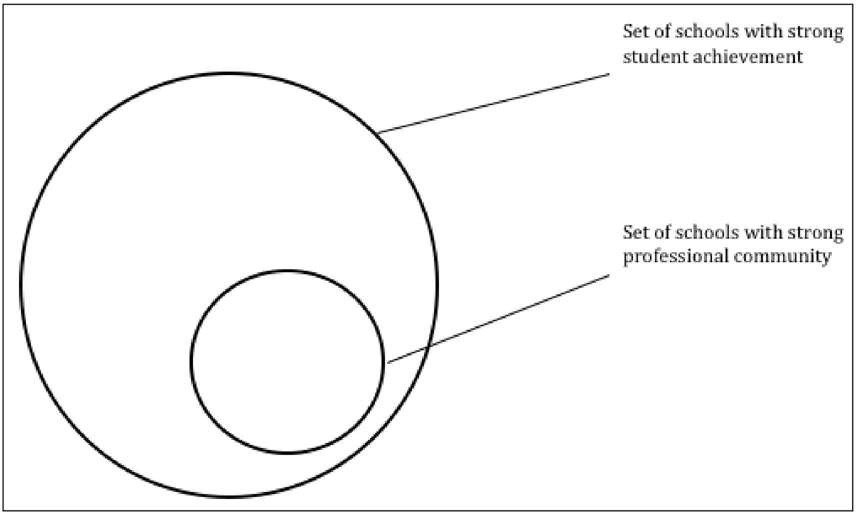
Consider a researcher with dichotomous (yes/no) data from a school district on several school organizational characteristics including "strong school leadership" and "strong professional community of teachers" and one school outcome "strong gains on student achievement." Consider that the researcher also has information on school contextual characteristics such as whether the school has a large student enrollment ("school size") and if the school is a selective enrollment school based on students' prior achievement ("high prior achievement"). If the researcher finds two results: (a) all schools with strong gains on achievement also have strong leadership and (b) all schools with strong school professional community have strong gains in achievement, this illustrates two important conditions in set-theoretic methods (Ragin, 2000, 2008). The first result (Figure 2) depicts the necessary condition indicated when instances of an outcome are a subset of instances of a condition. A necessary condition must be present for the outcome to also be present, but it may not be enough on its own. The second result (Figure 3) depicts a sufficient condition indicated when instances of the condition are a subset of instances of the outcome. A sufficient condition produces the outcome but may be one of several conditions that does so.

Figure 2. Set–subset diagram representing necessary condition



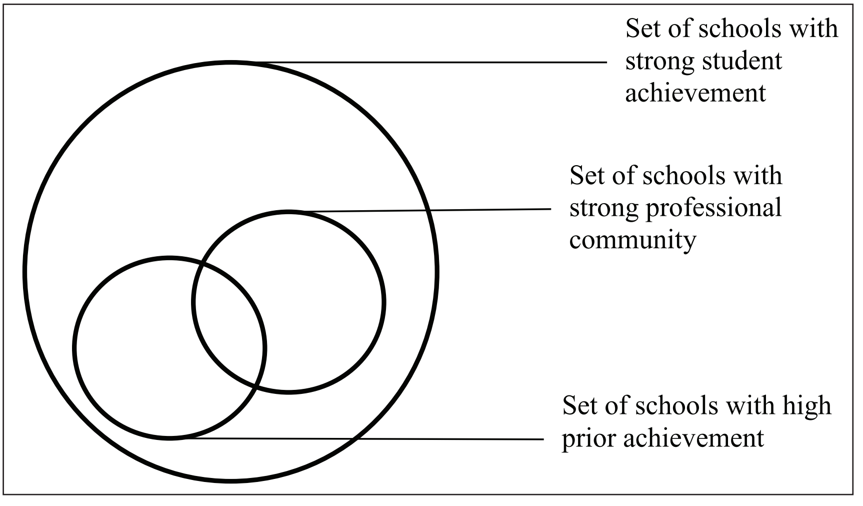
These examples show how important connections can be missed by correlational analysis (Ragin, 2008). In the first result, the set-theoretic method establishes that school leadership is a necessary condition for achievement gains, as all schools with strong student achievement also have strong leadership. But the presence of schools with strong leadership that do not meet the outcome (strong gains in achievement) can result in a weak correlation between leadership and achievement gains. The fact that there are many schools with strong leadership that do not have strong gains in student achievement does not undermine a claim that school leadership is a necessary condition; those schools may simply lack other conditions that need to accompany strong leadership for a school to show high achievement. The set-theoretic approach makes intuitive sense because it is likely the case that strong leadership alone cannot result in effective schools; rather leadership may need time to foster other factors such as teacher capacity and strong professional development in order for schools to be successful.

Figure 3. Set–subset diagram representing sufficient condition



In Figure 3, the fact that all schools with strong professional community have strong student achievement indicates that this condition is sufficient on its own to produce strong achievement gains. As with the leadership example in Figure 2, the fact that there are schools with strong gains in achievement that do not have strong professional community does not undermine the claim that a strong professional community of teachers is a sufficient condition for gains in achievement. There might be alternative pathways through which schools might reach the same outcome even though those pathways might be more difficult for schools to follow. These pathways perhaps involve strengthening of other organizational structures such as professional development to compensate for weakness in teacher community. Perhaps contextual factors such as selective enrollment of high achieving students can play a role, so that a strong professional community of teachers is not necessary if the school only serves highly motivated, academically strong students. Figure 4 depicts such a hypothetical situation where either strong professional community or selective enrollment of students with high prior achievement lead to achievement gains.

Figure 4. Set–subset diagram representing multiple sufficient conditions



In Boolean notation the Venn diagram in Figure 4 is expressed as:
Professional Community + High Prior Achievement → Achievement Gains

read as: Professional Community *or* High prior achievement lead to student achievement gains. In Boolean notation, the + sign stands for the logical OR (union of conditions), "●" stands for the logical AND (intersection of conditions), and "~" stands for the absence of a condition. Typically researchers are interested in complex combinations of organizational and contextual variables that lead to outcomes. QCA is well suited for this as it can analyze complex causation or association (Ragin, 2008), defined as "situations in which an outcome may follow from several different combinations of causal conditions, that is, from different causal recipes" (p. 23).

In our previous example a hypothetical result could be:

Strong School Leadership ● Professional Community
+ High Prior Achievement ●~ School Size → Achievement Gains

This statement introduces a contingency hypothesis (Fiss, 2007), i.e., schools with strong leadership will have high student achievement gains, provided they also have a strong professional community. Similarly, schools enrolling students with high prior achievement will also produce achievement gains provided they maintain a small school size (absence of large school size). As noted by Fiss (2007), these Boolean statements can very elegantly summarize the match between organizational characteristics, context, and performance.

