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The Organization as a Filter of Institutional Diffusion

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Background/Context: *Institutional theories sometimes characterize the normative influence of institutions as diffusing like waves and as exerting uniform pressures on individuals. This article contributes to a growing literature on the microfoundations of institutions, investigating how intraorganizational networks mediate the diffusion of institutions on teachers' instructional practices.*

Purpose/Objective/Research Question/Focus of Study: *This study focused on the normative influence of reading policy on teaching practice in the early 2000s. We chose to focus on reading during this period, which was marked by an unusual level of policy coherence. Federal and state agencies, as well as school districts, implemented a number of policies and programs to encourage teachers to follow the National Reading Panel's (2000) recommendations to emphasize basic skills development in reading instructional practices.*

Setting: *The research took place in 11 elementary schools. An important note is that the pressure teachers experienced in these schools to adopt the practices recommended by the National Reading Panel was indirect. The schools in the study did include three Title I schools, but no schools in programs that required them to adopt these practices. All schools used state-adopted curricula in reading that were aligned with recommended practices.*

Population/Participants/Subjects: *All faculty members in the 11 schools were part of the study from 2004 to 2008. The sample in the final analysis (n = 136) included teachers with direct responsibilities for teaching reading in a single school over these 4 years. This figure represents 84.47% of our original sample (N = 161).*

Research Design: *This study is a longitudinal observational study that includes social network data and multilevel analysis. We surveyed faculty four times in waves conducted in 2004, 2005, 2007, and 2008.*

Data Collection and Analysis: *The primary source of data was a survey that asked teachers to identify their close colleagues and colleagues who provided them with help on reading instruction (including measures of frequency of interaction). The dependent measure in our analyses was based teachers' responses to items about instructional practices in reading, especially skills-based instructional practices. We fit multilevel models to estimate the extent to which reading practices were a function of teachers' interactions with colleagues and their membership in subgroups, which were identified from the indicators of closest colleagues using Frank's algorithm.*

Findings/Results: *Teachers' practices did not conform exclusively to the new normative regime but rather depended on exposure to external professional development in reading instruction and on local norms of practice in their schools and collegial subgroups. Over time, moreover, subgroups' practices diverged with respect to teachers' implementation of skills-based reading instructional practices.*

Conclusions/Recommendations: *Our study findings provide strong evidence that local social dynamics such as the ones we illuminate here are key in shaping the implementation trajectory of any instructional practice or reform. Policies may set the stage for adopting particular practices and direct resources toward certain kinds of supports through curriculum and professional development programs they incentivize. However, teachers' interactions with colleagues mediate the response to these directions and incentives in ways that can produce outcomes that diverge widely from policy makers' intentions.*

A recurring finding in studies of institutional diffusion and change is that even though institutional pressures may be similar for organizations in a field, the same institutional forces can result in divergent organizational outcomes (e.g., Scott, 2008). In this study, we add to this body of research by exploring how the organization as an institution (Williamson, 1981) filters the effects of other institutions on workplace practice. In particular, we focus on how intraorganizational networks contribute to organizational response to external pressure (Brass, Galaskiewicz, Greve, & Tsai, 2004; Kilduff & Tsai, 2003).

Our empirical analysis focuses on how teachers shape one another's

responses to a new institutional regime for reading instruction. The regime, instituted formally through federal policies and regulations, encouraged teachers to adhere to an evidence-based approach to developing students' basic skills in reading (National Reading Panel, 2000). It is important to note that the schools in our study were not subject to legal requirements that compelled them to follow this new approach, but as we show, individual teachers did change their practices after it became federal policy. To preview the main finding from our study, teachers' practices did not conform exclusively to the new regime but rather depended on exposure to external professional development in reading instruction and on local norms of practice in their schools and collegial subgroups.

Next, we elaborate a theoretical account of how normative pressures shape the diffusion of institutions within organizations that can help explain this pattern of results. We then present our empirical example featuring institutions for teaching reading and describe our data and measures. We specify multilevel models to estimate the extent to which teachers' responses to external forces depended on exposure to professional development external to the school, peers in the school, and subgroup members. The subgroup effects were estimated from our data on teachers' social networks, providing empirical work in response to recent calls for the integration of network analysis into organizational research (Brass et al., 2004; Kilduff & Tsai, 2003; Kilduff, Tsai, & Hanke, 2006). We conclude by considering how teachers' inclinations to conform to local professional norms can create divergent responses and emergent, school-level patterns that conflict with the policy goals that aim for coherent, consistent teaching practices.

