
Solving Real-Life Problems of Practice and Education Leaders' School Improvement Mind-Set

RICK MINTROP AND ELIZABETH ZUMPE

University of California, Berkeley

When educational leaders think about how to solve problems, we expect them to identify a problem, think about causes and a theory of action, implement changes, and reflect on effects. This straightforward sequence is actually quite challenging. Through writings and interviews collected over 2 years within a doctor of education program, this study examines leaders' problem solving in real-life organizational improvement projects. From data on nine cohort members' thinking, the study distills a set of heuristics frequently deployed: defining problems as the absence of preferred solutions, conceiving of change as filling an empty vessel, understanding learning as implementing, aiming at conventions, and seeing "rationality" in adopting "what works."

That school improvement is a highly complex undertaking is a truism. But how do education leaders (in this article, school and district administrators) deal with this complexity when they go about solving problems that their organizations face? Are there characteristic mind-sets that are called into action when education leaders think about these problems? This article investigates educational leaders' thinking about school improvement. Framing school improvement in the language of problem solving invokes a sort of rationality that may roughly follow what Bransford and Stein (1993) call the "IDEAL sequence," consisting of identifying, defining and diagnosing, exploring alternatives, acting, and looking back on a problem. In the IDEAL sequence, problems and solutions, means and ends, follow from each other in a consistent stream of thinking.

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Cycles of inquiry, widely advocated as a means of professional learning, follow a similar logic (Copland 2003; McLaughlin and Talbert 2006).

Educational reform and school improvement approaches, advanced over the past 20 years or so, could be seen as an attempt to tighten relationships between means and ends in schools' decision making and problem solving. Accountability systems introduced performance measurements, goals, and incentives into educators' work, seemingly enabling or encouraging more robust, evidence-based strategizing and problem solving. Presumably, standards more clearly describe the knowledge to be imparted, standardized tests measure outcomes, quantitative performance goals mitigate against goal ambiguity, and data-driven decision making and research-based best practices are meant to make professional practice more evidence-based and more oriented toward effectiveness (Datnow et al. 2007; Fuhrman and O'Day 1996).

In parallel, ideas that school improvement could, and should, be science based gained momentum (Slavin 2002). Comprehensive organizational designs and instructional programs, labeled "scientifically proven," held sway (Cohen et al. 2013). Usually these products were developed externally. In some cases, schools were expected to implement them with fidelity to achieve the designers' claimed improvement effects, whereas in other cases, schools were given room to adapt (Correnti and Rowan 2007). In either case, the challenge of implementing externally developed designs put stress on marshaling internal organizational resources to create a good fit between external solutions and internal needs of schools.

RICK MINTROP is a professor in the Graduate School of Education at the University of California, Berkeley. Since 2006, he has been the director of the doctoral-level Leadership for Educational Equity Program (LEEP) at Berkeley. The book *Design-Based School Improvement* (Cambridge, MA: Harvard Education Press, 2016) comes out of this work. As a researcher, he explores school change and improvement in the nexus of educational policies, teachers' work, and broader institutional changes. His research on teacher motivation, incentives, and accountability has resulted in the book *Schools on Probation: How Accountability Works (and Doesn't Work)* (New York: Teachers College Press, 2004) and numerous other publications. ELIZABETH ZUMPE is a doctoral candidate in the policy, organizations, measurement, and evaluation program and an instructor in LEEP at the Graduate School of Education at the University of California, Berkeley. Before graduate study, she taught for more than a decade in urban districts and earned a National Board Certification in Teaching. Her research focuses on understanding the social psychological dynamics of improvement in schools facing adversity. She is a contributing author in Rick Mintrop's book, *Design-Based School Improvement: A Practical Guide for Education Leaders* (Cambridge, MA: Harvard Education Press, 2016).

The idea of schools as professional learning communities (PLCs) envisions district administrators, principals, coaches, teacher leaders, and ordinary classroom teachers sharing in the effort of leading instructional change (Hord 1997; Knapp et al. 2014; Louis and Kruse 1995; McLaughlin and Talbert 2006; Spillane 2006; Stoll et al. 2006; Stoll and Louis 2007). This presumes that practitioners inside schools and central offices have internal problem-solving capacity beyond the ability to merely implement what others have designed for them.

In recent years, continuous organizational improvement—built on notions of “improvement science” (Bryk et al. 2015; Lewis 2015) or design-based school improvement (Mintrop 2016; Penuel et al. 2011)—has gained momentum. School improvement in this vein consists of problem solving as an iterative, data-based cycle of inquiry in which often external partners and internal problem solvers collaborate with each other. Various versions of these cycles exist. An early conceptualization is Deming’s “Plan Do Study Act” sequence, which was recently reappropriated in the approach to improving educational organizations developed by Bryk et al. (2015). In their model, change agents identify needs and metrics directly linked to improvements in specific practices. A theory of action connects an evidence-based understanding of a problem to focal change drivers that generate rapid cycles of prototyping and evaluation according to a continuous stream of data (Bryk et al. 2015). Continuous quality improvement, according to the principles of improvement science or design development, calls for tight means-ends connections in which solutions are designed to address contextually diagnosed problems, and effectiveness is verified through practice-embedded metrics. The approach seems to require a high degree of problem-solving capacity on the part of internal school and district actors beyond their ability to merely implement solutions generated from the outside.

The power of standards-based accountability, data-based decision making, research-based designs and programs, PLCs, and improvement science—to name a few approaches of the recent past and present—rests on the assumption that educators in schools and districts, and especially education leaders, have the capacity to wield the new tools and affordances for increasingly tighter means-ends relationships in decision making and problem solving. But how education leaders solve problems is a surprisingly underdeveloped field of research.

Public School Settings as Context for Problem Solving

Modern human beings see themselves as rational (Dobbin 1994; J. W. Meyer and Rowan 1977; Suchman 1995). It seems easy for them to identify with the

IDEAL sequence of rational problem solving. It seems intuitive that we identify a problem, define and diagnose it, explore solutions, act, look back at the results of our actions, learn, and do it better next time. But in public school settings, this ostensibly simple sequence is a challenge for a number of reasons, three of which are especially salient: (a) the required pace of decision making, (b) the complexity of the problems encountered, and (c) the competition between different logics of action that impose different ways of reasoning on educational actors, teachers, and organizational leaders alike.

Fast Pace

Lunenburg (2010) summarizes the education leader's workplace, with a focus on the principal, in this way: "Research on administrative behavior in schools is consistent in identifying the demands on the principal as fragmented, rapid fire, and difficult to prioritize (Lunenburg & Irby, 2006; Matthews & Crow, 2010; Sergiovanni, 2009; Ubben, Hughes, & Norris, 2011). Half of the activities of principals last less than ten minutes and only 8 percent exceed an hour. Researchers conclude that principals are action-oriented and do not like reflective activities. These data support the observation that much decision making is intuitive" (10). A fast pace in decision making necessitates and rewards "thinking fast" (Kahneman 2011). In thinking fast, leaders rely on heuristics and intuitions. Heuristics are rules of thumb that abbreviate the decision-making process (Gilovich et al. 2002). Heuristics operate with rules, categories, or whole patterns that are recognized from past experiences. Patterns from previous experiences are matched with present situations. Heuristics, for all their power of relieving the cognitive capacity needed to think through a problem in detail, often have biases built into them that diminish the quality of problem solving or decision making. Decision makers judge the likelihood of an outcome according not to careful analysis of a situation but rather to "the ease with which the mental operation of retrieval, construction, or association can be carried out" (Tversky and Kahneman 1973, 208; see Mintrop and Zumpe 2016). For example, "the way we have always done things" comes with a premium.

Intuitions, as Davis and Davis (2003) point out, have an expressive-emotional and creative side to them that speaks to the practical wisdom that successful leaders employ, especially when faced with the human side of adult learning and organizational change (Evans 1996), which is more easily intuited than analyzed. For educational leaders, thinking fast and using intuition and heuristics may be powerful ways of thinking, in the face of which the demand to slow down and think through a problem may appear unrealistic and impractical.

Problem Complexity in Public Administration

Charles Lindblom (1959), in his famous conceptualization of a science of “muddling through” (see Braybrooke and Lindblom 1970; Hirschman and Lindblom 1962; Lindblom 1958, 1965, 1979) approaches problem solving in public policy and administrative decision-making settings with the assumption that problem complexity in such settings is of a scope that would make what he termed a “rational-comprehensive” method of problem solving unwieldy. In the rational-comprehensive mode, he argues, values and objectives are clarified and stated up front and means-ends analyses lead to the best possible solution among alternatives. Problem solvers strive to take relevant factors into account and use theoretical generalizations to simplify complexity.

According to Lindblom (1959), public administrators struggle with value conflicts and disagreements among constituents. They cannot easily rank-order values (the tension between student performance and personal development comes to mind in the sphere of school administrators), and they cannot easily predict up front how much of one value is sacrificed in favor of another by a specific policy or solution under consideration because policy choices affect a variety of values and objectives in differing and shifting constellations. For example, abolishing “social promotion” may strengthen performance incentives but also damage self-esteem for those who fail and may increase overage student populations and dropouts. In contrast, abolishing grades in favor of formative reports may increase the richness of direction for improvement but overload teachers and parents, with unclear repercussions for performance incentives. Possible dimensions of impact for these sorts of policies are multiple, contextually sensitive, and not easily predictable.

A way out of this conundrum for the administrator is to relax on the requirement for clarity in goals and values up front, to limit oneself to recognizing the combinations of values and objectives on which chosen policies or solutions impinge, and then to compare these policies with each other as to the desirability of the unique mix they provide. “Paradoxically, the only way to disclose one’s relevant marginal values even to oneself is to describe the policy one chooses to achieve them” (Lindblom 1959, 82). Such muddling through relies on serial trial and error. One tries a policy and then another, or one incrementally tweaks solutions to mitigate undesired and unintended consequences. In the process, public administrators become clearer about what they actually value, what their problem actually is, and what objectives seem realistic. In muddling through, it is the chosen solution, available from the menu of possible alternatives, that structures the problem in its various dimensions.

Lindblom (1959) considered the method of successive comparisons of solutions an appropriate “science” for the complexity of ill-structured problems that

public administrators face. Where Lindblom sees a science, Michael D. Cohen and colleagues (1972) see “organized anarchy” (2). They advanced the provocative thesis that problem solving and decision making in educational organizations functioned more like a “garbage can” rather than a rational model that tightly connects means and ends. In the garbage can, problems and solutions are decoupled from each other. In organized anarchies, values, goals, or preferences are ambiguous or contested, technologies (i.e., means-ends relationships) are unclear, and multiple and shifting sets of stakeholders vie for influence—a characterization not unlike that of Lindblom’s. In such organizations, however, Cohen et al. (1972) contended that rationality is severely bounded in that solutions may not directly flow from problems; rather, broader purposes may be looking for situations in which they might be aired as problems, and solutions may be looking for problems they might fit. Thus, problems rise to the attention of organizational decision makers or problem solvers depending on the demands of shifting constituencies. Solutions are proffered by solution advocates. Muddling through is all that decision makers can hope for in the garbage can, and it looks decidedly less rational than Lindblom’s science.