Formal analysis of complex combinations of organizational structures and contextual features that result in an outcome starts in QCA with construction of the truth table—a list of every single combination of conditions along with the outcome associated with each combination (Ragin, 2008; Ragin & Fiss, 2008). If there are k conditions in the analysis, this will result in a truth table with 2^k rows. Each observation or case in the study is categorized into this truth table based on their values for the conditions. Therefore some rows on the truth table will have many cases, implying that there are many observations that have the particular combination of attributes; some rows will have few cases, and some none (Fiss, 2011; Ragin, 2008). From the truth table, two important concepts in QCA are used to reduce the 2^k rows in the table. Coverage refers to the minimum number of cases for a particular combination to be considered as a relevant solution by the researcher (Ragin & Fiss, 2008). When the sample size of a study is small, a researcher might want to consider any configuration of conditions that result in the outcome. For medium sized or larger samples, the researcher might be more restrictive, requiring at least two or three cases for a solution (i.e., a particular combination of conditions) to be considered. For medium or large sized samples, considering every combination that leads to an outcome might not be useful as some information might simply be noise and the solutions will be too numerous to interpret. Consistency refers to the extent to which cases have a common configuration of also display the outcome of interest (Ragin, 2000, 2006; Rihoux & Ragin, 2009). Thus, when considering a solution, if half the cases displaying that particular combination show the outcome but the rest of the cases do not display the outcome, the consistency of that solution cannot be considered very high. Consistency can be estimated by the proportion of cases displaying a particular combination of conditions that also displays the outcome (Fiss, 2007; Ragin, 2008). The minimum recommended consistency level is 0.75 (Ragin, 2006, 2008) or higher (Fiss, 2011).

Boolean algebra is used to simplify the results from the truth table that list the various configurations that are sufficient for the outcome. Consider for example the following hypothetical solutions for the study described earlier:

Strong School Leadership ● Professional Community ●~ School Size →Achievement

Strong School Leadership ● Professional Community ● School Size →Achievement

Clearly both the presence or absence of large school size are associated with the outcome, and these two statements can be logically reduced to one Boolean statement:

Strong School Leadership ● Professional Community → Achievement.

Using similar operations to reduce the number of combinations, the Quine-McCluskey algorithm is used to obtain simple statements that contain all possible combinations that lead to the outcome (see Fiss, 2007, 2011; Ragin, 2000, 2008).

The procedures used to logically reduce configurations associated with an outcome also include a step termed counterfactual analysis (Fiss, 2007, 2011; Ragin, 2000, 2008). As described earlier, if there are k conditions considered in a study the truth table will have 2^k combinations. This leads to the problem of limited diversity, which means that often there will be a limited number or no instances of particular combinations that will complicate the reduction of combinations into simple statements using Boolean algebra. Counterfactual analysis is a method to deal with lack of empirical instances of particular combinations by including substantive and theoretical knowledge about conditions. The reader is referred to (Fiss, 2007, 2011; Ragin, 2000, 2008) for detailed descriptions of counterfactual analysis. Very briefly, there are two types of counterfactual analysis, "easy" and "difficult." When a redundant condition is added to a configuration because theoretical knowledge suggests that the cause is associated with the outcome, it is called an easy counterfactual. In contrast, if a condition is assumed to be redundant and is removed from a configuration associated with the outcome, even though prior theory links the presence of the condition with the outcome, it is termed a difficult counterfactual (Fiss, 2011; Ragin, 2008).[3]

There are three types of solutions to QCA analysis depending on whether easy and/or difficult counterfactuals are included to simplify the solution. A parsimonious solution includes both easy and difficult counterfactuals to get the simplest solutions. An intermediate solution only includes easy counterfactuals. A complex solution does not include any counterfactual analysis. The intermediate solutions that consider only easy counterfactuals are usually of most interest to researchers (Fiss, 2011). In short, when substantive knowledge and prior research is used to simplify the solution we obtain an intermediate solution. On the other hand, if all possible combinations of conditions are used to simplify the solution, regardless of prior research and substantive knowledge, we obtain the parsimonious solution. Easy and difficult counterfactuals also determine core and peripheral conditions. Core conditions show a strong association with the outcome and appear in the intermediate and parsimonious solutions; peripheral conditions show weaker evidence of a relationship with the outcome and are only part of intermediate solutions (Fiss, 2011).

Binary Data to Fuzzy Sets

The QCA methods described so far are applicable to binary data. However, because most phenomena in social science do not have a binary character and vary by degree, set theoretic methods were not widely used until recently in social science research (Ragin, 2000; Ragin & Fiss, 2008). Recent mathematical developments allow the application of set theoretic methods to nonbinary data through the use of fuzzy sets. Fuzzy sets allow for membership in a set to be less restrictive than binary sets, and instead of just two values zero or one, researchers can calibrate "partial membership in sets" with values that range in between zero and one (Ragin, 2000; Ragin & Fiss, 2008). They can be seen as a continuous variable that has been converted to a fuzzy set using calibration (Ragin, 2000, 2008; Rihoux & Ragin, 2009). Researchers use thresholds that are based on substantive knowledge to define set membership with values close to zero indicating nonmembership and values close to one denoting full membership in that set.

Consider for example, a researcher examining the quality of principal leadership in a school based on the proportion of teachers endorsing their principal's leadership. The researcher can aggregate information from teachers to the school level and convert this information to a fuzzy set of principal endorsement using at least three values, 0, 1, and 0.5. Nonmembership in the fuzzy set of principal endorsement is denoted by 0, 1 denotes full membership and 0.5 denotes a crossover point, a point of maximum ambiguity or fuzziness (thus the name fuzzy sets) and where membership is neither in nor out (Ragin, 2008). Substantive knowledge has to be used in deciding where to set these thresholds. The researcher in this example might set the benchmark of 0.5 in the fuzzy set of principal endorsement for schools where 50% of teachers endorse the principal but 50% do not, clearly a situation where there is ambiguity about principal endorsement. Creation of fuzzy sets usually involves more than three benchmarks to produce more refined fuzzy sets.

With calibration, all the original raw scores are converted to range from zero to one based on anchors chosen as thresholds; an intermediate step involves transforming scores into a log odds metric (Fiss, 2011). Calibration or the setting of meaningful benchmarks to create fuzzy sets is another instance that involves the researchers' substantive knowledge to proceed with QCA analysis. Recall that substantive knowledge is also required in considering easy and difficult counterfactuals to simplify the analysis of Boolean statements. The creation of fuzzy sets allows us to use the set-theoretic concepts and operations described earlier in relation to binary data, such as necessary and sufficient conditions, creation of truth tables, and logical reduction of combinations of conditions using Boolean algebra (Ragin, 2008).

RESEARCH QUESTIONS

In this study we examine the relationship of school leadership and the organizational supports of school climate, professional capacity of staff, and parent–community ties as they relate to school organizational performance. The configuration approach described here permits the study of different combinations of essential supports that are associated with school performance. The method also allows us to separately examine if these are the same supports (when absent, for example) that are associated with a lack of school performance instead of assuming this to be the case. In order to make clearer comparisons to correlation-based approaches such as regression and SEM, we use the same data and the same conceptual model previously used by Sebastian and Allensworth (2012) in the study of the mediating processes between leadership and classroom instruction. The key research question they focused on was: Which areas of school leaders' work are most strongly related to classroom instruction and student learning? Here we instead focus on necessary and sufficient conditions of organizational supports including school leadership that are associated with school performance. Our specific research questions are:

- What combinations of organizational supports are associated with school performance? Are these the same supports that are also associated with absence of school performance?
- Is school leadership necessary for school performance? And conversely, is lack of school leadership necessary for absence of school performance?

As described earlier, a difference from the Sebastian and Allensworth (2012) study is that we are focusing on one aspect of instruction as an indicator of school performance and not examining student achievement. The difficulties of using QCA to examine student achievement outcomes for the present data lies primarily in determining meaningful thresholds to create fuzzy sets of student outcomes at the school level (especially after accounting for students' incoming achievement).