THE ORGANIZATION AS FILTER OF INSTITUTIONAL FORCES ON WORKPLACE BEHAVIOR

Assuming that organizations are exposed in some measure to external institutions, the goal of our study is to understand how workers within organizations respond to external institutions. In particular, we focus on how organizations structure social networks that filter individual responses to institutional pressures. These networks are salient because they provide relevant resources for complex, locally adapted production, such as teaching (e.g., Bidwell, 1965; Frank, Zhao, & Borman, 2004). For example, a teacher may draw on her colleagues for knowledge of how to implement new practices given the types of students in her school, other elements of the curriculum, and so on.

It is important to note that the organization establishes the context for an exchange of knowledge for compliance. A worker possessing

knowledge may share it to gain status in the organization (Blau, 1964) and so that others may implement new practices that contribute to organizational productivity or legitimacy (Frank, et al., 2004). The worker accessing knowledge conforms to organizational norms to maintain her personal legitimacy and standing in the organizational social system. For example, a junior teacher may conform to the norms of others in exchange for accessing their local knowledge of how to implement the curriculum, improve classroom management, or navigate school politics.

To say that production workers' networks affect their responses to institutional pressures may seem straightforward (e.g., Scott, 2008). It conflicts, however, with Meyer's (2008) claim that "institutionalized forces usually diffuse more as cultural waves than through point to point diffusion" (p. 805). The difference has important implications for institutional diffusion; our conceptualization implies that a worker's response will depend on the norms to which she is exposed in her network and the resources that inhere in her network (Kilduff et al., 2006). In turn, organizational response will depend on how organizations distribute relevant resources and convey norms. The challenge for our analysis is then to characterize the mechanisms through which institutional norms permeate organizations. Before turning to this task, we characterize in more detail the changing institutional pressures on schools and teachers in the United States.

CHANGING INSTITUTIONAL PRESSURES ON SCHOOLS AND TEACHERS IN THE UNITED STATES

Early institutional accounts of schools portrayed them as organizations capable of exerting very little normative pressure on teachers, especially with respect to their instructional practices. For example, Meyer and Rowan (1977) argued that schools build gaps between their formal structures and actual work activities, leading to a "loose coupling" of the formal and informal organization. Forms of loose coupling documented in the 1970s include minimal observation or monitoring of the performance of work, making goals ambiguous and hard to measure, and making inspection and evaluation activities "ceremonial" (Bidwell, 1965; Meyer & Rowan; Meyer, Scott, & Deal, 1981; Weick, 1976).

One aspect of loose coupling has been supported by cultural norms of teaching. Institutions concerning teaching practice may not have succeeded in penetrating classrooms in the past because they encountered competing professional institutions concerning norms of privacy and autonomy. For example, Lortie (1975) described teaching as an isolated

profession, in which he likened teachers in schools to eggs in an egg crate, each teacher conducting her practice in a self-contained classroom with little need to interact with other teachers. He emphasized that the physical and social organization of schools supported norms of privacy, the obligation not to interfere in colleagues' instructional decision-making, and the idea of teaching as a highly individualized craft. During a wave of reform focused on school restructuring, a number of researchers began to emphasize the potential of greater collaboration on instructional matters as a way to overcome these norms (Rowan, 1990); however, that wave produced in most schools contrived forms of collegiality that did little to undercut norms of privacy and autonomy (Glidewell, Tucker, Todt, & Cox, 1983; Hargreaves, 1991; Little, 1990).

ACCOUNTABILITY-BASED REFORM AS A POLICY CHALLENGE TO LOOSE COUPLING

In the past two decades, a new institutional force of accountability has emerged in education. For example, in the mid-1990s, accountability-based programs were widely adopted by states (Elmore, Abelmann, & Fuhrman, 1996). Such programs have enjoyed bipartisan support among policy makers since that time because they address multiple goals of concern to people across a wide political spectrum, including the need to monitor progress toward providing equal opportunity and outcomes for children of color and children living in poverty, and the need to provide citizens with data on whether schools they support with their tax dollars are achieving high standards (Hess & Petrilli, 2006). The low cost of testing regimes relative to the costs of other policies (e.g., new curriculum or professional development initiatives) and the ability to render outcomes of schools visible to the public also facilitated the rise of accountability-based reforms (Linn, 2000).