Scholars in subsequent decades have investigated and contested Lindblom’s claim (Arrow 1964; Bendor 1995; Boulding 1964; Dror 1964; Etzioni 1967; Forester 1984; Goodin and Waldner 1979; Lustick 1980; Schulman 1975). Although critics concede that the muddling-through model may be a more realistic description of how public administrators solve policy problems than the rational-comprehensive model, they contend that the muddling-through approach is normatively undesirable because it tends to perpetuate inertia and limit the range of solution choices to what seems possible within the narrow horizon of precedent and the status quo. Critics also claim muddling through is insufficient when high dissatisfaction with past and current states renders known alternatives irrelevant or objectionable (Dror 1964).

The debates between Lindblom and his critics reveal a core dilemma of real-life organizational problem solving: how to respond effectively to problems that are too complex to understand comprehensively and too significant to consign to heuristic, fast-thinking trial and error. Problems of this sort may be “fundamental” (Etzioni 1967) in that they call for innovation, more thorough analysis, more clarity on goals and values up front, and the use of a mix of “theory and experience, rationality and extrarationality” (Dror 1964, 156). Dror suggests a “normative-optimum” model—a mix of muddling through and more rationality—in which rational analysis, creativity and intuition, and “intellectual effort” (156) are combined to consider known and new alternatives through systematic learning.

In research on educational leadership, the concept of muddling through is used to generally represent critiques of overly rational models of school change

and is a descriptive metaphor for realities on the ground in complex educational organizations. In a review of decades of implementation research, McLaughlin (1987) concludes that incrementalism and mutual adaptation in muddling through may be a “beneficial response” (175) to produce lasting and appropriate change in the midst of incoherent and shifting reform demands. For Honig and Hatch (2004), muddling through is the general frame for describing the dynamic process by which schools “craft coherence” between sets of external policy demands and internal goals. In a survey of research about school change, Fullan (2007) connects muddling through to the “ready-fire-aim” pattern noted in improving school systems.

According to Fullan (2007), the complex problems facing education leaders are usually made comprehensible not through painstaking abstract analysis but rather through a “bias for action” (11). Although thoughtful approaches to change are possible and desirable, too much planning is a sign of “hyperrational” (Fullan 2007, 108) assumptions that produce errors, and change agents should not “spend too much time in the early stages on needs assessment, planning, and problem definition activities” because “clarification is likely to come in large part through reflective practice” (123). Through multiple in-depth case studies and a national survey of reforming urban high schools, Louis and Miles (1990) found that the most successful leaders engage in both muddling through and strategic planning, a combination they term “evolutionary planning,” in which leaders alternate between rational strategizing and “incremental experimentation” (193) with solutions. Although probably insufficient on its own, muddling through may describe a useful strategy for education leaders to structure complex and messy problems by considering and trying out known solutions.

Competing Logics of Action

When leaders solve problems in their organizations, they may sense urgencies; perceive situations; entertain values, goals, and objectives; define their own role and agency; and draw from solution repertoires. They may reason through these steps with underlying logics of action (March and Olsen 1989, 2006) that may, in fundamental ways, shape what aspects of the situation come into view, what goals are privileged, where one draws the boundaries of agency, and what solutions seem suitable. March and Olsen distinguish between two logics: a logic of consequence and a logic of appropriateness. In the logic of consequence, the emphasis is on instrumental connections between means and intended outcomes, that is, the likelihood that one achieves ends with chosen means. In the logic of appropriateness, the emphasis is on rules, roles, norms, and identities

that guide actors toward what they ought to do in a given situation. Guidance emanates from institutions that provide behavioral codifications, principles of conduct, and rules with attendant moral obligations. “To act appropriately is to proceed according to the institutionalized practices of a collectivity, based on mutual, and often tacit understandings of what is true, reasonable, natural, right, and good” (March and Olsen 2006, 690). The salience of these logics differs depending on the context in which actors move. March and Olsen suggest that in public institutions, the logic of appropriateness is especially salient.

Research on educational organizations in the tradition of institutional theory (Burch 2007; Hanson 2001; Honig 2006; H.-D. Meyer and Rowan 2006; J. W. Meyer and Rowan 1978; Ogawa 1994; Rowan 1982; Rowan and Miskel 1999) has shown that when educational leaders make decisions using the logic of appropriateness, they may privilege legitimacy—that is, acting according to public expectations of what is appropriate—over effectiveness. In a liberal democracy, educational organizations are contested terrain. Issues and problems arise from many quarters, and they arise frequently. Multiple constituencies, sometimes in conflict with each other, need to be placated. Leaders need to show that they can respond with appropriate solutions. The solutions themselves should carry the aura of public legitimacy as “best practices” that one ought to implement. Legitimacy may rest on the authority of science or government, community preferences, or simply on emulation or imitation of what is currently in vogue (Hanson 2001; Honig 2006; Rowan and Miskel 1999).

This is not to say that consequences (i.e., efficiency and effectiveness) do not play a role in education leaders’ decision making or problem solving. More recent developments in the “new” institutionalism in education have demonstrated how concerns about legitimacy and results can operate as complementary logics in schools, particularly in an institutional environment in which performance has become more salient due to standards-based accountability reforms (H.-D. Meyer and Rowan 2006; Spillane et al. 2011). But concerns about creating the appearance of being forceful problem solvers may all too often supersede concerns about the actual effect of the chosen solution, resulting in a perpetual churn of change attempts drawn from a menu of currently legitimate solutions that leave little trace in organizational practices (Cuban 1990; Hess 1999; Newmann et al. 2001). Such tendencies reflect an incoherent system of governance and policy that calls for piecemeal and shifting reforms (Cohen and Spillane 1992; Fuhrman 1993). As middle managers, education leaders’ efforts at problem solving may become complicated in striving to maintain legitimacy in the eyes of multiple conflicting stakeholders and charting a course of action for improved results (Hatch 2001; Spillane et al. 2002).

The Boundedness of Rationality in the Context of Education Leaders' Work

In sum, the fast pace for decision making and problem solving, pervasive in schools and districts, and the importance of intangible human relations in school improvement put a premium on heuristics and intuitions that abbreviate needed information processing as actors swiftly recognize familiar patterns and associate them with known remedies. Muddling-through strategies of problem solving reduce the complexity of ill-structured problems by making them intelligible and actionable through the lens of solutions. Moreover, the institutional context of educators' work prompts leaders to approach problem solving through a logic of appropriateness. Their proper role is to have solutions for problems at hand that have attained urgency, and their aim is to communicate to a concerned public that they are doing the right thing by adopting well-regarded solutions.

Under these circumstances, education leaders may develop habitual ways of problem solving, that is, mind-sets that are appropriate to the situations they regularly encounter. Different problem-solving mind-sets and mental models of their organizations' functioning may come into play if the leaders' aim is to keep stakeholders happy, to muddle through in the midst of uncontrollable complexity, to implement best practices, or to engage in an internal process of designing solutions based on principles of improvement science. Requirements for instrumental rationality are highest in the last case, as leaders need to think deeply about their understanding of a problem, their theory of change, and their metrics that show progress. Although the garbage can may be a caricature of a bygone era, improvement science and design-based approaches to school improvement may move us closer to the realm of rational-comprehensive models of problem solving. But are educational leaders up to the task? The fast pace of decision making, the intangible human side of change, solutions as cognitive shortcuts, and concern about doing what appears right as opposed to what works might make the task a challenging one.

In this article, we investigate how education leaders think about school improvement when they are asked to solve problems of practice in a design-based way. It is conceivable that habits of mind, formed in circumstances that reward muddling through or implementing externally developed programs, mitigate against design-based or improvement-science-based rationality. Alternatively, educational leaders may be capable of switching among various modes of thinking about school improvement, depending on the demands of the situation. We investigate these questions in the context of a leadership preparation program that aims to train leaders to solve problems of school improvement through real-life change projects in a design-based way.

Conceptualizing Problem Solving

To conceptualize educators' thinking about their problems of practice, we draw from three strands of literature: (a) theories about problem solving generally; (b) research about problem solving specifically for school leaders, including evidence about leaders' data use; and (c) theories of design-based thinking and practice.

Problem Solving

The literature on problem solving tells us that there are two main classes of problems: those that are well-defined (or structured) or ill-defined or ill-structured (Jonassen 1997, 2000; Pretz et al. 2003). Well-defined problems have goals, solution paths, and constraints that are clear based on known information (Jonassen 2000; Pretz et al. 2003). Complexity and uncertainty produce ill-defined problems with unknown solution paths, unclear constraints, and ambiguous goals. Addressing a given problem requires defining and framing the problem itself and considering multiple solution paths (Jonassen 2000; Pretz et al. 2003). Problem framing and defining occurs as problem solvers construct a problem and solution space according to a mental model that represents the complexity of a given problem in a simplified, categorical form (Chi and Glaser 1983; Jonassen 2000; Newell and Simon 1972). The simplified model or theory of action clarifies and diagnoses the problem and connects ideas of what constitutes the problem to a set of strategies and constraints within a given context (Jonassen 1997, 2000; Newell and Simon 1972; Pretz et al. 2003).

Problem solvers need both domain-specific declarative knowledge and procedural knowledge that comes about through practice and experience (Bransford 1993; Jonassen 2000). Declarative domain knowledge remains "inert" (Bransford 1993) if it is not transformed into procedural knowledge: if-then statements that connect the recognition of a problem pattern with a known set of actions (Chi et al. 1981; Jonassen 1997). This procedural knowledge is often tacit, intuitive, and heuristic (Schön 1983; Wagner 1993). Intuitions and heuristics are mental shortcuts needed to reduce the information processing load and to cope with complexity, but they are also associated with systematic biases (Chaiken and Trope 1999; Davis and Davis 2003; Kahneman 2011; Tversky and Kahneman 1974). For ill-structured problems, overreliance on tacit and heuristic thinking can encourage fuzzy problem perception and forestall thinking through alternative solutions (Jonassen 1997, 2000). This may be of little consequence for relatively small and routine problems but may be a detriment for problems of larger scope that affect larger numbers of people.

Education Leaders' Problem Solving

The literature on education leaders' problem solving is relatively sparse. The main approach in the existing research has been a comparison of expert and novice (or typical) problem solvers. A series of studies by Leithwood and colleagues classified leaders as experts on the basis of their leadership effectiveness, identifying effective leaders through a combination of reputation and performance during a screening interview (Leithwood and Stager 1989; Leithwood and Steinbach 1992, 1995; Leithwood et al. 1993). These studies investigated the problem-solving process in six dimensions: problem interpretation, goal setting, principles or values, consideration of constraints, solution process, and effect (Leithwood and Steinbach 1995). The studies found that expert leaders spend more time collecting data about and constructing problems before attempting to solve them; relate relevant prior experiences to help understand the problems; understand immediate problems in relation to broader goals, values, and challenges; anticipate and address constraints in a deliberate solution plan; and monitor the solutions for progress. In contrast, novice and typical leaders tend to make intuitive assumptions about problems rather than collecting information, apply irrelevant prior experiences when trying to understand the problem, see problems in isolation, see constraints as obstacles, and remain committed to a preconceived solution with little attention paid to planning or follow-up (Hallinger et al. 1993; Leithwood and Stager 1989; Leithwood and Steinbach 1992, 1995; Leithwood et al. 1993). The relationship between constructing problems and generating solutions was the focus of a study by Copland (2000). He found that experts, although not thinking "solution free," are capable of suspending the rush to solutions.