RESEARCH METHODS AND DATA

The data used for this study come from high schools that are part of the Chicago Public Schools (CPS), the third largest school system in the United States. The student population is about 50% African American, 38% Latino, 9% White, and 3% Asian. Approximately 85% of students are eligible for free/reduced priced lunches. About two thirds of Chicago high school students remain in school to graduate. This study used two data sources: administrative and test data from CPS and teacher survey data. The teacher survey data come from the University of Chicago Consortium on Chicago School Research's (CCSR) survey administered in the spring semester of the 2006–2007 academic year on a range of issues including classroom instruction, professional development, learning climates, parent involvement, and principal leadership. The overall response rate for the 2007 teacher surveys was 71.6%. Data for a total of 4,317 teachers from 98 high schools were used in this study. Table 1 compares the demographic and student performance characteristics for all CPS high schools and the high schools that participated in the survey and are included in the analysis.

Table 1. Performance and Demographic Characteristics of Schools

Characteristic	2006–2007	
	Schools in sample	All CPS high Schools
(*N*- Schools)	98	110
Average enrollment	1013	974
Achievement: ACT composite score	16.63	16.80
Racial composition (%)		
African American	62.98	60.35
Latino	26.80	29.34
White	5.76	5.80
Truancy rate	9.68	9.63
Graduation rate	66.89	68.25
Attendance rate	85.24	85.76
Students—% low income	83.92	83.45
Mobility rate	22.35	21.71

ANALYTIC MODEL

As described earlier, we use fuzzy set QCA to examine how configurations of organizational conditions are associated with a school outcome. The computer program fs/QCA (Ragin, Drass, & Davey, 2006) was used to conduct the analysis. We set the consistency and coverage thresholds based on recommendations of prior research on using QCA methods (Fiss, 2011; Ragin, 2008). We set the lowest acceptable consistency for solutions to the minimum recommended value of 0.75 (Ragin, 2008). Coverage is like strength or importance; it indicates the relevance of a solution. QCA was initially developed as a small N method where every configuration related to meeting the outcome could be considered for solutions. More recently, QCA has been extended to larger samples with larger coverage values required. For example, Fiss (2011) used a coverage value of three cases for a sample of 205 technology firms. With our sample of 98 schools, we set the minimum acceptable coverage to two—at least two cases had to display a specific configuration of conditions related to the outcome to be considered as a solution.

DEPENDENT MEASURES

In this study we focus our analysis on one aspect of instruction as the outcome—students' classroom participation. The importance of classroom participation and student engagement for student learning has been extensively documented in prior literature. Researchers contend that classroom participation is most proximally related to student learning (Finn, 1993) and that it is important regardless of subject area (Newmann & Associates, 1996; Turner & Patrick, 2004). Prior research has shown that classroom participation is associated with student grades, attendance, academic competence, and achievement (Finn, 1993; Finn & Voelkl, 1993; Ladd, Birch, & Buhs, 1999; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008). The Sebastian and Allensworth (2012) study used a measure of classroom instruction that comprised of several dimensions including student participation, classroom disorder, quality of student discussions, and critical thinking; among these measures, student participation had the strongest factor loading on an underlying latent measure of instruction and also showed the most between-school variance among all dimensions included in instruction.

Ladd et al. (1999) identify two types of classroom participation; at one level students engage in the tasks and demands of the class by showing up for class, being prepared with supplies, textbooks, following directions, and completing homework. At a higher level, they actively participate and take initiative by asking questions and working independently (Ladd et al., 1999). The composite measure for student participation in this study contains both aspects. It is derived from questions asking teachers how many students in a target class: come to class on time, attend class regularly, come prepared with the appropriate supplies and books, regularly pay attention in class, actively participate in class activities, and always turn in their homework. Teachers were asked to provide information about their second period class on Mondays. A scale was created using Rasch analysis (Wright & Masters, 1982), producing a measure with high reliability (0.89). Because the surveys were administered in the spring, teachers had considerable experience with their target classes to draw some general and valid conclusions about them.

The analysis with fuzzy set QCA requires transforming variables into calibrated sets in relation to three substantively meaningful thresholds: full membership, full nonmembership, and the crossover point. Based on these benchmarks a continuous variable is converted to scores denoting membership in a fuzzy set with transformations that are based on the log odds of membership (Ragin, 2000). However, much of research in social science does not use calibrated measures; benchmarking is not a commonly practiced procedure (Ragin, 2008). Therefore, there is no prior research to guide the benchmarking process necessary for conducting fuzzy set QCA for this data. The original response categories for questions about student participation were gradations of agreement: 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree. We created an average across all items and then rounded that average to a binomial value to indicate whether a teacher was more in agreement or disagreement on the set of items that were related to classroom participation of students. Then, for each school we estimated the proportion of teachers who were in agreement that students were participating in their class. In order to account for differences in survey response (some schools had better response rates from teachers), we weighted information using hierarchical linear models (HLM; Raudenbush & Bryk, 2002). A nonlinear HLM (see the appendix for details) was used to calculate a weighted estimate for each school of the proportion of teachers who agreed on questions about student participation in their classrooms. The high correlation (0.90) between this estimated value (proportion of teachers who agree that students participate in class) with the school average of the original Rasch measure (see Table 2), shows that little information is lost with the transformation.

Table 2. Correlations between Original Rasch Measures and Proportion of Endorsers

Rasch measures	Proportion endorsing (school level)
Instructional leadership	0.89
Teacher influence	0.95
Collective responsibility	0.96
Teacher collaboration	0.90
Program coherence	0.93
Parent–teacher interaction	0.89
Teacher–parent trust	0.90
Teachers	0.96
College expectations	0.92
Student participation	0.90

We created two fuzzy set outcome measures based on student classroom participation. For the first fuzzy set, membership in the set of schools with high student participation was coded one if at least 75% of teachers in a school agreed that students actively participate in the classroom and was coded zero if 25% of teachers or less agreed that students participate in class. As the crossover point we chose 50% to indicate that if only half the teachers in school felt that students participated in classroom activities, then that denoted the point of maximum ambiguity or the fuzzy point. The second fuzzy set measure, membership in the set of schools with very high student participation, was coded one if 90% of the teachers or more agreed that students actively participate in class and zero if less than 50% of the teachers agreed that students participate in class. As the crossover point, we chose 75% of teachers agreeing on student participation. Low student participation was simply coded as the negation of high student participation described above (one for ≤ 25% of teachers in agreement, zero for ≥75% agreement, and the crossover point at 50%).

MEASURES OF SCHOOL LEADERSHIP AND SCHOOL ORGANIZATIONAL PROCESSES

We use the Bryk et al. (2010) conceptual model (Figure 1) as the basis for the analysis plan. School leadership in the Bryk et al. (2010) model focuses on multiple leadership roles of the principal: developing the mission and goals of the school, setting high standards and communicating expectations to staff, developing trust and collaboration among staff, and supporting instruction. It also includes a distributed leadership perspective, defined as the influence of teachers in school decision-making processes. Although distributed leadership need not to be restricted to the roles of teachers alone (Spillane, 2006; Spillane et al., 2007), teacher leadership is typically emphasized, as teacher influence and distributed leadership are often used interchangeably (Robinson, Lloyd, & Rowe, 2008). Therefore, the conceptualization of distributed leadership in this particular model primarily focuses on principals and teachers.