   The new institution of accountability struck at the very heart of loose coupling because greater accountability linked community interests to observable outcomes that are a function of teacher behaviors and collaboration (D. K. Cohen, Raudenbush, & Ball, 2003; O'Day, 2002). Indeed, a number of new organizational roles and routines have emerged in the last 15–20 years in response to the push for accountability. For example, routines focused on the examination of student achievement data became common, especially those that look at patterns by student subgroups, which are the focus of attention in the current federal accountability system (Anderson, Leithwood, & Strauss, 2010; Means, Padilla, DeBarger, & Bakia, 2009; Wayman, Midgley, & Stringfield, 2006).

POLICY ATTEMPTS TO INFLUENCE TEACHING PRACTICE

Although most accountability-based reforms have not historically made specific demands on teachers' pedagogical practices (Hess & Petrilli, 2006; O'Day, 2002), concurrent with the emergence of higher stakes, federally mandated accountability in the United States has been an unusual level of coherence in federal reading policy. This coherence formed around a National Research Council report (National Reading Panel, 2000) that focused reading instruction on the basic skills required to decode print, especially phonological awareness and phonics. Soon after the publication of the report, states passed reading initiatives that reflected its recommendations (Allington, 2001; Miskel & Song, 2004). Significantly, the panel report came at the culmination of a period characterized by "the reading wars," which pitted alternative approaches to teaching reading against one another (Pearson, 2004), and the policy shift coincided with the passage of the federal No Child Left Behind Act (NCLB), which created a federal system of accountability for schools and districts.

NCLB established new programs and resources to incentivize schools—especially those serving low-income students—to adopt curriculum materials consistent with the panel report's recommendations. The Reading First program authorized by NCLB became the primary supplementary resource for funding professional development activities and curricula in reading in schools eligible for federal assistance from this program. Schools in the program were required to adopt reading curricula that focused on core reading skills identified in the consensus report of the National Reading Panel (2000). In interpreting and enacting the law's mandate, the U.S. Department of Education privileged programs emphasizing skills-based reading instruction that taught students primarily how to decode print (e.g., phonics-based instruction; U.S. Department of Education, 2006)

THE CONFLUENCE OF ACCOUNTABILITY-BASED REFORM AND A COHERENT VISION FOR CHANGE IN READING INSTRUCTION

The confluence of a coherent vision for instructional change with heightened accountability constituted a new "regulatory regime" (Schneiberg & Clemens, 2006) that defined both specific norms and constraints on action, a hallmark of institutionalization (Meyer, Boli, & Thomas, 1994). Thus emerged, in 2002 with the passage of new laws and funding for reading programs aligned to this regime's goals, a new, potentially powerful institutional wave in reading—a wave that, if past history is a guide,

could be expected to crest in 3–5 years (Cuban, 1990). Thus, our study, featuring data collected in the 2006–2007 and 2007–2008 school years is ideally situated to measure the impacts of the institutional wave associated with the new regime in reading.

In the next section, we develop a set of hypotheses concerning how institutional norms diffuse from the national level ultimately into the school. We begin with a baseline hypothesis concerning the effects of professional development. We then move to effects attributable to the school, the more novel effects concerning intraschool processes, and their implication for variable effects over time.

FACTORS AFFECTING TEACHERS' RESPONSES TO INSTITUTIONAL FORCES

Absent specific prescriptions for behaviors, institutions created at the national level need some mechanism of conveyance to affect worker productivity at the local level. For some institutional fields, mass media is an important mechanism (Scott, 2008). However, even though teaching quality is sometimes the focus of mass media attention (e.g., Felch, Song, & Smith, 2010), teachers' specific practices are rarely the subject of mass media.