Other studies comparing experts and nonexperts suggest that the relationship among effectiveness, experience, and problem-solving expertise is not necessarily straightforward. Brenninkmeyer and Spillane (2008) and Spillane et al. (2009) revisited expert-novice comparisons using scenarios related to instructional leadership. These studies classified leaders as experts on the basis of a strong track record of improvement in their schools, as shown by longitudinal teacher survey measures about organizational and leadership quality and student test scores (Brenninkmeyer and Spillane 2008; Spillane et al. 2009). Although these studies confirmed some of the earlier findings, the distinctions between experts and novices were not as pronounced as in earlier research, and Spillane et al. (2009) found a point of divergence. They found that effective leaders were more likely, rather than less, to "make assumptions" about the problem, contending that experienced leaders may draw on prior knowledge to make broad generalizations that lead them to perceive ill-structured problems as more structured (Spillane et al. 2009). Studying the types of knowledge that problem solvers tend to use, Allison and Allison (1993) identified experts by using

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professors and graduate students to rate leaders' thinking about a problem scenario. They found that veteran principals call on procedural and domain expertise when solving problems but also tend to overgeneralize and to rely heavily on their tacit knowledge (Allison and Allison 1993). Thus, differences between experts and novices are not necessarily reliably distinct, and even experienced leaders can employ cognitive operations that interfere with the thinking needed to generate novel and effective solutions to ill-structured problems of practice.

Studies of administrators' use of data and evidence show that analytical thinking and rational deliberation play rather limited roles when education leaders make decisions about improvement strategies. Leaders tend toward quick, intuitive decisions that can satisfy felt pressure to appear decisive, interpret data in ways that support their preexisting beliefs, and prefer evidence that supports their preconceived ideas (Coburn et al. 2009; Corcoran et al. 2001). Timperley and Robinson (1998) found that educators tend to judge the efficacy of a solution by the harmony and consensus it affords. Begley and Leithwood (1990) and Leithwood and Stager (1989) found that leaders' values play a key role in how they process problems and form opinions about solutions.

Design-Based Thinking

Most studies on educators' problem solving tend to use short problem scenarios or relatively brief case narratives to extract the leaders' reasoning about the problem and the solution strategies through "think-alouds" or careful recordings of thought processes. Typical real-life problems associated with school improvement, however, involve developments over longer time periods, perhaps over a semester or even a school year, and they are much more complex than scenarios or cases. They involve designing. In school improvement designs, sequenced intervention activities are held together conceptually by theories of action that conjecture how changes in beliefs, attitudes, and practices may emerge as a result of the whole intervention (Bryk et al. 2015; Mintrop 2016; Plomp and Nieveen 2010; van den Akker 1999). The literature about design thinking suggests that designing is nonlinear and iterative. Schön (1983) describes it as a conversation between the designers and their materials as the former move back and forth between the problem space and the solution space (see Jonassen 1997; Schön and Rein 1995). Design ideas arise from creativity, intuition, and theories-in-use but are tested systematically and analytically as designers try out solutions and the situation "talks back" (Schön and Rein 1995), rendering new problem framings (Jonassen 1997; Schön 1983). In education, it is people who do most of the back talk.

In sum, modes of education leaders' problem solving may differ depending on a number of key operations: how problem solvers attend to constructing ill-

structured problems through definitions and frames, draw from their values, deploy intuition and heuristics, use data and evidence, access relevant domain knowledge, connect their understanding of the problem to understanding the change process, and select specific solution strategies given assets and constraints in their organization. Problem solving is at the core of design-based thinking. Designing is not a sequential process. Leaders move back and forth between the problem and solution space by weighing intuitive and tacit theories in use against evidence and relevant domain knowledge, in the process arriving at problem reframing and consideration of alternate solutions.

Thus, design-based thinking is neither all rational-comprehensive nor just muddling through, to use Lindblom's terms. It has common characteristics with both. It is akin to muddling through in that both are incremental; allow for a blurring of thinking about goals, causes, and effects of solutions in a non-linear way; are iterative; and limit analysis to a manageable number of impact dimensions and process variables (Kopecka et al. 2012). Design-based thinking aims toward the rational-comprehensive in its careful attention to structuring and deeply understanding the problem, guarding against prematurely adopting solutions, and reasoning about the likelihood of success, given chosen metrics.

Solving Problems of School Improvement in a Design-Based Way

The Leadership for Educational Equity Program (LEEP) in the Graduate School of Education at the University of California, Berkeley, grants a professional doctorate (EdD) to educational leaders, most of whom are principals or lower-level administrators in the central office. The program trains these leaders to develop improvement designs for their organizations around high-leverage problems of practice (Mintrop 2016). Usually the change projects last for about 3 months. The improvement designs are informed by clear and thoughtful ideas about the adult learning that is needed to accomplish intended results. The students in the program consider the complexity of specific organizational contexts, employ both the predictive quality of research and the creative power of practical problem solving, and achieve results iteratively in trial-and-error fashion (Mintrop 2016, 4). Thus, both rationality and intuition play a role in this type of problem solving.

The study discussed in this article was conducted within LEEP. In LEEP, coursework occurs over 2 academic years during which leaders complete courses in knowledge domains germane to leadership and research methods and a sequence of four semester-long "milestone" courses during which leaders participate in regular workshops about their dissertations in both whole-class and small-group formats. Since its inception in 2006, LEEP has experimented with

design research, but it was not until 2012 that design-based improvement projects became the signature approach to the dissertation for a whole cohort (Mintrop 2016). The research was conducted within this cohort of nine students: five principals and four lower-level district administrators.

The projects are “real-life” projects in that they usually engage practitioners from the students’ own organizations. The program strongly encourages students to select problems that speak to real organizational needs and that are in tune with the strategic orientation of given districts or other such administrative units. Students are strongly encouraged to form design teams with other leaders in their districts or with colleagues at their school sites. In addition, they draw from critical friends in the program. Not all projects proceed this way. Some students choose to work alone, but a good portion of them embed their change project in a collective effort. Because the majority of the students are principals at the time of entry into the program, they tend to work with teacher leaders, fellow principals, or other codesign partners available in their organizations. The projects are real life, but authenticity is constrained in that they also need to meet the requirements of the university and are developed in the artificial environment of a doctoral program. As to the three in-depth cases presented in this article, one leader (Sofia) worked alone, one (Chris) worked with a fellow district leader, and one (Nick) worked with a teacher leadership team.¹ However, all three leaders assumed the primary responsibility for design development. It is worth noting that this setup could diminish the potential for distributed expertise that can develop more strongly in a more naturalistic setting.

In the beginning of the milestone courses, leaders are asked to articulate a problem of practice facing their organizations and to devise an evidence-based theory of action to guide the design of an intervention intended to bring about results that can be ascertained with standardized metrics of the leaders’ choosing (for more details about this process, see Mintrop 2016). In a first step, leaders develop a theory of action. Theories of action connect the values and intentions of leaders with their understanding of the problems at hand and their knowledge of effective processes of change in given organizational contexts (Argyris 1996; Mintrop 2016, 76). Thus, theories of action encapsulate the leaders’ thinking about their chosen problem or improvement challenge. Studying how leaders craft these theories is a good way to uncover their thinking about problem solving. Theories of action challenge leaders to perform a number of potentially thorny cognitive operations discussed in the previous section: identifying, defining, and framing a problem of practice; conducting exploratory needs assessments; setting goals and specifying current problematic and desired end states; moving from practical intuitions to analytical theorizing by making intuitions explicit and accessing the professional knowledge base; understanding the problem through evidence-based diagnosis of symptoms and causes and more thorough assessment of user needs; and understanding the change process by rec-

ognizing key change drivers, considering contextual assets and constraints, and articulating first practical steps of an intervention. As leaders engage with these tasks, they presumably reveal their ways of solving problems and thinking about change. Understanding their thinking is the focus of this study.

The study has direct practical applications. In the quest to make school improvement a more systematic, evidence-based, scientific, or design-based undertaking, we bank on education leaders' capability to be expert problem solvers who can engage successfully with the enumerated tasks. It is unlikely that leaders will deploy these operations in their daily practice if they cannot put them to good use in a sheltered and scaffolded learning environment. Alternatively, if leaders come to the program as skillful problem solvers, we would expect them to compose a theory of action for their chosen problem of practice with relative ease.

Methods and Data

In the tradition of cognitive psychology, invisible cognitive processes are inferred through think-alouds, verbal protocols, or subjects' writings (Ericsson and Simon 1984). For this study, methods of data collection were chosen that would allow inferences to be drawn about leaders' ways of thinking by examining how leaders responded to the tasks posed by the program. The focus was on the development of theories of action over a period of 2 years.

Data collection was longitudinal. The data sources included participant observation during the so-called milestone or dissertation workshop courses, individual design coaching sessions, leaders' written papers, and interviews. The first author was the director of the leadership program and so acted as a participant during the research by serving as the instructor of two of the four milestone courses, consulting with other instructors about student progress and course materials for the other two milestone courses, overseeing students' progress in the program, and providing feedback on students' papers. The second author was one of two PhD students who acted mostly as participant observers while embedded in the four-course milestone sequence over four semesters. The PhD students gathered observational data during all sessions of the milestone courses in the form of field notes about course activities and discussions. Data on coaching were collected during specified workshop segments of some milestone course meetings, during which the PhD students stepped into more participatory roles to provide coaching to individual leaders who asked for support. Typically, coaching sessions lasted for about 30 minutes and helped leaders surface their assumptions and reasoning through probing questions. During and after each coaching session, the PhD students documented the conversations in low-inference summaries combined with reflective memos. Data from leaders' writing included all drafts of in-class writing

assignments, course papers, and qualifying papers, with written feedback provided to leaders by course instructors and (when requested by the participating leaders) by PhD students. In-class writing assignments typically consisted of brief summaries of leaders' current theories of action, whereas course and qualifying papers consisted of longer academic compositions in which leaders' theories of action were explicated in relationship to evidence from needs assessments and sources in the knowledge base (theories, studies, and practitioner sources). Last, the second author conducted a round of semistructured interviews with five of the nine leaders in the cohort. The interviews were about an hour in length and were audio recorded and transcribed. Leaders were asked to describe improvement goals for their current organization and ways of meeting these goals through improvement activities. Probing questions revealed leaders' thinking about organizational improvement.

Although we initially intended to conduct repeated semistructured interviews of this sort with all nine leaders, after conducting the first interviews, we determined that the data yielded through this method were not as useful for understanding leaders' ways of thinking about a theory of action as data generated through field notes and design coaching. For ethical and practical reasons, it was necessary to limit our data to those that were useful not only for the study but also for students' progress and program development, and we concentrated on methods that could generate data as part of routine activities of the program. Ideally, we would have conducted more design coaching with all of the leaders, but the coaching was limited by the available class time and by leaders' choice to avail themselves of the support. However, many group activities during milestone courses documented in the field notes involved whole-group workshops on leaders' theories of action; as such, the observational notes contain data about leaders' thinking similar in kind to data generated through one-on-one coaching sessions and added depth by showing how leaders supported and challenged one another's thinking.