The measures available to us are identical to those used in the Bryk et al. (2010) study. We use a measure of principal instructional leadership that reflects the extent to which teachers see their principals as instructional leaders with respect to setting standards for teaching and learning, communication of a clear vision, and tracking academic progress. A measure of teacher influence reflects the extent to which teachers are involved in various aspects of school decision making. The descriptions of the other mediating organizational supports, their influence on classroom instruction and student learning, and the importance of school contextual factors have been described in prior research (see e.g., Bryk et al., 2010; Sebastian & Allensworth, 2012). As with classroom participation, composite measures have been developed based on previous empirical work (Bryk et al., 2010), and Rasch analysis (Wright & Masters, 1982) was used to create the original measures.

Principal instructional leadership (alpha = 0.91) is made from questions about whether the principal sets high standards for teaching, knows what is going on in the classroom, has clear expectations for meeting instructional goals, communicates a clear vision, understands how children learn, carefully tracks student academic progress, participates in instruction planning, presses teachers to implement what they have learned in professional development, and has clear expectations for meeting instructional goals. Teacher influence (alpha = .81) reflects the degree to which teachers are involved in school decision making. Questions ask of teachers' influence on the selection of instructional materials, setting of school policy, in-service program planning, discretionary funds spending, setting standards for student behavior, and hiring of professional staff. The transformation of these variables to fuzzy scores replicated the same steps and same benchmarks used for transforming the measure of classroom participation to a fuzzy set of high classroom participation.

Professional capacity is described with two measures. Program coherence (alpha = .79), describes the quality and coordination of programs in the school that support instruction. Another measure, peer collaboration (alpha = .73) captures one aspect of the professional community at the school level by describing how much teachers collaborate around instruction and the extent to which they engage in deprivatized practice by observing other teachers or inviting other teachers to observe their own instruction. Two measures are used to capture the learning climate present in the school. Teachers' perceptions of crime and disorder (alpha = .89) is highly correlated with students' perceptions of school safety and captures problematic aspects of the environment (Steinberg, Allensworth, & Johnson, 2011). School orientation toward postsecondary education or college expectations (alpha = .79) captures the academic environment—the degree to which the school is pressing students to have high academic achievement. Two measures capture the quality of parental and community ties. Teacher–parent trust (alpha = .67) measures the extent to which parents and teachers support each other to improve student learning and feel mutual respect. Parent–teacher interactions (alpha = .58) measure the degree to which teachers contact parents when there is some academic problem with their children or when their children have performed well in class. For the specific items that comprise each measure the reader is referred to prior research using CCSR measures (Bryk et al., 2010; Sebastian & Allensworth, 2012). The transformation of these variables to fuzzy scores also replicated the steps taken for transforming the measures of instructional leadership, teacher influence, and other organizational supports to fuzzy set variables. Benchmarks of ≥ 75%, = 50%, and ≤ 25% were used to denote the points of full membership, the crossover point, and full nonmembership for these fuzzy sets.

SCHOOL CONTEXTUAL VARIABLES

The models also included important school level contextual variables—school size, average prior ability of the students in the school, and percentage of low income students in the school (as measured by eligibility for free and reduced price lunch). For the fuzzy set of schools of large size, schools that had over 1,500 students were fully in, schools with 600 students were fully out, and as the crossover point we chose a school size of 900 students. These categories correspond to those used in studies on high school size (Lee, 2004; Lee & Smith, 1997) and also correspond closely to the 75th, 50th, and 25th percentiles of school size for the sample of high schools used in the study. Lee and Smith (1997) labeled schools with 600–900 students as middle-sized high schools and found that learning gains were highest in these schools. Prior ability was measured using students' scores on the EXPLORE standardized test on ACT's Education Planning and Assessment System (EPAS). In 2007, all CPS ninth graders took the EXPLORE early in the fall and therefore this test represents a good measure of their prior achievement. In 2007, the national average on the EXPLORE was 15; using this score as a benchmark we calculated the percentage of students who scored at least a 15 on the EXPLORE test. For the fuzzy set of schools with a high proportion of students coming adequately prepared academically (at least a 15 on the EXPLORE), schools where ≥ 75% of students met this criteria were fully in, schools where ≤ 25% of students met the criteria were fully out, and the crossover point was kept at 50%. For incoming achievement, a more readily available category was also used; whether the school was a selective enrollment school or not. The use of this variable is also useful to illustrate how crisp data (where variables take on binomial values, zero or one) can be used together with fuzzy set data (where variable have values ranging from zero to one) in QCA.

For the socioeconomic status of the school, the proportion of students on free and reduced lunch was used. Specifically for the fuzzy set of schools with high poverty, schools where ≥ 75% of students were eligible for free and reduced lunch were fully in, schools where ≤ 25% of students met the criteria were fully out, and the crossover point was kept at 50%. These categories correspond to the categories used by the National Center for Education Statistics (NCES) in their Condition of Education series (see e.g., Aud et al., 2011, 2012); these studies use consistent benchmarks for defining high-poverty and low-poverty schools based on student eligibility for free/reduced lunch to allow for comparability across years. These categories might be considered too restrictive for the Chicago context where most schools serve high proportions of low-income students. On the other hand, they allow for comparability with studies such as the Condition of Education series that look at national samples. They also underscore the fact that most Chicago high schools serve low-income students; analyzing relative differences among these schools might lead to erroneous conclusions if the context is not emphasized.

The above benchmarks for leadership, school organization, and contextual variables make intuitive sense, are not sample driven, and are meant to begin a discussion on benchmarking school organizational and contextual variables. The fuzzy sets of high classroom participation, high leadership, and high organizational supports have arguably lenient benchmarks of 50% teacher agreement for the fuzzy point and 25% agreement to be fully out. One could contend that if only half the teachers are in agreement about leadership, or classroom participation, that should qualify for being fully out in corresponding fuzzy sets rather than being the point of ambiguity. To consider this, we redid all analysis with more conservative benchmarks where benchmarks of ≥ 75% was used to denote full membership, ≤ 50% was used to denote full nonmembership, and ≥ 62% was used to denote the crossover point or the fuzzy point. These benchmarks correspond closely to those used by Fiss (2011) in a study of typologies of high technology firms using QCA.

We considered the intermediate solutions obtained from the QCA analysis wherein substantive knowledge is used for conducting the counterfactual analysis. We assumed that the presence of all school organizational and contextual factors except for large school size and the proportion of students on free and reduced lunch were linked to higher student participation in classrooms. We also assumed that the absence of those two conditions, large school size and proportion of students on free and reduced lunch, were linked to higher student participation in classrooms. The most parsimonious solutions that consider all possible combinations in order to simplify the solution regardless of substantive knowledge were not considered. Comparing solutions by relaxing or changing various assumptions were beyond the scope of the present study but would be valuable to further school organization research using QCA methods.

It could be argued that none of the benchmarks used thus far for any of the fuzzy sets are appropriate. The benchmarks for creating the fuzzy set of classroom participation may be too lenient, while the benchmarks for parent–teacher interactions may be too conservative; high schools in general may have a limited amount of parent teacher interaction in contrast to elementary schools, where such interaction might be more frequent. Also, one might argue that the benchmarks for creating fuzzy set measures of school poverty and incoming achievement are not useful to the Chicago context where most schools serve more than 75% low-income students, especially if a researcher is not very concerned about comparisons to other contexts. Future studies could focus on determining meaningful and appropriate benchmarks that are more specific to local contexts. Lastly, relative variation in a measure might be important in explaining differences between schools in terms of important outcomes. Correlation-based approaches are well suited to examining relative variation among variables and have already been applied to this dataset before (see Sebastian & Allensworth, 2012). The set theoretic approach followed in this study is an additional tool for research on school organizations and offers a different approach by requiring researchers to make decisions related to relevant (rather than relative) variation based on substantive knowledge.