Teaching practices are largely influenced by organizations that make up what is sometimes called the "school improvement industry" (Rowan, 2002). This refers to the constellation of organizational actors, many of which are in the private for-profit and nonprofit sectors and provide curriculum materials and professional development services to schools. Of these actors, organizations that provide content-focused professional development are most critical to changing practices because they provide models for how to implement new approaches to teaching (D. K. Cohen & Hill, 2000, 2001). These organizations thus serve as an important conduit between national institutions and the organizational boundary of the school. Furthermore, while providing professional development content, professional developers can convey normative messages about goals for teaching and the best strategies for reaching those goals (Zwart, Wubbels, Bergen, & Bolhuis, 2009). These are likely to be messages that align with emerging regimes for instruction (e.g., basic skills), because such alignment contributes to the legitimacy of these organizational actors' activities. Therefore we hypothesize:

> Hypothesis 1: *The more a teacher receives professional development in reading instruction, the more the teacher will implement basic skills instruction consistent with current institutional norms.*

Note that although professional development typically occurs outside the school, we consider it on the organizational boundary of the school because the school chooses most professional development providers and has considerable influence over participation in professional development (Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009).

If an institutional force has penetrated a school via a few teachers' participation in professional development, the question arises as to how and why other members of the school would adopt similar practices. First, many teachers may feel a strong identification with their school, and this identification may create a strong motivation to conform to others in order to preserve standing in the community (Akerlof & Kranton, 2010). Second, teachers may form a tight-knit, cohesive community that perceives a high level of collective responsibility for improvement, making outright resistance to faculty who bring new resources or ideas about teaching unlikely (Penuel, Riel, Krause, & Frank, 2009). Our second hypothesis, then, is:

> Hypothesis 2: *When a teacher's school conforms to institutional norms regarding skills-based reading instruction, that teacher will implement similar practices.*

This hypothesis might seem straightforward from the perspective of organizational identification (Akerlof & Kranton, 2010). However, in this context, the hypothesis explicitly recognizes the role of organizational members in mediating the diffusion of institutions defined external to the school.

Within schools, previous research suggests that informal subgroups or cliques can play important roles in defining salient norms (Frank & Zhao, 2005; Yasumoto, Uekawa, & Bidwell, 2001). The dense ties within subgroups contribute to norms to which subgroup members are likely to feel compelled to respond (Burt, 2005; Buskens, 1998; Coleman, 1990; Portes & Sensenbrenner, 1993) because subgroup members serve as a basis of reference (Merton, 1957) or identity (Akerlof & Kranton, 2010). Indeed, informal norms emphasizing conformity to colleagues are critical to the functioning of many organizations (Nadel, 1957; Nee & Ingram, 1998; Simmel, 1955; Weber, 1922/1947). In our example, a teacher might increase her emphasis on basic skills if she is a member of a subgroup focused around basic skills practices and materials. Our third hypothesis relates to subgroups:

Hypothesis 3: *The more a teacher's subgroup members implement basic skills instruction, the more she will implement similar practices.*

Critically, this hypothesis implies that an underlying structuring of stable relations, in terms of subgroups, can anticipate the implementation of new innovations (Frank & Zhao, 2005). Thus, though workers may be influenced by different members of their subgroups, subgroup members nonetheless provide a dynamic stability (Kilduff et al., 2006) concerning how workers respond to forces exogenous to their organizations.

Together, our second and third hypotheses imply that processes by which individuals induce cooperation and conformity in others mediate the diffusion of institutions. One counterargument is that institutional norms are conveyed by direct and frequent interaction. It may be that simply being "in the air" of the subgroup or school does not produce sufficient normative pressure to change practices. Indeed, past empirical research suggests that teachers are likely to conform to those teachers with whom they have *direct* interaction on matters related to instruction (Frank et al., 2004; Penuel, Frank, & Krause, 2006). Therefore, we evaluate our second and third hypotheses with and without controlling for exposure to colleagues' practices through direct interaction.

Although the diffusion of the institution as we have described it may seem natural and uneventful, it has implications for the distribution of teaching practices within schools. Namely, if teachers conform to school norms (as specified in Hypothesis 2) and there are initial differences across schools, then we would expect divergence in practices among schools as teachers within schools become more similar to one another and teachers between schools become more different from one another. The social influences within the school essentially create a multiplier effect (Becker & Murphy, 1990), which has been demonstrated for divergence of crime rates by city precincts (Glaeser, Sacerdote, & Scheinkman, 1996) as well as math course-taking among adolescents within high schools (Frank et al., 2008), and which amplifies initial differences between different social contexts. Thus, we hypothesize:

Hypothesis 4: *Variation among schools in the implementation of basic skills instruction will increase over time.*

This hypothesis potentially informs the divergence of organizational responses to external institutions.