Following traditions in action research methodology (Coghlan and Brannick 2007), the program director and PhD students met regularly as a research team, joined by other course instructors at least twice a semester, to critically reflect on data, to identify preliminary lines of analysis, to connect analyses to theory, and to review analytical memos. The research team also exchanged reflections about individual students' needs and progress and generated ideas for adjustments to course materials and instructional strategies to better support students.

Data Analysis

Data from nine cases were analyzed, but this article concentrates on three in-depth cases to illustrate dominant patterns across the nine cases in leaders'

thinking and their improvement mind-sets. The three participants in the cases presented are elementary school principals in traditional public schools. These three leaders addressed a variety of problems of practice and different types of interventions pursued across the cohort: culturally responsive pedagogy (CRP), developing professional community, and improving instructional supervision.

Coding of the data was assisted by the software program Dedoose (Socio-Cultural Research Consultants 2018). For the complete cohort, the total observational data include field notes from more than 109 hours of participant observation during 33 class sessions (140 pages of field notes) broken into 170 thematic episodes. The sample data set of observational, written, and interview data for the three in-depth cases is summarized in table 1.

First-order codes (Miles et al. 2014) were developed according to the components of a theory of action as conceptualized in the design development model used in the doctoral program: “framing and definition of a problem of practice,” “problem diagnosis,” “problematic and desired behaviors,” “theory of change,” and “intervention.” These codes are the broader bins that allowed for a first ordering of the material.

Within these broad bins, data were analyzed using inductive methods borrowed from grounded theory. A grounded theory approach is appropriate when studying a process that is undertheorized or for which theory has been developed for populations other than those relevant to the research (Corbin and Strauss 1990; Creswell 2012). The literature review had indicated that although an extensive base of theory exists for explaining problem solving and cognitive processes in general, very few studies exist to explore the way that education leaders engage in problem solving. The studies that exist generally use a hypothetical scenario exercise or retrospective approach, which is less relevant for understanding the developmental thinking of leaders engaged in real-life problem solving about midrange school improvement projects.

TABLE 1

Summary of Data for Three Cases

PARTICIPANT	OBSERVATIONAL DATA		COURSE PAPERS		INTERVIEWS	COACHING SESSIONS
	Episodes	Class Sessions	Drafts	Pages		
Sofia	58	18	15	202	1	...
Chris	25	16	21	293	1	4
Nick	40	14	13	126	...	3

Inductive second-order coding (Miles et al. 2014) yielded 194 patterns that were reduced to 38 patterns within 13 categories (table 2).

For within-case analysis, the codes developed through the inductive analysis helped identify prevalent patterns in each leader's ways of thinking while developing a theory of action over time. To represent each case, metamatrices (Miles et al. 2014) were constructed that summarized the prevalent patterns within each element of the theory of action and noted key changes over time. Through analytic memoing (Miles et al. 2014), patterns were summarized and tested by checking for representativeness, triangulating across data sources, and searching for disconfirming evidence (Maxwell 2013; Miles et al. 2014). Cross-case analysis began by using the codes developed through the inductive analysis and our case summaries to generate metamatrices to examine patterns of similarities and differences between the cases. Through analytic memos (Miles et al. 2014), key dimensions of comparison were connected to relevant concepts from our literature review. We used these concepts to help construct explanations for the patterns.

To analyze the thinking of the remaining five leaders in the cohort, the data for these cases were simultaneously coded deductively using the coding scheme developed previously and inductively for noting new themes or patterns. With the help of metamatrices and analytic memoing to search for discrepancies, to note within-case and cross-case patterns, and to construct explanations, we found that the patterns that had been identified in the analysis of the first three cases were also dominant across the remaining cases. For a summary of the data set and analysis of the remaining cases, see tables A1 and A2.

Findings

In presenting the three cases, we try to maintain the three leaders' unique train of thought while attempting to structure the material in a way that cuts across the cases. The distinct tasks that the leaders pursued as they were building up a theory of action provide a useful way of structuring. The main steps are defining and framing initial problems, seeking evidence from their organizations, consulting the professional knowledge base, understanding the problem, understanding the change process, formulating goals and desired states, and designing an intervention. These steps do not necessarily occur in this sequence in each case.

If the leaders were expert problem solvers and design thinkers, we would expect that their initial definition and framing of the problem might emanate from broad concerns (e.g., the achievement gap) but would soon narrow to problematic practices that they have experienced in their organization. The professional knowledge base (research, design experiments elsewhere, and shared practical wisdom) would presumably give them some orientation as to what causes

TABLE 2

Reduced Pattern Codes from Inductive Analysis

First Order	Second Order	Description
Problem of practice	Frame	Intuition Preferred solution
	Define	External regulation Narrow practice
Problem diagnosis	Level of causal analysis	Broad condition or practice Macro Meso Micro
	User needs	Absence of the solution Evidence of learning needs Specific Generic
Problematic and desired behaviors	Approach to operationalization	High-inference judgment Low-inference observation Absence of the desired state
	Scope	Proximal to intervention Distal
Theory of change	Means-ends relationships	Tight Loose Very loose
	Theory of learning	Deep learning Implementing Reflection
	Drivers	Leadership/Purpose Urgency Motivation
	Time frame	Collaboration and community Data and inquiry Tools and protocols Professional development Incremental, iterative
Intervention	Consistency with theory of action	Open-ended Consistent Inconsistent
	Context specificity	Ready-made solution Adapted to contextual assets and constraints
Use of evidence	Confirmatory or prescriptive Critical	

these practices, which causes they might be able to influence, and what dynamics might produce change, although students were asked to document the gaps and shortcomings in the knowledge base that they encountered in practically all projects. (Design development studies are not needed, the program stresses, if all is known about one's problem and its solution; one can simply implement and save the trouble of designing.) Leaders would consult evidence from the organizations they are trying to change to empirically verify the specific knowledge, skills, beliefs, attitudes, routines, and so forth that currently exist and the concrete learning needs of participants to which the imagined solution or intervention would have to respond. Desired states at the end of the intervention would be mindful of existing practices in relationship to realistic goals. Goal setting would ensue in reference to organizational assets and constraints and the scope of the envisioned intervention. Given a record of successful experience, leaders would draw on intuition about potential solutions early in their thinking about problems but would be able to question these initial assumptions and expand their search as they learned more about the problem and incorporated new understanding from the knowledge base and evidence from their organization.

The leaders discussed in this article bring assets to their design-based problem-solving challenge. They see themselves as change agents and readily articulate a vision attached to desired end states for their organizations. It appears relatively easy for them to choose significant problems that are relevant for practice—and that are core to educational equity—as the focus of their improvement work. When formulating problems, these leaders recognize constraints, particularly the conditions of adversity in their high-poverty schools, the limited resources and capacity provided by districts to support them, and the constraints on their authority that come from strong union contracts, compliance with regulations, and pressures from state accountability systems. They approach their plans for change with a view toward measurable impact and can articulate some key change drivers for organizational change from the start, including data and inquiry. Although their aspirations for the scope of change are generally high, they approach the task with the assumption that a thoughtfully planned, medium-term, incremental, and iterative approach is more likely to result in meaningful improvement.

These assets suggest that the leaders described in this article are well positioned to construct a theory of action and demonstrate expert problem solving. However, it turns out that problem solving in a more systematic, design-based, or improvement-scientific way poses significant challenges for even highly qualified and experienced educational leaders who may be novices in this kind of problem solving.

In the following sections, we show how the three participants described in the in-depth cases—Sofia, Chris, and Nick—tackled these tasks or operations with a set of school improvement heuristics that posed obstacles to problem solving.

These heuristics made up a mind-set that proved enduring throughout the design process. In essence, the leaders defined problems in terms of the absence of their preferred solutions. They conceived of change as a process of filling an empty vessel with new material. Learning was mainly about identifying how to effectively implement. In the design process, despite the premium put on creativity and innovation, they aimed at conventions. And through all of this, they perceived their thinking about school improvement as eminently rational.

Sofia

Initial framing.—Sofia begins the design process with a passion for CRP. She views CRP as the key intervention because of a “consistent measurable achievement gap for black and Latino students in our public school systems” that stems from having “curriculum [that] is not culturally and linguistically relevant to the students” and teachers who lack “the cultural/linguistic capacity to engage students or make the curriculum relevant.” In her initial framing, the problem, which is broadly construed, and the programmatic solution are tightly interwoven.

For her, “closing the gap in achievement is the central focus and passion of [her] career.” She is convinced that professional development (PD) in CRP is what her school needs to address the cultural divide that creates the achievement gap. During a small group workshop about her design project, a fellow leader asks her, “How do you know that that’s the main intervention for that problem?” and she replies, “Because my professional work experience indicates it.” Her conviction also rests on her observation that “millions of dollars have been spent on professional development in the area of culturally and linguistically responsive [CLR] pedagogy by public school districts.” Sofia frames her problem of practice as an absence of her chosen solution: “A problem of practice exists at [my school] in that teachers have not been exposed to the main intervention prescribed for this big problem in education, CLR PD.”

Consulting the knowledge base.—On multiple occasions over time, colleagues and instructors try to help Sofia see that she appears to be arriving at a definition of the problem, as one instructor put it, “through the back door.” She is urged to consider other possibilities about which problem might need addressing in her school and that another solution may be warranted. Despite this feedback, when Sofia consults theory and research to find out more about her problem, she seeks and finds support for her view of cultural relevance as an explanation of the achievement gap. Theory suggests to her that the main causal factor of what she terms the “cultural-linguistic mismatch” is institutionalized racism: “Racism’s effects on American institutions and teachers’ underlying assumptions about students and their home cultures are the contextual elements most

critical for understanding the cultural mismatch between schools and students' home culture." Having identified literature that points to a systemic and pervasive problem of cultural relevance related to macrosocial and omnipresent structures in society, she believes that she has identified a phenomenon that surely exists in her school as well. The literature gives further weight to and confirmation of her conviction.

Evidence sought from the organization.—Again urged to check her assumptions, Sofia conducts a needs assessment that includes demographic and performance data about the teachers and students in her school and survey data that ask teachers to report the kinds of PD in which they had participated and the degree to which the PD had affected their practice or attitudes toward students. In her summary of the needs assessment, she confirms her original understanding of the problem: "The results of this preliminary inquiry and the demographic data support the idea that a big problem statewide, difference in student/teacher culture and language, is also a problem in [my district] and at [my school] and that a problem of practice exists at [my school] in that teachers have not been exposed to the main intervention prescribed for this big problem in education, CLR PD." Sofia defines her organization's needs as needing her solution.

Further probing into the needs assessment.—Sofia is asked to make her understanding of the problem more precise and concrete by naming observable, low-inference behaviors that indicate how the problem exhibits itself in practices in her school. She notes: "Deficit thinking, low expectations, and the belief that students should be indoctrinated into school culture, combined with instructional practices that reify unequal societal power relationships and devalue student identity." During a whole class workshop on her design project, the instructor asks her to describe these "beliefs" in terms of "an action," to which she replies, "I think I can do that . . . dishonor and disrespect of student home culture and home language." A colleague asks, "But how do they do that?" and Sofia replies, "Not honoring it, not including it, not giving a place at the table for it." In a whole class workshop the following semester, another instructor prompts her, "What is currently happening regarding a belief, practice, attitude that you can observe or you can detect?" Sofia replies, "I think you can observe teachers having only one way of doing things and imposing that on everyone else," and, "It is deficit thinking and the belief that students should be indoctrinated into school culture that sustains and supports the cultural and linguistic mismatch." Sofia describes problematic behaviors in terms of high-inference judgments, though for her, she can see "deficit thinking."