RESULTS

The descriptive statistics and correlations for all measures used in this study are presented in Table 3. The descriptive statistics for teacher survey measures are not based on the fuzzy sets but from the HLM-based Empirical Bayes estimates that represent proportions of teachers who agree across items for each measure. The descriptive statistics show that on average, the proportion of teachers who agree that their principal is an instructional leader is quite high (0.78). The average agreement across schools for teacher safety (0.36) and parent–teacher interaction (0.31) is much lower. As expected, the correlation of classroom participation with teacher safety is high (0.72), and the correlation of classroom participation with college expectations is moderate (0.62). Also as expected, there is a strong correlation of classroom participation with incoming achievement (0.72).

Table 3. Descriptive Statistics and Correlations

	Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11
1	Enrollment (size)	1013.76	800.66											
2	Proportion students with free/reduced lunch	0.84	0.15	−0.15										
3	Proportion students with > 15 on EXPLORE	0.35	0.23	0.25	−0.72									
4	Instructional leadership	0.78	0.11	0.00	0.03	−0.08								
5	Teacher influence	0.55	0.16	−0.31	−0.09	0.13	0.47							
6	Teacher collaboration	0.49	0.08	−0.04	0.07	−0.20	0.42	0.30						
7	Program coherence	0.51	0.12	0.04	−0.23	0.20	0.59	0.48	0.40					
8	Parent–teacher trust	0.67	0.11	−0.05	−0.42	0.45	0.35	0.39	0.11	0.54				
9	Parent–teacher interaction	0.31	0.05	0.04	0.08	−0.13	0.11	0.00	0.08	0.16	0.11			
10	Teacher safety	0.36	0.29	−0.20	−0.42	0.61	0.13	0.40	−0.04	0.47	0.58	−0.03		
11	College expectations	0.70	0.19	−0.19	−0.47	0.61	0.19	0.42	0.07	0.40	0.72	−0.04	0.70	
12	Classroom participation	0.56	0.16	0.08	−0.49	0.72	−0.03	0.25	0.00	0.33	0.54	−0.14	0.72	0.62

Table 4 shows the results for a fuzzy set QCA analysis for the outcome of high student participation. Here we use the notation developed by Ragin and Fiss (2008) by which dark circles ("●") indicate the presence of a condition, and a circle with a cross ("**m**") indicates the absence of a condition. Core conditions are indicated by large circles; these conditions are present in both the intermediate and parsimonious solutions and are strongly related to the outcome. Peripheral conditions are indicated by small circles; these conditions are present only in the intermediate solutions and have weaker evidence of a relationship with the outcome. A blank space means that the condition can be absent or present and indicates a "don't care situation" (Fiss, 2011). We ran two different sets of analysis, one with a fuzzy set of incoming achievement based on proportion of students coming in with at least 15 on the EXPLORE and the second with a dichotomous indicator of whether the school was a selective enrollment school or not. The results from both sets of analysis for the outcomes of high student participation and very high student participation are virtually identical. The results discussed below are for models that used the fuzzy set based on average incoming achievement.

Table 4. Configurations Related to High Classroom Participation

		Solution	
Configuration		1	2
Context			
	Large size		
	High poverty		
	High incoming achievement		
Leadership			
	Principal instructional leadership	●	●
	Teacher influence		●
Organizational supports			
	Peer collaboration		●
	Program coherence		●
	Teacher safety		
	College expectations	●	
	Teacher–parent trust		●
	Parent–teacher interaction		
Consistency		0.71[4]	0.86
Raw coverage [5]		0.89	0.49
Unique coverage [6]		0.41	0.02
Overall solution consistency		0.71	
Overall solution coverage		0.91	

● Core condition (presence)
● Peripheral condition (presence)

The solution table (Table 4) shows that the fuzzy set analysis for high classroom participation results in two solutions exhibiting the presence of both core and peripheral conditions. The results indicate two solutions for high participation highlighting equifinality of solutions. The core condition for the first solution is high expectations of students whereas the core condition for the second solution is high teacher influence in school policy. Both solutions indicate the presence of instructional leadership, indicating that instructional leadership from the principal seems to be a necessary condition. At the same time, leadership is not enough. There are no schools that meet the outcome solely on the basis of strong principal or teacher leadership. Solution 1 indicates that instructional leadership combined with high college expectations can lead to high student participation in classrooms, regardless of the school context. The other solution to obtaining high student participation involves instructional leadership and teacher influence but requires many more of the essential supports. There is less coverage for this solution indicating that many more schools achieve success with the configuration involving high academic expectations.

Table 5. Configurations Related to Very High Classroom Participation

Configuration		Solution 1
Context		
	Large size	
	High poverty	
	High incoming achievement	●
Leadership		
	Principal instructional leadership	●
	Teacher influence	●
Organizational supports		
	Peer collaboration	
	Program coherence	●
	Teacher safety	●
	College expectations	●
	Teacher–parent trust	●
	Parent–teacher interaction	
Consistency		0.85
Raw coverage		0.48
Unique coverage		0.48
Overall solution consistency		0.85
Overall solution coverage		0.48

● Core condition (presence)
● Peripheral condition (presence)

Table 5 shows the results of the QCA analysis for *very high* student participation and here asymmetry is highlighted—the set of conditions that lead to an outcome may well be different from the set of conditions that lead to higher degrees of the outcome. As Table 5 shows, the core condition for very high student participation in classrooms is the presence of a high proportion of students that come in with adequate academic preparation (at least a 15 on the EXPLORE).

However, not all schools that have a high proportion of students with adequate academic preparation show very high student participation. The presence of almost all essential supports, instructional leadership, teacher influence, program coherence, teacher safety, college expectations, and teacher–parent trust are required together with the core condition of high incoming student achievement. The number of schools that meet the outcome of very high classroom participation is only 15 schools to begin with. Therefore the solutions shown in Table 5 explain the patterns of very few schools indicating that it is difficult for schools to attain very high classroom participation and that there is little consistency in their patterns.

Finally, Table 6 shows the results of the fuzzy set QCA analysis for absence of student participation in classrooms. The results indicate that absence of teacher safety is a core condition that leads to schools meeting this outcome. Lack of teacher safety as a core condition is combined with the peripheral conditions of absence of a high proportion of students coming in with adequate academic preparation, the presence of a high proportion of students classified as low-income students, and the absence of parent–teacher interaction. Notice that principals' instructional leadership and teacher influence do not matter for this solution. This solution can be interpreted to indicate that lack of safety, regardless of principal or teacher leadership, is the critical condition that results in low classroom participation.