The principle of divergence also applies to subgroups to the extent that

teachers conform to subgroup norms apart from the norms of their school. Namely, if teachers conform to subgroup norms (as specified in Hypothesis 3) and there are initial differences across subgroups, then we would expect divergence in practices among subgroups as teachers within subgroups become more similar to one another and teachers between subgroups become more different from one another. Thus, we hypothesize:

> Hypothesis 5: *Variation among subgroups in the implementation of basic skills instruction will increase over time.*

This hypothesis has important policy and administrative implications because variation between subgroups within schools can create coordination challenges for the school. Students may experience instruction consistent with one regime or approach one year and a different, perhaps contradictory approach the next (Hong & Raudenbush, 2008; McLaughlin & Talbert, 2001). Furthermore, teachers adopting different practices would have vastly different sets of practices on which to graft further innovations (Rogers, 1995), creating further challenges to organizational coordination.

THE CURRENT STUDY: ELEMENTARY TEACHERS' IMPLEMENTATION OF BASIC SKILLS READING INSTRUCTION

METHODS

Sample

This study consists of 11 elementary and middle schools from eight school districts engaged in whole-school reform activities prior to the passage of NCLB. The schools were located in urban and suburban areas near major cities in California. None of the schools was a Reading First school, and none of the schools participated in the federal reading program associated with the new policy consensus about how to teach reading (only one sampled school had funded Reading First programs in the district; however, the school itself was not a Reading First school). Only two failed to meet requirements of NCLB that students make "adequate yearly progress" toward proficiency in reading and mathematics. It is important to note that for purposes of the current study, no school was both in the Reading First program and under pressure for improvement under NCLB; thus, pressure to adopt the consensus approach to

teaching reading in these schools could best be described as primarily normative rather than regulative.

Each of these schools employed one of two (at the time) curricula that had been adopted by the state for teaching reading. Both of these claimed strong alignment to the framework of the National Reading Panel. These texts were adopted, however, 2 years prior to the beginning of the study; thus, we interpret these materials as providing support for teachers and schools implementing skills-based instruction conforming to the guidance of the new policy regime in reading. Case study research in these schools shows that, as in many other schools, teachers supplement materials and implement strategies that can diverge in philosophy and approach from adopted materials (Penuel et al., 2009).

Table 1. School Demographic Information, 2007–2008

ID	Grade Span	Student Enrollment	White	FTE Teachers	Title I School	Met AYP?	Reading First District
Pomo (1)	K–5	441	56.0%	25	No	Yes	No
Pasteur (3)	K–6	898	0.7%	43	Yes	No	No
La Plaza							
Charter (8)	K–6	542	14.6%	27	No	Yes	Yes
Glade (14)	K–8	646	0.3%	29	Yes	No	No
Forest (26)	K–8	538	27.1%	26.8	Yes	Yes	No
Crosswinds (39)	K–5	619	37.6%	33.3	No	Yes	No
Innovation Charter (45)	K–4	239	77.8%	14.6	No	Yes	No
Downtown (47)	5–8	580	74.8%	24.8	No	Yes	No
Hermosa (48)	5–8	554	70.6%	22.2	No	Yes	No
Sage (53)	K–4	342	64.6%	19.2	No	Yes	No
Dickersen (54)	K–5	288	25.7%	18.6	Yes	Yes	No

Note. In the AYP status column, Yes means that the school met AYP in both reading and math in 2007–2008; No means that the school did not meet AYP in either reading or math; an exception is Pasteur (School 3), which did not meet AYP in reading but met AYP in math. Data sources: Common Core of Data from the National Center for Education Statistics for the 2007–2008 school year; Reading First Eligible District from California Department of Education. All school names in the table are pseudonyms

Table 1 shows basic characteristics of schools in the sample obtained from the Common Core of Data of the National Center for Education Statistics for the 2007–2008 school year and from the California Department of Education. We focused on 11 schools in this study, nine elementary schools and two middle schools; the grade span in each school is indicated in the second column of Table 1. These 11 schools served diverse but relatively stable student populations. Enrollments

ranged from 239 to 898, with an average of 517. Of these schools, six had a majority non-White student population. On average, the mean percentage of African American students was approximately 5%, Hispanic 40%, and White 43%. The average number of full-time equivalent (FTE) teachers was 26. Among the 11 schools, four were Title I schools (schools that receive funds because they have high concentrations of low-income children), and the median percentage of students eligible for free or reduced-price lunch was 25%. Thus these schools define an important cross-section, being neither unusually advantaged nor homogeneous.