Understanding the change process.—In the early stages of the design process, Sofia's idea of the CRP PD intervention is a literacy curriculum that will unfold over a 3- to 6-month period as a series of lesson implementations. However, a closer read of literature about culturally relevant instruction (Gay 2010; Ladson-Billings 1995) prompts her to expand her concept of CRP to "core

practices” of engagement, reflection, cultural competence, counterstorytelling, and critical consciousness. By the time of implementation, her intervention has contracted to “a principal led professional development . . . [of] five two-hour professional development sessions . . . spanning a period of three months,” but the scope of the change she envisions remains unchanged: “developing the literacy practices of counterstorytelling, critical literacy, and linguistic awareness and the core practices of culturally relevant pedagogy.”

Making use of the literature on organizational culture change and social justice leadership, Sofia intends to leverage a dynamic of moral commitment and guilt to motivate teachers to learn. She imagines that the PD sessions create cognitive dissonance between teachers’ deficit beliefs and those reflected in CRP, an experience that will generate change if teachers are presented with a compelling moral argument from a trusted leader. She believes that principals “play a key role in developing and sustaining trust” and that “framing cultural competence as an ethical and professional responsibility . . . helps teachers arrive at the conclusion that it is their professional and ethical obligation to develop cultural competence.” Having realized their role in reproducing inequality, teachers can be inspired to “serve as change agents for school wide reform.”

Goals and desired states.—Sofia is aware that her envisioned intervention is short term, but she sees it nevertheless as a way to move toward an ideal. Her description of the desired state is one in which “all students feel equally comfortable and welcome in the classroom,” which is “the desired state of all classrooms . . . in the United States.” She predicts that her 3-month PD series “will be an effective way to change teachers’ perception of students, and their practice from the current practices toward more desirable practices that will result in increased student engagement and achievement.” Sofia reasons she will be able to find measurable impact from this intervention in terms of how frequently teachers “implement the literacy practices of counter storytelling, linguistic awareness, and critical literacy” and in terms of changes in “teachers’ underlying beliefs and cultural competence.” At times, Sofia communicates self-assuredness that her thinking is correct and her design is powerful. At other, less frequent, times, she allows for skepticism, noting that there “exists no example of an effective professional development system capable of creating systemic, sustained change,” and that “the likelihood that I might succeed where countless other researchers and practitioners have failed is minimal.” Nonetheless, she continues to assert that a program of effective PD for CRP is necessary because meeting the needs of “culturally and linguistically diverse students remains a matter of urgency and moral responsibility.”

Summary.—For Sofia, the development of a theory of action starts from noting a systemic problem—the achievement gap associated with a racial and cultural divide—about which she is personally passionate. From the start, she defines the

problem of practice within her organization in relation to a preferred intervention, CRP, or as she says “CLR PD,” which seems convincing according to her intuition, its perceived popularity, and its justification in scholarship. With this frame of a systemic, broad problem in mind, she turns to macrolevel theories to explain it, uncovering a host of related problems, including deficit thinking and low expectations. She ascertains the needs of her organization and the learning needs of her teachers as requiring her preferred solution. The evidence for this need is that her organization has not been exposed to her solution in the past. Her conceptualization of change veers between all-encompassing culture change and specific teaching practices. The scope of her imagined changes is enormous relative to the resources that she intends to expend on her intervention. Although she admits that the impact of her imagined solution may be small, this is not reason to question or change the theory of action. To her, the quest for social justice, embodied by a committed leader, is the primary value, and in this idealist pursuit, the intervention is morally justified and undoubtedly moving in the right direction regardless of whether it accomplishes its goals.

Chris

Initial framing.—Chris begins the design process with a frustration that he faces regularly in his district: principals giving short shrift to the task of teacher evaluation such that ineffective teachers remain in the classroom. Poor instructional supervision enables, as he writes, “the dance of the lemons” in which teachers designated as “needs improvement” by one principal are reassigned and reevaluated as “satisfactory” by the next principal, resulting in “damaging school experiences for our students.” Chris believes that poor instructional supervision stems from inconsistencies in, as he writes, “the ways that principals use the evaluation tool,” and he perceives a need to “calibrate principals’ practices around the use of evaluation systems.” For Chris, the big picture of his problem narrows quite swiftly as the imagined solution, use of evaluation tools, comes to define his problem.

Evidence sought from the organization.—To check his assumptions about inconsistencies in principals’ evaluation practices, Chris conducts a needs assessment. Interviewing a district administrator and several principals, he finds confirmation “that there was a wide range of practices and perceptions among principals” about how to evaluate teachers and significant variation in principals’ training. He also examines a random sample of teacher evaluation documents and finds that they all contained the designation “satisfactory” according to a wide variety of evidence provided to support that rating, although only a

handful of instances when that evidence cited “specific practices.” Chris concludes from these data that his problem definition is correct. Evaluation practices are in a sorry state. However, he has no specific evidence why this is so—that is, what specific competencies, skills, attitudes, or routines might be responsible for principals’ actions and what specific learning needs they might have as a result.

Consulting the knowledge base.—Chris consults literature on instructional leadership and supervision. He finds that the literature supports his frustration. He states that “administrators can devote varying amounts of time and energy to the work of formal teacher evaluations” and struggle to prioritize. He also finds research that suggests the importance of a “systematic and standardized set of protocols and tools” so that teachers do not “receive different levels and types of feedback.” To Chris, the literature seems to confirm his framing of the problem as one of administrators’ lack of will, lack of standards enforcement, and lack of consistent use of tools. He mainly interprets the literature as affirming his view of what needs to be done.

Understanding the change process.—Based on this investigation of the problem, Chris reasons that principals’ evaluation practices in his district are the result of a lack of “sufficient direction . . . in regard to identifying and describing instructional practices” and a lack of “a systematic and standardized set of protocols and tools for observation and feedback.” From this he derives the need to improve the evaluation practices of the principals in his district through training on a standardized tool: “Evaluators need to be trained in the use of the evaluation protocols and have a clear understanding of the standards and rubrics in use. They should also be calibrated and tested to meet expectations of reliability.” He describes an intervention process that leverages monthly principal meetings to reach “consensus on specific instructional practices that would meet expectations” [on the evaluation tool] and “implement use of common language derived from standards calibration.” He assumes that such training on the tool will help principals and teachers communicate about “specific instructional practices” in evaluations and result in “an increase in the number of teachers being marked as ‘needs improvement.’”

Further consulting the knowledge base.—When course instructors ask Chris to probe further into his initial theory of action, he broadens his problem framing to explore more factors related to principals’ evaluation practices. Returning to his concern about teacher quality, he reasons that teacher evaluations matter because teachers need administrators’ feedback to improve their performance. He finds confirmation in recent state legislation that emphasizes “holding teachers accountable” through teacher evaluations to “create the conditions necessary for school improvement.” But the literature (Black and Wiliam 1998; Blase and Blase 1998) also suggests to him that such evaluations have limited potential

to help teachers improve unless they are connected to effective feedback that is embedded in “professional learning opportunities, collaboration and coaching” and “continued opportunities for dialogue.” From this literature, Chris adds new layers to his thinking, now defining a model of effective feedback that entails “a clear vision of expected performance, instruments for gathering evidence of instructional practice, tools for identifying the gap between expected and desired practices, and the implementation of the post conference” to “discuss the necessary professional development structures that should be in place to move forward.” With this new line of thinking, Chris has expanded the necessary learning in which he envisions principals needing to be engaged.

Further evidence sought from the organization.—Drawing from further needs assessment, Chris identifies more specific principal behaviors associated with the problem of evaluation. He notes that principals “can identify specific elements of good teaching strategies, but have differing protocols, perceptions, and attitudes about the formal process of conducting teacher observations and evaluations,” that “post observation conferences and evaluation conferences are often short or non-existent,” and that evaluation comments were focused on “aspects of classroom management . . . and classroom procedures.” Chris concludes that although principals can identify good teaching strategies, they “do not sufficiently communicate with teachers” about “developing qualities of good instruction” and “do not focus on describing observable behaviors that identify the gap between the current instructional practices.”

Returning to the knowledge base.—From scholarship, Chris tries to understand causal factors that might explain principals’ ineffective feedback. From literature on professional community and effective schools, he reasons that norms of privacy and autonomy in the profession inhibit the existence of a shared vision of good instruction. He determines that effective feedback requires of principals “to not only recognize the characteristics of quality instruction, but also to articulate these elements and make concrete suggestions to teachers.” He finds that according to research, most principals feel limited not only in “the capability to identify the differences between strong and weak instruction” but also “in conducting critical feedback discussions with teachers.” Reflecting on the insights gained from scholarship, Chris surmises that before they can give effective feedback, principals may need to develop a deeper understanding of teaching and learning. As he explains in a coaching session, “Before, I was thinking about it like a checklist—did they do think-pair-share, did they check for understanding . . . but now I am realizing that principals need to think about why think-pair-share is a good idea.” Adjusting his diagnosis, he decides that principals “do not have a deep and complex understanding of the cognitive and emotional dimensions of learning,” which inhibits their ability to “sufficiently engage in individualized discussions with teachers about reflecting on and developing qualities of rigorous instruction.”

Further understanding of the change process.—Chris revises his theory of action to reflect his diagnosis. Now, in addition to principals being “overwhelmed with the daily demands of their work,” he understands the problem of ineffective feedback to require that principals have “sufficient opportunities to observe good teaching” and “engage in structured and facilitated discussions” using a “rubric related to observable practices in the classroom.” For Chris, the “deep and complex understanding of . . . learning” that he believes principals need can be developed by providing them with more practice and guidance in instructional analysis and coaching. But Chris does not abandon his initial theory of action: the evaluation tool remains central. As he writes, “In order for principals to be able to give teachers effective feedback they will need to develop an understanding of what are the observable behaviors that constitute quality instruction. . . . When principals have developed this understanding then they can guide teachers to identify the gap between the current instructional practices and effective instructional practices.” To bring about this learning in principals, Chris envisions a series of workshops that will include “discussions with colleagues, watching video clips, as well as role-playing conversations” to follow the recommendations of learning theory that these activities “will enhance learning transfer.”

Goals and desired states.—Conversations among colleagues are powerful because, as Chris explains in a coaching session, they help educators internalize expectations. As he writes, “Dynamic conversations . . . can increase understanding about core elements of instructional practices and expectations.” Tools and protocols facilitate these “dynamic conversations” by clarifying procedures: “Tools can be used as a way to engage teachers in complex conversations” because “using the observation report tool, [principals] can describe the gap between current and desired practices and . . . make specific recommendations that are designed to close the gap.” Whereas Chris’s early ideas about change revolved around tools and clear directions, he now allows for a more elaborate learning experience, but it is a learning experience “centered around an observational tool that guides observation of lesson sequences and a protocol that drives professional conversations.” From this learning, Chris expects that principals will “give observations and evaluations a higher priority.” In thinking about the change process, Chris veers between a more elaborate notion of principal learning and one with a narrow focus on tools and “directions.” In the end, when he translates his conceptualization into a plan for an intervention, he settles on a series of workshops during which participating principals read expository text about qualities of good instruction and closely examine the evaluation tool to be “calibrated.” The goals for his intervention are rather proximal.