Table 6. Configurations Related to Absence of Classroom Participation

		Solution
	Configuration	**1**
Context		
	Large size	
	High poverty	●
	High incoming achievement	m
Leadership		
	Principal instructional leadership	
	Teacher influence	

Configuration		Solution 1
Organizational supports		
	Peer collaboration	
	Program coherence	
	Teacher safety	m
	College expectations	
	Teacher–parent Trust	
	Parent–teacher interaction	m
Consistency		0.65
Raw coverage		0.92
Unique coverage		0.92
Overall solution consistency		0.65
Overall solution coverage		0.92

m Core condition (absence)
m Peripheral condition (absence)
● Peripheral condition (presence)

DISCUSSION

A configuration-focused approach shows that different conditions are required to achieve high student participation, when compared to the school conditions required for very high student participation in classrooms, which are again different from the configurations that correspond to low student participation. It also shows that certain conditions are only a possibility—or a risk—in schools serving particular populations of students. These differences might not be discerned using a traditional regression-based approach.

For the outcome of *absence* of student participation, the most important condition is a lack of teacher safety in schools. Neither principal instructional leadership nor distributed leadership among teachers is adequate to compensate for low school safety. In schools where teachers feel unsafe, students also report feeling unsafe (Steinberg et al., 2011), and this fear may prevent students from engaging fully in classroom instruction and may also influence teachers' capacity to engage students as they deal with concerns for their own safety. It also suggests that only certain types of schools are at risk for very low student participation—those serving many students in poverty and schools not serving high achieving students.

School leadership seems to be a necessary condition to meet the outcome of high student classroom participation. In order to have high student participation, where at least 75% of teachers report that students actively participate and engage in the classroom, the core condition is the presence of *either* high college expectations or high teacher influence, but neither condition is sufficient by itself. These core conditions have to be combined with other supports, including strong school leadership. When these conditions are met, schools show high levels of student classroom participation, regardless of the contextual characteristics of the school.

Finally, to be a school with very high student participation, the core condition is selective enrollment, or the presence of a very high proportion of students entering high school with high achievement. Yet not all schools with a high proportion of students with strong academic preparation achieve this outcome. Selective enrollment needs to be complemented by strong leadership and a wide array of organizational supports. This highlights the importance of principal and teacher leadership and organizational supports over and above the prior achievement of the students. High schools face considerable challenges in organizing leadership and key supports to maintain a very high level of classroom participation even when most students come in adequately prepared. The challenge is even greater when the schools are not selective enrollment schools; there are no systematic solutions for such schools to achieve very high participation in classrooms in the data used for this study.

With k conditions related to the outcome there are 2^k possible combinations that can theoretically be observed. Therefore, the choice of conditions must be carefully made so that the solutions do not get needlessly complex. At the same time, it limits the ability to understand the relationship of all school organizational supports with important outcomes. In this study we chose one or two important constructs within each essential support (Bryk et al., 2010); ideally we would have liked to include a more comprehensive set of constructs. For example, the presence or absence of professional community was not found to be strongly related to the classroom participation outcomes that we examined. The particular aspect of professional community we examined was teacher peer collaboration and deprivatized practice. Other aspects of professional community such as collective responsibility, reflective dialogue, and teacher socialization were left out and could be studied in future research.

The causal interpretations from the fuzzy set QCA results are limited by the cross-sectional nature of the data. Typically, QCA is used to uncover causal relationships of conditions to an outcome but they can be used to examine associative relationships as well (Ragin & Fiss, 2008). Although the sections discussing the methodology used terminology typically used in QCA literature denoting/implying causality, the results shown here only describe associative relationships as the data is cross sectional. Another limitation is that the leadership and school organizational fuzzy sets were created from items from an annual teacher survey. Teachers may provide a biased view of school organization and classroom instruction. Requiring them to characterize things based on recalling events that stretched over an entire year may introduce additional errors. The implied causal direction from leadership to organizational supports to instruction is adopted from the Bryk et al. (2010) conceptual framework (Figure 1) as a basis to interpret the QCA results; nothing inherent in the analysis itself implies this directionality. Unlike SEM where path diagrams can be specified to fit the conceptual framework, all conditions including leadership and other organizational factors have equal weight here as they relate to the outcome of classroom participation. The results suggest that leadership is a necessary condition for classroom participation but do not indicate whether there is a direct or indirect relationship. Perhaps the use of longitudinal data along with QCA methods can be used to uncover the directions of relationships among leadership, organizational, and instructional variables.

The study also does not go beyond classroom instruction to actual student learning outcomes such as test scores and grade point averages. The difficulty involved with benchmarking school average test scores and GPA after controlling for prior achievement and demographic characteristics is a challenge. Examining student outcomes such as test scores and GPAs is the immediate and most compelling next step in this research. An important limitation of this study is the use of benchmarks that have not been validated or discussed extensively by education researchers. The use of benchmarks and calibration is relatively rare in the social sciences; education research is no exception. However, the primary goal of this study is not to derive the perfect benchmarks for classroom participation, school leadership, and other organizational factors. It is to propose the applicability of fuzzy set QCA as an additional tool along with correlation-based methods to study school leadership and organization. It is likely that the solutions will be different if the benchmarks used in this study are changed to recalibrate the fuzzy sets. The limited analysis we did with more conservative benchmarks showed that the condition of selective enrollment emerged as the core condition for most outcomes.[7] Lastly, the potential of QCA to uncover relevant “fit among the important contextual, structural, or strategic factors” (Doty & Glick, 1994, p. 231) has not been fully exploited in this study as the conceptual framework was based on one model of school organization proposed by Bryk et al. (2010). Future studies could explore different models of school leadership and organization, e.g., instructional and transformational leadership models to examine under what circumstance and through which organizational structures a particular mode of leadership works, or if integrating both modes has distinct advantages as found in prior research (Marks & Printy, 2003).

In summary, the configurational approach using QCA methods proposed here offers an exciting direction for the study of school leadership and organizational processes as they relate to instruction and student learning. It is important to note that researchers have cautioned against using QCA in a routinized manner and relying on software to produce the most parsimonious solutions rather than relying on theory (Cooper & Glaesser, 2011). Some researchers have also suggested that there is nothing genuinely new to the QCA methodology that is not already covered by regression analysis (Achen, 2005). Seawright (2005) for example, argues that QCA is not an improvement over regression methods, although it could be useful in highlighting the importance of higher order interactions and the value of considering nonlinear measurement models. In concluding, we maintain that this work is intended to begin a discussion of the usefulness of configuration approaches and QCA methods in school organizational research in addition to, rather than in opposition of, correlation-based methods.

Acknowledgments

We would like to thank Eric Camburn for his feedback on early drafts of this manuscript. We would also like to thank Charles Ragin, three anonymous reviewers, and the editor of this journal for their advice and feedback. The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant #R305A120706 to the University of Chicago. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education. We would also like to acknowledge the Spencer Foundation for supporting core work at CCSR on school leadership that allows us to do this work.

Notes

1. It would have been ideal to simultaneously examine multiple aspects of instruction as the outcome but this is not possible in QCA analysis. Selecting another aspect of instruction such as academic demands or the quality of classroom discussions would again represent only one aspect of instruction. Moreover, procedures in QCA that require measures have substantively meaningful interpretations and benchmarks make it difficult to use a latent measure.

2. There are multiple models that have been proposed to describe relationships between leadership, school organizational processes, student learning, and the influence of context (see for example, Bryk, et al., 2010; Knapp, Copland, & Talbert, 2003; Leithwood et al., 2004; Louis, Leithwood, et al., 2010). While there

are several unique features of each framework, there is also a great deal of overlap among them.

3. Fiss (2011) explains easy and difficult counterfactuals in this way:

> Assume one has evidence that the combination of conditions A●B●~C (read: A and B but not C) leads to the presence of an outcome. No evidence exists as to whether the combination A●B●C (read: A and B and C) would lead to the outcome, but theoretical or substantive knowledge links the presence (not the absence) of C to the outcome. In such a situation, an easy counterfactual analysis indicates that both A●B●~C and A●B●C will lead to the outcome, and the expression can be reduced to A●B because whether C is absent or present has no effect on the outcome (p. 402). In contrast with reference to a difficult counterfactual, one might have evidence that the combination A●B●C leads to the outcome, but no evidence as to whether the combination A●B●~C also does so, This of course is the inverse of the situation above. . . . Theoretical or substantive knowledge links the presence, not absence of C to the outcome, and lacking an empirical instance of A●B●~C, it is much harder to determine whether C is in fact a redundant condition that can be dropped, thus simplifying the solution to merely A●B. (p. 403)

4. Although the minimum consistency was set at 0.75, the final solutions after all analysis include configurations with consistencies below this value.

5. Raw coverage indicates the share of the outcome explained by one the different solutions.

6. Unique coverage indicates the share of the outcome explained by one of the solutions net of that solution's overlap with other solutions identified.

7. We also conducted analysis using more conservative benchmarks where 50% agreement by teachers was considered fully out in terms of membership in fuzzy sets. Selective enrollment schools along with leadership and almost all other organizational supports was the only solution associated with high and very high student participation.

References

Achen, C. H. (2005). Two cheers for Charles Ragin. *Studies in Comparative International Development, 40*(1), 27–32.

Aud, S., Hussar, W., Johnson, F., Kena, G., Roth, E., Manning, E., . . . Zhang, J. (2012). *The condition of education 2012* (Report No. NCES 2012-045). Washington, DC: National Center for Education Statistics.

Aud, S., Hussar, W., Kena, G., Bianco, K., Frohlich, L., Kemp, J., & Tahan, K. (2011). *The condition of education 2011* (Report No. NCES 2011-033). Washington, DC: National Center for Education Statistics.

Bass, B. M. (1998). *Transformational leadership: Industrial, military, and educational impact.* Mahwah, NJ: Erlbaum.

Bill and Melinda Gates Foundation. (2011). *Learning about teaching: Initial findings from the measures of effective teaching project. MET project research paper.* Seattle, WA: Author.

Brooks, J. S., Scribner, J. P., & Eferakorho, J. (2004). Teacher leadership in the context of whole school reform. *Journal of School Leadership, 14*(3), 242–265.

Bryk, A. S., Sebring, P. B., Allensworth, E., Luppescu, S., & Easton, J. Q. (2010). *Organizing schools for improvement lessons from Chicago*. Chicago: University of Chicago Press.

Camburn, E., Rowan, B., & Taylor, J. E. (2003). Distributed leadership in schools: The case of elementary schools adopting comprehensive school reform models. *Educational Evaluation and Policy Analysis, 25*(4), 347–373.

Cohen, D. K., & Ball, D. L. (1999). *Instruction, capacity, and improvement*. Philadelphia: Consortium for Policy Research in Education, University of Pennsylvania.

Connelly, G. (2010). A conversation with secretary of education Arne Duncan. *Principal, 90*(2), 34–38.

Cooper, B., & Glaesser, J. (2011). Paradoxes and pitfalls in using fuzzy set QCA: Illustrations from a critical review of a study of educational inequality. *Sociological Research Online, 16*(3).

Crawford, S. (2012). What is the energy policy-planning network and who dominates it?: A network and QCA analysis of leading energy firms and organizations. *Energy Policy, 45*, 430–439.

Delery, J. E., & Doty, D. H. (1996). Modes of theorizing in strategic human resource management: Tests of universalistic, contingency, and configurational performance predictions. *Academy of Management Journal, 39*(4), 802–835.

Doty, D. H., & Glick, W. H. (1994). Typologies as a unique form of theory building: Toward improved understanding and modeling. *Academy of Management Review, 19*(2), 230–251.

Finn, J. D. (1993). *School engagement & students at risk*. Washington DC: National Center for Education Statistics.

Finn, J. D., & Voelkl, K. E. (1993). School characteristics related to student engagement. *Journal of Negro Education, 62*, 249–268. doi: 10.2307/2295464

Fiss, P. C. (2007). A set-theoretic approach to organizational configurations. *Academy of Management Review, 32*(4), 1180–1198.

Fiss, P. C. (2011). Building better causal theories: A fuzzy set approach to typologies in organizational research. *Academy of Management Journal, 54*(2), 393–420.

Gresov, C., & Drazin, R. (1997). Equifinality: Functional equivalence in organizational design. *Academy of Management Review, 22*(2), 403–428.

Hallinger, P. (2005). Instructional leadership and the school principal: A passing fancy that refuses to fade away. *Leadership and Policy in Schools, 4*(3), 221–239.

Hallinger, P., Bickman, L., & Davis, K. (1996). School context, principal leadership, and student reading achievement. *Elementary School Journal, 96*(5), 527–549.

Hallinger, P., & Heck, R. H. (1996a). Reassessing the principal's role in school effectiveness: A review of empirical research, 1980-1995. *Educational Administration Quarterly, 3*(21), 5–44.

Hallinger, P., & Heck, R. H. (1996b). The principal's role in school effectiveness: A review of methodological issues, 1980-95. In K. Leithwood, J. Chapman, P. Hallinger, & A. Hart (Eds.), *The international handbook of educational leadership and administration* (pp. 723–784). Dordrecht, Netherlands: Kluwer.

Hallinger, P., & Heck, R. H. (1998). Exploring the principal's contribution to school effectiveness: 1980–1995. *School Effectiveness and School Improvement, 9*(2), 157–191.

Hallinger, P., & Heck, R. H. (2010a). Collaborative leadership and school improvement: Understanding the impact on school capacity and student learning. *School Leadership & Management, 30*(2), 95–110.

Hallinger, P., & Heck, R. H. (2010b). Leadership for learning: Does collaborative leadership make a difference in school improvement? *Educational Management Administration & Leadership, 38*(6), 654–678.

Halverson, R., Grigg, J., Prichett, R., & Thomas, C. (2007). The new instructional leadership: Creating data-driven instructional systems in school. *Journal of School Leadership, 17*(2), 159–194.

Katz, D., & Kahn, R. L. (1978). *The social psychology of organizations* (2nd ed.). New York: Wiley.

Kent, R. A., & Argouslidis, P. C. (2005). Shaping business decisions using fuzzy-set analysis: Service elimination decisions. *Journal of Marketing Management, 21*(5/6), 641–658.

Knapp, M. S., Copland, M. A., & Talbert, J. E. (2003). *Leading for learning: Reflective tools for school and district leaders.* Seattle, WA: Center for the Study of Teaching & Policy, University of Washington.

Kvist, J. (2007). Fuzzy set ideal type analysis. *Journal of Business Research, 60*, 474–481.

Ladd, G. W., Birch, S. H., & Buhs, E. S. (1999). Children's social and scholastic lives in kindergarten: Related spheres of influence? *Child Development, 70*(6), 1373–1400.

Lee, V. E. (2004). Effects of high-school size on student outcomes: Response to Howley and Howley. *Education Policy Analysis Archives, 12*(53).