Summary.—Chris’s initial problem is framed by his commitment to a solution: rigorous evaluation procedures for his district and the use of an authoritative

tool that is to calibrate instructional supervision. Although coursework, consultations with scholarship, and analyses of data add depth to his thinking, he stays true to his original commitment to the evaluation tool through the entire development of his theory of action. The purpose of his initial needs assessment is to confirm that his hunches about evaluation practices in his district are correct and, therefore, that his organization needs his preferred solution. He largely uses the professional literature in a similar confirmatory manner. In his initial understanding of the change process, he treats professional learning as a simple act of implementation: principals are directed to pay attention to the new rigorous tool.

In further probing, he develops his theory of action further. Delving more deeply into the professional literature opens up more complex perspectives on principal learning about good instruction and good feedback. In further needs assessments, he actually explores his principals' instructional supervision practices and infers their learning needs. In thinking about his change process, he is torn between a notion of learning as implementing and learning as more complex sense making. However, when he transitions from thinking "theoretically" to thinking "practically," his original commitment to a solution comes back to the fore. It entails a view of learning as exposing and implementing. For Chris, developing a "deep and complex understanding" hinges on principals adopting procedures, and the assumption remains that what is needed is a clear, concise tool that can guide principals' behavior.

Nick

Initial framing.—Nick is concerned about a pervasive problem in schools: a culture of defensiveness that inhibits change. Given, as he writes, "the growing diversity" and "chronic underachievement of marginalized students," schools need to be "willing to learn" but tend to have a "toxic culture" in which teachers "keep their doors shut" and "do not share practices, nor learn new practices." As Nick understands it, this problematic culture derives from teachers' entrenched beliefs, including their "deficit" views that presume that underperformance relates to students' backgrounds and attitudes rather than their teaching. Because of these assumptions, teachers lack a sense of "personal responsibility to ensure that students improve" and feel that they "don't need to learn anything new." In contrast to this toxic culture, Nick writes that what schools need to develop is an "organizational culture of learning" in which teachers are "open to collaboration," willing to "learn from colleagues," hold students and themselves to "high expectations," and feel a sense of "collective responsibility for student learning." Thus, the initial framing of Nick's problem of practice is circumscribed by a broadly constructed pattern of organizational or occupational culture.

Consulting the knowledge base.—To understand more about this toxic culture, Nick consults research about the organizational culture of schools. He is most interested in finding connections between norms of responsibility, teacher learning, and change. The literature confirms, in his reading of it, the syndrome of toxicity that was his initial frame. The literature suggests that most teachers ascribe to, he writes, a “*blame the student* theory of teaching” known as “knowledge transmission,” in which it is assumed that the teacher’s responsibility is “to transmit information into the empty vessel of the student,” and “attribute failure to learn based on student deficit.” He states that “resistance to change” describes “the culture of most schools today” and that teachers’ reluctance to collaborate stems from a “tradition of non-interference” tied to a presumption that “all teachers are . . . equal and interchangeable.”

Understanding the change process.—Having clarified the toxicity pattern as his problem, both in his initial intuitive framing and through literature, Nick then develops an understanding of what changes are needed to improve the situation and create a “culture of learning.” He recalls from his principal training program that, he writes, “the most effective strategy to improve teacher practice” is “through the assistance of their colleagues,” through peer observation and collaboration, particularly in the form of PLCs. However, when he tried to implement PLCs in the past, he found that it was not so easy because “some teachers appeared then and still appear resistant to fully participating” so that “their PLC meetings are less productive.” This experience taught him that PLCs cannot overcome the culture of defensiveness if teachers are “resistant to collaboration” and are not “willing to learn about and exchange teaching practices with each other.” He surmises that for collaboration and peer observation to be productive, teachers have to experience them in a way that is motivating and gets past their defenses. When Nick reads about City and colleagues’ (2009) “instructional rounds” (IRs), he recognizes this model as a good fit to his vision of peer observation and collaboration and considers that this intervention might be appropriate for addressing the problem of toxic culture.

Evidence sought from the organization.—Instructors prompt Nick to check whether his initial assumptions about the problem and the change process hold true within his particular organizational context. In his needs assessment, he interviews a number of teachers at his school about their feelings toward collaboration and the idea of doing peer observations through IRs. Nick first confirms his problem definition when he finds “unanimous agreement among the teachers” that there is generally a “resistance to collaboration among teachers.” He confirms his ideas about the change process when he finds that his interviewees feel that peer observations “could increase motivation” and “improve collaboration as teachers would be inspired by having first-hand knowledge of their colleagues’ practice.” Yet, his teachers also caution that peer observations “would provoke anxiety as it would be synonymous with perfor-

mance” and that it will be “difficult to get buy-in to this approach at our school.” Even though his teachers share a similar skepticism about IRs that Nick himself had stated earlier for PLC development, he interprets these findings as sufficient support for his assumptions, banking on the curiosity factor. Rather than prompting him to question whether IRs might be the best intervention for his teachers, Nick interprets his needs assessment to mean that he is on the right track, and he commits more firmly to using IRs as his intervention as he moves forward in the design process.

Further consulting the knowledge base.—As Nick reads more deeply in the literature (Little 1990; Sarason 1990; Weick 1976), he expands his understanding of the problem as he realizes that the entrenched beliefs associated with the toxic culture are inherent in the institutional structures of schooling. Because schools are “loosely coupled” organizations, he writes, individuals “operate somewhat independently of each other without much oversight,” enabling strong “norms of privacy.” He finds that leaders also contribute to the toxic culture due to their historical tendency to approach instructional leadership as a matter of “inspection” in which they act as “compliance checkers.” This “prevailing form of supervisory practice,” he writes, is control oriented, provoking a “defensive attitude” toward instructional supervision and “mistrust between supervisors and teachers.” Nick concludes that toxic cultures stem from the “legacy of teacher isolation and independence,” a prevalent “transmission theory of teaching,” and “the history of authoritative, directive style supervision.” In his readings, Nick finds that “a social theory of learning” suggests that “group learning . . . within the community” can be motivating because it empowers teachers to “reflectively share their practice . . . and co-construct knowledge.” The key is to find a way that does not put individual teachers’ performance on the spot, he thinks. Trust can be increased and defensiveness overcome, he writes, if “the performance of individual teachers is not discussed” so that teachers “feel safe to raise questions.” With anonymous feedback and safety to criticize, teachers will be able to “problematize the teaching practice” once they “have had the opportunity to discuss the effectiveness of a slice of instructional practice across a number of classrooms.” As he writes, “Although there might be some resistance at first,” this will fade as “peer observations become ingrained in the ongoing routine of the school.” Over time, Nick predicts, a routine practice of peer observation can prompt teachers to develop “collective responsibility for student learning” and “a shared understanding of high quality teaching,” which will gradually “cause their perspective of teaching to shift from knowledge transmission to learning facilitation” so that “if a student doesn’t learn, the teacher will . . . attempt to make improvements.” However, how this learning scenario is supposed to be come about is not conceptualized in his theory of action.

Drawing on literature about developmental supervision (Glickman et al. 2010), Nick notes that routinizing this “group learning” means the school leader

needs to play a different role and avoid the typical tendency to provoke, rather than lower, defensiveness. Noting his preference for what he describes as “shared leadership,” Nick finds that the research suggests that successful instructional leadership is, he writes, “inclusive facilitative leadership” that is “democratic, cooperative, [and] clinical,” in which leaders “encourage the broad involvement of their staff as they . . . guide reform.” He concludes that the collective learning process he has in mind calls for “collaborative leadership” in which the principal and teachers participate jointly as a “school community.”

Further understanding of the change process.—Although Nick’s exploration of the knowledge base suggests complex institutional and social psychological dynamics involved in shifting the toxic culture, these insights do not prompt him to question whether IRs are a good fit to his vision of change. Rather, he sees IRs as capable of bringing about changes to this culture because it is “a group learning process” in which “teachers, administration and other school staff from the same school community” work together to “visit classrooms as a group with the goal of addressing a problem of instructional practice.” He describes a 3-month intervention in which the group will “engage in rounds three times.” During the rounds, he will join a group of teachers who will “switch roles” to being observers and being observed during brief classroom visits, followed by a principal-facilitated “debrief” in which participants will share “two commendations and one question” about their observations. At this point, the stress of his thinking is on activities, and he takes for granted the learning that he hypothesizes will occur.

Goals and desired states.—Once IRs become the actual intervention focus, the intervention becomes a matter of implementing its procedures. But Nick also attributes far-reaching cultural shifts to IRs and predicts that a main outcome of his intervention will be the “development of a learning facilitation orientation toward teaching.” He plans to assess this impact through various metrics that capture changes in “orientation toward learning and sharing practice.” How exactly this learning is supposed to come about and what specific activities would foster it remain opaque.

Further evidence sought from the organization.—In the middle of his design development efforts, Nick switches jobs, and he carries his same design idea over to a different school when he assumes the new principalship. When prompted by a design coach to check whether his assumptions about the problem are correct within his new organizational context, Nick argues that the problem of a toxic school culture and the desired “culture of learning” are universal. He can infer a toxic culture at the new school as well because, as he explains in a coaching session, he has noticed that his teachers “see the low achievement . . . as a problem with the kids” and “do not seem interested” in peer observations, “making statements that they don’t see it as having any value.” As he explains to a design coach, the problematic culture exists “across the profession because of the nature of teaching in most schools” and “learning organizations are good no

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matter what.” For Nick, IRs are a researched remedy that has been applied in varied contexts with what he asserts are positive results across the board, and he can therefore assume that this remedy is just as appropriate for his new school as it was for the previous one.

Summary.—Nick’s design-based problem solving begins with a broad frame: a syndrome of organizational culture that he assumes to be a universal condition. This syndrome is matched with a similarly broad set of change principles that translate into a practical intervention when he finds a match between his principles and IRs. He treats IRs as a cure-all: the teachers will begin to collaborate, and as they visit each others’ classrooms in a nonthreatening way, coupled with democratic and collaborative leadership that lessens evaluative threat, they will appreciate the learning opportunities and recognize the need for change. This new sense of community and problem awareness will push them toward assuming a shared responsibility for student learning, which will prompt shifts in their teaching practices from transmission to facilitation. How these learning processes may come about given the specific beliefs, attitudes, or routines prevalent in his school is never developed.

Cross-Case Analysis

The three leaders whose ways of thinking about problems of school improvement we explored are seasoned midcareer elementary school principals. To recap, they joined a selective doctoral program that enrolled experienced leaders with excellent recommendations from their supervisors as to their leadership and career potential, a solid undergraduate education, and respectable scores on the Graduate Record Exam. As these criteria of excellence go, it is reasonable to assume that these leaders are above average, if not exceptional, in their field.

The leaders identify different problems of practice as most urgent, and they cognitively process these problems in different ways. Yet, as evident in table 3, similarities across the three cases are striking despite the differences.