Lee, V. E., & Smith, J. B. (1997). High school size: Which works best and for whom? *Educational Evaluation and Policy Analysis, 19*(3), 205–227.

Leithwood, K., & Jantzi, D. (1999). Transformational school leadership effects: A replication. *School Effectiveness and School Improvement, 10*(4), 451–479.

Leithwood, K., & Jantzi, D. (2005). Transformational leadership. In B. Davies (Ed.), *The essentials of school leadership* (pp. 31–43). Thousand Oaks, CA: Sage.

Leithwood, K., Louis, K. S., Anderson, S., & Wahlstrom, K. (2004). *Review of research: How leadership influences student learning.* New York: Wallace Foundation.

Louis, K. S., Dretzke, B., & Wahlstrom, K. (2010). How does leadership affect student achievement? Results from a national US survey. *School Effectiveness and School Improvement, 21*(3), 315–336.

Louis, K. S., Leithwood, K., Wahlstrom, K., & Anderson, S. (2010). *Learning from leadership project: Investigating the links to improved student learning.* St. Paul, MN: University of Minnesota.

Marks, H. M., & Printy, S. M. (2003). Principal leadership and school performance: An integration of transformational and instructional leadership. *Educational Administration Quarterly, 39*(3), 370–397.

Marzano, R. J., Waters, T., & McNulty, B. A. (2005). *School leadership that works: From research to results.* Alexandria, VA: Association for Supervision and Curriculum Development.

Meyer, A. D., Tsui, A. S., & Hinings, C. R. (1993). Confugurational approaches to organizational analysis. *Academy of Management Journal, 36*(6), 1175–1195.

Newmann, F. M., & Associates. (1996). *Authentic achievement: Restructuring schools for intellectual quality.* Thousand Oaks, CA: Corwin Press.

Ordanini, A., & Maglio, P. P. (2009). Market orientation, internal process, and external network: A qualitative comparative analysis of key decisional alternatives in the new service development. *Decision Sciences, 40*(3), 601–625.

Ragin, C. C. (1987). *The comparative method: Moving beyond qualitative and quantitative strategies.* Berkley, CA: University of California Press.

Ragin, C. C. (2000). *Fuzzy set social science.* Chicago: University of Chicago Press.

Ragin, C. C. (2006). Set relations in social research: Evaluating their consistency and courage. *Political Analysis, 14*, 291–310.

Ragin, C. C. (2008). *Redesigning social inquiry: Fuzzy sets and beyond.* Chicago: University of Chicago Press.

Ragin, C. C., Drass, K. A., & Davey, S. (2006). *Fuzzy-Set/Qualitative comparative analysis 2.0.* Tucson, Arizona: Department of Sociology, University of Arizona.

Ragin, C. C., & Fiss, P. C. (2008). Net effects anaysis versus configurational analysis. In C. C. Ragin (Ed.), *Redesigning social inquiry: Fuzzy sets and beyond* (pp. 190–212). Chicago: University of Chicago Press.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Rihoux, B., & Ragin, C. C. (2009). *Configurational comparative methods: Qualitative Comparative Analysis (QCA) and related techniques.* London: Sage.

Robinson, V. M. J., Lloyd, C. A., & Rowe, K. J. (2008). The impact of leadership on student outcomes: An analysis of the differential effects of leadership types. *Educational Administration Quarterly, 44*(5), 635–674.

Sager, F., & Andereggen, C. (2012). Dealing with complex causality in realist synthesis: The promise of qualitative comparative analysis. *American Journal of Evaluation, 33*(1), 60–78.

Seawright, J. (2005). Qualitative comparative analysis vis-à-vis regression. *Studies in Comparative International Development, 40*(1), 3–26.

Sebastian, J., & Allensworth, E. (2012). The influence of principal leadership on classroom instruction and student learning: A study of mediated pathways to learning. *Educational Administration Quarterly, 48*(4), 626–663.

Spillane, J. P. (2006). *Distributed leadership.* San Francisco, CA: Jossey Bass.

Spillane, J. P., Camburn, E., & Pareja, A. S. (2007). Taking a distributed perspective to the school principal's workday. *Leadership and Policy in Schools, 6*(1), 103–125.

Stein, M. K., & D'Amico, L. (2000, April). *How subjects matter in school leadership.* Paper presented at the American Educational Research Association Annual Meeting, New Orleans, LA.

Stein, M. K., & Nelson, B. S. (2003). Leadership content knowledge. *Educational Evaluation and Policy Analysis, 25*(4), 423–448.

Steinberg, M., Allensworth, E., & Johnson, D. (2011). *Student and teacher safety in Chicago public schools: The roles of community context and school social organization.* Chicago: Consortium on Chicago School Research.

Supovitz, J., Sirinides, P., & May, H. (2010). How principals and peers influence teaching and learning. *Educational Administration Quarterly, 46*(1), 31–56.

Turner, J. C., & Patrick, H. (2004). Motivational influences on student participation in classroom learning activities. *Teachers College Record, 106*(9), 1759–1785.

Valiente, C., Lemery-Chalfant, K., Swanson, J., & Reiser, M. (2008). Prediction of children's academic competence from their effortful control, relationships, and classroom participation. *Journal of Educational Psychology, 100*(1), 67–77.

Witziers, B., Bosker, R. J., & Kruger, M. L. (2003). Educational leadership and student achievement: The elusive search for an association. *Educational Administration Quarterly, 39*(3), 398–425.

Wright, B. D., & Masters, G. N. (1982). *Rating scale analysis.* Chicago: MESA Press.

APPENDIX

HLM Model Used to Create School-Level Estimates from Teacher Surveys

To estimate school average scores for measures such as classroom participation, school leadership, and other organizational supports we used logistic hierarchical regression models with two levels: Level 1 represents teachers and Level 2 represents schools. The models were unconditional models because we did not adjust for teacher or school characteristics.

Level-1 Model:
$\text{Prob}(Outcome_{ij}=1|\beta_j) = \varphi_{ij}$
$\log[\varphi_{ij}/(1 - \varphi_{ij})] = \eta_{ij}$
$\eta_{ij} = \beta_{0j}$

Level-2 Model:
$\beta_{0j} = \gamma_{00} + u_{0j}$
Level-1 variance $= 1/[\varphi_{ij}(1-\varphi_{ij})]$,
where the outcome is the survey measure (e.g., classroom participation, instructional leadership, etc.) that is estimated for teacher *i* in school *j*. At Level 1 the logistic regression model is written in terms of the log odds of the probability of a response denoted by φ_{ij}. Here, η_{ij} denotes the log odds of success (teacher endorsement) for a particular survey measure. At Level 2 we estimate the overall school average estimate γ_{00} of the log odds of success. HLM provides Empirical Bayes estimates for calculating individual school estimates for the outcome. These can be converted to probabilities to yield a school specific estimate for the probability of endorsement on teacher survey outcome.

JAMES SEBASTIAN is an assistant professor in Educational Leadership and Policy Analysis at the University of Missouri, Columbia. His research interests include school leadership, organizational theory and behavior, and urban school reform.

ELAINE ALLENSWORTH is the Lewis-Sebring Director of the University of Chicago Consortium on Chicago School Research. She conducts research on factors affecting school improvement and students' educational attainment.

DAVID STEVENS is Associate Director at the University of Chicago Consortium on Chicago School Research. His research focuses on high school reform and instructional development. Stevens received his PhD in sociology from Northwestern University.