The process of problem solving, as demonstrated by the development of the theory of action, in all three cases is heavily path dependent on the initial framing of the problem. Sofia maintains her commitment to a solution throughout. Chris’s gravitational force remains procedure, and as he works on his theory of action, Nick harkens back on his vision of organizational culture as the central idea that structures his goals and justifies his means.

The link in the theories of action among the leaders’ understanding of the problem and the chosen solutions is weak. It is not necessarily that the leaders select solutions first and then construct a problem that fits or justifies that solution, although Sofia comes closest to this pattern. The problem does exist a priori of the solution in the minds of the leaders, but it is diffusely defined and at

TABLE 3

Design-Based Problem-Solving Metamatrix

	Sofia	Chris	Nick
Initial framing	Driven by CRP and passion about the achievement gap	Driven by experience of problem and commitment to solution (tool and calibration)	Driven by assumption of broad syndrome of org. culture, backed up by experience (toxicity)
Knowledge base	Confirmatory and normative	Normative; challenging assumptions	Confirmatory and normative
Needs assessment	Absence of solution	Absence of solution and learning needs of actors	Buy-in for solution
Understanding problem	Broad societal structures; matched in school	Malfunctioning organizational procedures; principal competence	Universal applicability of organizational culture
Understanding change process	Implementing elements of CRP	Implementing use of tool; complex learning	Implementing IR three times
Goals and desired states	Wide	Narrow	Wide
Eventual intervention	CRP	Tools and calibration	IR

NOTE.—CRP = culturally responsive pedagogy; IR = instructional rounds.

a much higher level of abstraction than the chosen solutions or interventions. The problems are constructed as broad general complexes, such as cultural mismatch, poor evaluation procedures, or defensive organizational culture. Specific existing practices in the schools are unnamed or weakly defined. Evidence sought from the organization is mostly about loose associations between one's intuitions and the solutions or about confirming the absence of one's chosen solution. Specificity comes in through the solutions or interventions at the level of practice: development of critical literacy practices of counterstorytelling and linguistic awareness, training in using an observation and evaluation tool, and facilitated peer observation through IRs. The leaders associate diffuse problem representations with these concrete and specific new practices. The solutions are made to fit, but the step of identifying low-inference existing practices as the launch from which adult learning would have to begin is skipped.

In the thinking of the three leaders, both problem descriptions and choice of solutions occur almost simultaneously. In the literature on expert-novice comparisons, experienced leaders do sometimes overgeneralize about problems in

relation to known solutions (Allison and Allison 1993; Spillane et al. 2009), but rushing into solutions is a sign of being a nonexpert; the three leaders, experienced as they are, exhibit patterns typical for novices. The interventions or solutions predominate in the three leaders' thinking. They become shorthand for the problem, now concretized and defined as a true problem of practice. But then the problem becomes defined not as a set of existing practices prior to the intervention but rather as a lack or absence, such as the absence of CRP, the absence of effective calibration, and the absence of collaboration.

Expert problem solvers have a repertoire of developed procedural knowledge. Experience in combination with domain knowledge and general problem-solving skills bolster procedural knowledge. When leaders have procedural knowledge, problem construction and search for solutions become abbreviated, as recognition of problem patterns is associated with a set of known actions. But tacit procedural knowledge or solid intuitions, as Allison and Allison (1993) point out, may also curtail careful problem analysis or diagnosis, especially among experienced leaders. Design-based school improvement, however, requires analysis and empirical grounding. The point is not to expect "solution-free" framing. Interplay between the problem and solution space is needed for a design to develop (Schön 1983), but this dialogue is moot if a tacit intuition about the solution occupies the problem space. For the three leaders, it is not "intuitively" obvious that their big problems are ill structured: in their minds, associations with defined interventions downshift this complexity and diffuseness.

Given these thought patterns, the way the three leaders assess needs and discuss constraints becomes intelligible. We saw that Sofia inquires during rounds of data collection whether teachers at her school had received training in CRP. When she finds that there had not been any, she concludes that teachers "need" training in CRP. Chris inquires about specific supervisory practices but focuses his inquiry on practices directly related to the existing evaluation tools and the aligned use of them in his district, concluding that principals "need" to be trained in using tools and protocols. In both instances, the evidence collected is largely used to define needs in terms of users needing the leaders' solutions—what users "need to do" or "need to understand." In each leader's instance, the evidence collected is perceived as robust enough to strengthen the loosely associative chain between the diffuse problem and the chosen solution.

The three leaders' discussion of constraints is similarly revealing. Not surprising, the three leaders name the nonspecific constraints that all change initiatives face: time, energy, and priority in the midst of competition with other initiatives or responsibilities. When they discuss the specific constraints related to their problem of practice and chosen solution, they mainly point to resistance or reluctance that the change leader needs to overcome in order for the recipients of the change to buy in and engage with the leader-chosen solution. Constraints seem to be interpreted as

those things on the scene that the leader needs to remove to create “room” for the chosen solution, rather than “connection” to recipients’ thinking, feeling, or routines.

School Improvement Heuristics

Earlier we asked what the engagement with design-based thinking could reveal about the school improvement mind-set of experienced and accomplished urban school leaders. We saw that the task of formulating an initial theory of action for a real-life intervention with a midrange scope of development activated cognitive thinking processes of the three educational leaders; we captured these thought processes with the conceptual tools of the problem-solving literature, generically and specifically for school administrators. The contribution of this article is to uncover leaders’ thinking when they engage in longer-term, somewhat more authentic improvement work and to show how the characteristics of their thinking in the various cognitive operations of problem solving add up to a mind-set, codified in a theory of action.

We formulate this mind-set in five heuristics that we derive from the cross-case analysis, as presented. These heuristics also feature across the analysis of the complete cohort of leaders (see table A2 for a summary).

My problem is the absence of my solution.—This is probably the most important feature of the mind-set as it structures related operations. We have shown how relatively quickly the big, diffuse problem becomes identified with a presumably known solution. The solution defines the problem as a problem of practice—that is, the solution brings the theory of action down from generalities and discourse to the level of identifiable “practice.” Needs assessments ascertain that the solution is not present and that users “need” it to improve. Therefore, implementing the solution is indicated.

Change is about filling an empty vessel with new material.—When change is about implementing a chosen solution without anchoring it in an empirical understanding of existing practices, ways of thinking, and learning motivations of the supposed recipients of the change, the latter are treated as empty vessels. Under a condition of change overload, the constraints of implementation are that the supposedly empty vessels are actually filled, and it is the leader’s role to make room for his or her preferred solution.

Learning is implementing.—Learning is an important ingredient of the leaders’ selected solutions. In fact, professional learning or development functions are the primary road to improvement in the three theories of action. But because learners come into view as empty vessels to be filled with things they need according to an interpretation of needs that conflates leaders’ “needs” to implement chosen solutions and supposed “needs” of the recipients, learning is all

about finding ways for smooth implementation and overcoming the obstacles of supposedly resistant adults.

Designing aims at conventions.—Design-based thinking is indicated when a clear course of action is not available and problems of practice are truly ill structured. New solutions are creative and iteratively brought closer to desired outcomes. But a legitimation and implementation-oriented concept of learning will rely on what is already known. Known conventional solutions provide a shortcut between a vague or diffuse notion of what the problem is all about and the certainty of the kind of learning that is needed to implement new practices. Conventional solutions advocated in the knowledge base as appropriate interventions compensate for the lack of an understanding of change in terms of adult learning that takes existing beliefs, attitudes, or practices as its point of departure.

Rationality is about adopting what works.—The logic of school improvement executed by the three leaders is eminently rational to them. It consists of diagnosing the problem (diffuse), assessing needs (absence of preferred solution), finding evidence (data that prove the point), attenuating constraints (making room), consulting the knowledge base (that normatively advocates solutions), and supporting professional learning (focused on implementing a conventional solution). At the heart of this rationality is the belief that the leaders' problem is the absence of their solution, a solution that research and the wisdom of the field have, after all, recognized as something that works.

Discussion

Educational leaders' improvement mind-set in solving midrange organizational development problems, in our understanding, is situated (Brown et al. 1989)—that is, it is an accommodation to leaders' decision-making authority and action space. The three leaders described are eminently thoughtful thinkers, but the school improvement heuristics they exhibit are more suitable to a rationality of muddling through than to the idea that school improvement is a science that proceeds from goals through understanding the problem to a solution that fits well and delivers on predicted and measured effects.

When it comes to solving problems of adult learning, which is at the core of much of school improvement, the education leaders in this study, it turns out, do not proceed so differently from the example of some teachers who solve the problem of student learning in this way. They feel compelled to hurry from lesson to lesson, use the guardrail of conventional curriculum in their thinking, and select a series of activities in hastily putting a lesson plan together. They intuitively think about what their "kids can do," only to discover on delivering the activities what their cognitive goal actually was and how the students ac-

tually learn the material—an insight that may guide their further thinking in intuitive ways when they feel rushed yet again to plan the next lesson.

Within the logic of design-based problem solving in the doctoral program, it was presumed that intuitive knowledge was a useful and necessary starting point for experienced leaders to identify a problem of practice in their organizations. The examples of the three cases show how these leaders, when given the opportunity to venture initial intuitions, began their problem solving with “activities,” that is, the solutions, even though this is not what was asked for through the learning prompts in the doctoral program. Despite ongoing workshops and sources of feedback aimed at redirecting leaders toward articulating a problem in terms of existing behaviors and practices in the organization, leaders typically clung to their initial framing of the problem in relation to preferred solutions because this way of thinking seemed necessary to them. The solution was a cognitive lens that helped them understand their problem; therefore, they had a hard time letting go of this scaffold. Even though they were encouraged to think creatively and to inquire into uncertainty, standing on the knowledge base and going beyond, they were neither surprised nor troubled when they, after tortuous “slow” thinking, arrived in the safe harbor of convention.

The leaders in this study were selected into an elite doctoral program based on their records of effectiveness and strong analytical skills, criteria that may have earned them the label of “experts” in some of the studies cited in the literature review. Yet, as illustrated in the cases, the expert leaders in this study employed cognitive processes that appear more novice. Why did our experts fail to use expert problem-solving processes? One explanation may be the types of problems and responses investigated. In previous research, expert processes were generally inferred from relatively short responses to scenarios or stimulated recall about limited problem solving during a single staff meeting (Allison and Allison 1993; Brenninkmeyer et al. 2004; Copland 2000; Leithwood and Stager 1989; Leithwood and Steinbach 1995; Spillane et al. 2009). These studies provide limited details about principals’ responses and infer general expert processes in comparison to more novice or less effective leaders. Leithwood and Stager (1989) found that experts view unstructured problems as necessitating careful thinking, offering examples of expert leaders’ responses: “that is a difficult one . . . so you would really have to think through your strategies very carefully” (140–141) and “It was one I gave a lot of thought to when I found out that I’d been assigned, (because) it was tough for me going into this” (141). For Brenninkmeyer and Spillane (2008), a principal response was considered an example of an expert process of “gathers data,” with the example given for how this process was inferred: “We then provided a survey to the staff and told them or asked them what their concerns or needs were” (451).

Had we used an approach similar to those in previous research, we might have concluded that our participants used “expert” processes. Consistent with

the demands of doctoral research, Sofia, Nick, and Chris attempted to think carefully and “gather data” to understand their problems. However, a finer grained analysis conducted in this study, drawing on the benefit of much evidence about leaders’ reasoning about problems of practice over a 2-year period, revealed how leaders’ attempts to learn and employ expert processes like thinking carefully, consulting research, or gathering data can be circumvented by ingrained heuristics. These heuristics interfere with the reasoning needed to specify problematic behaviors in the organization, revisit problem definitions over time, gather and interpret data in ways that can shift preconceived ideas, and connect understandings about problems and change processes to rationales for solutions. To develop a sound theory of action, it does not appear sufficient that a leader tries to interpret a problem or that one gathers data; it also matters how the problem is interpreted, what kind of data are gathered, whether the interpretation of data challenges preexisting assumptions, and whether such deepening understandings about the problem become relevant in leaders’ solution designs.

This study reveals how attempts to develop leaders’ organizational problem-solving expertise must contend with habits of thinking that develop in response to institutional and work contexts. We theorized earlier that the rapidity of decision making and the intractability of the human side of school improvement would put a premium on experience and intuition, that the complexity of ill-structured problems in the midst of political contestation would suggest to leaders the rationality of muddling through, that concerns for appropriateness and legitimacy would divert their gaze from sharp and precise means-ends relationships with respect to changing practices, and that the disjointed nature of educational policy churn would inure them to expectations of deliberate improvement. We find validity for these assumptions. What was especially revelatory in our study was the enduring power of school improvement heuristics throughout the hard cognitive work described in the in-depth cases. We identify patterns that were evident not just in one leader but across the whole cohort. The leaders subscribed, and clung, to these patterns over time, revealing a mind-set that makes eminent sense to them, despite engaging with a 2-year experience in a university-based design studio that encouraged and persistently coaxed them to think in alternative design-based ways. The influence of a leadership development program over educators’ problem solving, even a program at a rigorous doctoral level, seems to pale in comparison to the pull of the contextual conditions that structure leaders’ work.

The leaders might have clung to these patterns for another reason. Design-based problem solving requires leaders to look in the right places when they assess the needs of organizational members or when they select powerful adult learning processes that may drive change. As we discussed in the section on problem solving, expert problem solving is a combination of knowledge about

how to design or problem solve and domain knowledge. As to domain knowledge, leaders would need to know what systemic processes produce the status quo in their organizations and where they have leverage for change through adult learning. They would need categories or theoretical models of the functioning of schools as organizations that explain these processes to them. Without these models or categories, they may understand their organizations intuitively but may face them as a black box analytically. Thus, leaders who lack this domain knowledge might have no option but to cling to putative best practices. If so, then how might we go about developing leaders' expertise in the reasoning and thinking entailed in design-based problem solving?

The Treatment

A significant limitation of this study is that we did not systematically study this mind-set in direct relationship to the teaching that was going on in the program that, after all, posed the challenge, or "treatment," to think differently from the template that seemed to work well in the leaders' practical context of action. We focused on the students' thinking rather than the instructors' teaching. Although we regularly reflected on the teaching that was going on in the milestone courses and made adjustments when needed, resources limited our ability to study both our students' thinking and our instruction systematically at the same time. Thus, as a first order of business, we focused on understanding our learners' needs and ways of thinking in a deeper way. As instructors, we were not prepared, initially, for the obstacles that we would face. We were caught in our own university-based intuitions and heuristics of believing that thinking slowly through the IDEAL sequence of problem solving would be "natural" and education leaders in doctoral programs needed mere nudging. This turned out not to be the case. Given the limitations of the data, our learning as instructors needs to be left to a report on practice and further systematic study. Suffice it to say that the teaching in the program, many years before this writing, began with a rather formulaic, abstract, and linear approach of going through the steps of designing. As we taught, we consulted the extant scholarly literature and learned from experience. We relaxed linearity. We learned how to switch from problems to solutions and back, from goals to metrics and back, and from passions to results and back. We intertwined waves of needs assessment with the unfolding of a theory of action that was challenged by evidence collected in an ongoing way. In a next step, we gave up on notions of designing experiments with clear contrasts between baseline (no treatment) and outcome when we encouraged students to get involved in preliminary and inchoate trials from day 1. We came to perceive the change projects as ongoing, and a baseline would be established midstream. We saw the necessity to confront leaders not only with data but also with

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direct experiences of the change effort so as to challenge their intuitions, and we discovered gaps in the participants' domain knowledge that needed to be filled with redesigned domain knowledge courses on organizational and adult learning.

Why Bother?

If the work is so difficult, why bother? This is not just a question for the narrow field of leadership preparation but for the field of education as a whole. The problem-solving capacities of principals and district leaders have tremendous repercussions for the practices of teachers and students in the system. Why not settle for muddling through or accept the limits of schools' and districts' design capacities and emphasize implementation of designs or programs developed elsewhere, a logic of action toward which principals' and district administrators' problem-solving mind-sets are presumably well adjusted?

We submit that to answer these questions in the affirmative would result in the acceptance of an undesirable status quo. We have learned that the supremacy of an outside-in dynamic in school improvement has often led to an incoherent churn of solutions and to implementation overload that wastes time and energy and uses up preciously scarce improvement capacities. Even comprehensive school designs presumably developed through systematic and rigorous research and development have not had the expected success (Cohen et al. 2013; Datnow et al. 2003; Mirel 2002). Moreover, we would accept atrophied internal problem-solving capacity in educational organizations that have a degree of autonomy in getting it right or wrong.

An Alternative Architecture of Improvement

Strengthening the internal problem-solving capacity of education leaders by engaging in design thinking does not mean that all solutions ought to be designed internally. The findings of this study caution against overestimating the design capacity of school and district leaders. Externally developed programs, materials, and designs clearly have their place in school improvement, but they need to be artfully interwoven into an internally coherent approach (Honig and Hatch 2004) to schools' and districts' urgent problems. This internally coherent approach may rely to a substantial degree on internal problem-solving capacities. The designs developed in this vein may not be designs "from scratch" but sequences of activities that artfully interweave externally developed programs with internally suitable approaches.

A leadership preparation program, such as the research site for this study, may have marginal utility for the students engaged in a multiyear design studio. Given the lessons learned from this study, it is doubtful that this experience by itself creates a sufficiently powerful counterweight to a system logic that runs counter to deliberate and coherent reform. At the very least, internal problem-solving and design capacities need to be augmented and reinforced by external partners that provide domain knowledge about school improvement and specific (design) expertise about selected problems of practice. The doctoral program mentioned in this article has served as one such external partner but one that is not proximate enough to realities on the ground, even though it strives to build bridges. Research-practice partnerships among university researchers, intermediary organizations, and districts and schools are a recently touted model that may bring internal and external partners together in joint problem solving. In fact, we have been involved in one over the past 4 years. Improvement science (Bryk et al. 2015), design-based school improvement (Mintrop 2016), and design-based implementation research (Fishman et al. 2013) are methodologies that may guide such partnerships.

We stated earlier that continuous quality improvement according to the principles of improvement science or design development calls for a high degree of rational problem-solving capacity on the part of internal school and district actors that surpasses their capacity to merely implement solutions generated from the outside or muddle through. If our small sample of nine participants who were part of the systematic study and our experience as instructors in the leadership doctoral program with a larger number of students are any indications, this capacity cannot be assumed to exist. Rather, it will be an arduous challenge for higher education programs to develop it. It should be noted that our study is limited in that it captures cognitive processes of problem solving at the level of the individual. Even though participants collaborated with their colleagues and interacted with critical friends and design coaches, the collective nature of problem solving is not sufficiently captured in this study. One potential benefit of partnership-based design research is the possibility that distributed expertise and collective processes of problem solving could mitigate against individuals' ingrained heuristics.

In the quest to make school improvement a more systematic, evidence-based, scientific, or design-based undertaking, we bank on education leaders as expert problem solvers who understand adult learning in an empirically grounded way and are capable of charting innovative territory. This capacity needs to be created. The purpose of this article was not to examine teaching. However, in a follow-up study, it behooves us to advance knowledge on how education leadership programs, such as the one explored, can be reimagined to create powerful teaching and learning experiences that help leaders move beyond ingrained heuristics of thinking about school improvement in collective ways.

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Appendix

TABLE A1

Data Set Summary for Remaining Cases

PARTICIPANT	OBSERVATIONAL DATA		COURSE PAPERS		INTERVIEWS	COACHING SESSIONS
	Episodes	Class Sessions	Drafts	Pages		
Martina	35	18	12	81
Irene	32	15	10	87	1	3
Alan	27	16	11	74	1	2
Henry	28	16	11	91	...	1
Richard	47	16	13	71	...	2
Danielle	43	21	17	68	1	3

TABLE A2

Design-Based Problem-Solving Metamatrix (for Remaining Cases)

	Martina	Irene	Alan	Henry	Richard	Danielle
Leadership position	Central office administrator	Central office administrator	Central office administrator	Principal	Central office administrator	Principal
Initial framing	Driven by commitment to equity regulations and implementing RtI	Driven by personal experience and commitment to in-home support by migrant parent liaisons	Driven by passion to use positional authority as leader to address inequities; commitment to RtI	Driven by passion for EL achievement and professional experience of mandates and accountability	Driven by commitment to technology in the classroom and constructivist pedagogy	Driven by legacy of civil rights and belief in value of community for black students' academic success
Knowledge base	Normative, prescriptive	Confirmatory, normative	Confirmatory, normative, challenging assumptions	Confirmatory, prescriptive	Normative, confirmatory	Normative, confirmatory
Needs assessment	Absence of solution and learning needs of actors	Absence of solution	Absence of solution and learning needs of actors	Absence of solution and generic learning needs	Absence of solution and learning needs	Absence of solution
Understanding problem	Unclear org. procedures; cultural competency of teachers and counselors	Broad structures of social and cultural capital, prevalence of deficit thinking; lack of model	Teachers' deeply embedded beliefs about students, system-level tracking practices	Limitations of mandates; principals' low competency in instructional leadership for ELD	Teachers' competency, fear about shifting pedagogy and using technology	Institutional racism, varied ed. and psych. factors contributing to low achievement for black students

Understanding change process	Implementing tool; complex learning	Implementing liaison model; lectures and training on protocol	Implementing tool; complex learning	Implementing effective instruction; complex learning for instructional leaders	Implementing technology; complex learning	Implementing standards and supports; learning through self-reflection
Goals and desired states	Narrow: school counselors learn better SST procedures	Wide: liaisons reduce deficit thinking, develop parents' social and cultural capital	Wide: teachers shift beliefs and practices through professional learning across array of interventions	Narrow: principals learn about ELD instruction and lesson observation, feedback skills	Wide: teachers become more willing to experiment with tech and become more constructivist	Wide: school community becomes more supportive of black students
Eventual intervention	Workshops on tool and coconstruction of SST handbook, as part of Rd	Liaison workshops about deficit thinking and social capital, training on protocol	Teacher PD series on intervention strategies, training on tool; inquiry about struggling student	Principal PD series about effective ELD instruction, culture, mandates; reflection on observation and feedback for teachers	Teacher PD series of coaching, demos, and experimenting with technology and constructivist teaching strategies	Not fully developed: engaging a teacher community in courageous conversations, self-reflection

NOTE.—Rd = response to intervention; EL = English learner; ELD = English language development; SST = student study team.

Notes

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1. Participants' names and other identifying details were altered to protect anonymity.

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