We surveyed all faculty members in the 11 schools four times in waves conducted in 2004, 2005, 2007, and 2008. The sample in the final analysis ($n = 136$) is for teachers with direct responsibilities for teaching reading in the same school over these 4 years. This figure represents 84.47% of our original sample ($N = 161$).

At the fourth wave of survey, all the teachers had full certification (advanced professional, regular/standard/probationary) in their main assignment field. In addition, the average teaching experience of the sample was 14.9 years, and the mean of years working at the current school was 9.2 years. The sampled teachers' relatively longer and stable working experiences in the current schools allowed us to estimate effects through teachers' enduring relations across years.

We selected 5 of the 11 schools in our sample for more focused case studies: Pasteur, Dickerson, Sage, Crosswinds, and Forest (all names of schools are pseudonyms). In each of the case study schools, we interviewed principals and a sample of teachers. We used social network data collected as part of an earlier wave of survey data to select teachers to interview, taking care to select representatives from different informal subgroups (determined using the algorithm described next). We selected roughly one teacher per subgroup.

DEPENDENT VARIABLE: SKILLS-BASED INSTRUCTION IN 2008

Our dependent variable is the extent to which teachers adopted "skills-based instruction" in their reading instruction in 2008. We asked teachers to indicate on a 5-point scale (1= *almost never*; 2 = *1 or 2 times a month*; 3 = *1 or 2 times a week*; 4 = *almost every day*; and 5 = *one or more times a day*)[1] how often they: read stories or other imaginative texts; practice dictation (teacher reads and students write down words) about something the students are interested in; use context and pictures to read words; blend sounds to make words or segment the sounds in words; clap or sound out syllables of words; drill and practice sight words (e.g., as part of a competition); use phonics-based or letter-sound relationships to read words in

sentences; use sentence meaning and structure to read words; and practice letter-sound associations. We took the mean of the nine items to form one composite variable (= 0.90).

Focal Independent Variables

Exposure to reading-content-focused professional development in 2008. In the context of this study, Hypothesis 1 concerns the effects of teachers' exposure to reading-content-focused professional development[2] on teaching practices. Our measure of exposure was how much professional development in reading the teacher indicated she had engaged in over the past year (0 = *none at all*; 1 = *1–8 hours*; 2 = *9–16 hours*; 3 = *more than 16 hours*).

   School mean of skills-based instruction in 2007. Our second hypothesis concerns the effect of organizational norms on teachers' practices. We defined the school norm as the average extent to which the teachers in a school implemented skills-based instructional practices in 2007. Our measure of prior skills-based practices in 2007 consisted of a composite of a subset of item prompts from the dependent measure used during the baseline year, with slightly different rating scales for each prompt (1 = *not at all*; 2 = *1 or 2 times per month*; 3 = *3 or 4 times per month*; 4 = *5 or 6 times per month*; 5 = *more than 6 times per month*). The items included were: read stories or other imaginative texts; use phonics-based or letter-sound relationships to read words in sentences; use context, pictures, and/or sentence meaning and structure to read words; and blend sounds to make words or segment the sounds in words (= 0.87).[3]

   Subgroup mean of skills-based instruction in 2007. As the institution penetrates deeper into the social organization of the school, our third hypothesis is that teachers will respond to specific subgroup norms. The prologue for creating this measure was to identify cohesive subgroups. We did so from a 2004 sociometric question asking teachers to list their closest colleagues in their schools, a stable and enduring relationship (Frank & Zhao, 2005; Kilduff, et al., 2006). Identifying subgroups across all schools in our sample then required an algorithm that could identify nonoverlapping within-school subgroups with a minimum of subjective input or interpretation from the researcher (e.g., specification of the number of subgroups, criteria defining subgroups). We used Frank's (1995, 1996) network-clustering algorithm for this purpose, which has been employed in both the social sciences (e.g., Foster-Fishman, Salem, Allen, & Fahrbach, 2001; Frank & Yasumoto, 1998; Yasumoto et al., 2001) and the natural sciences (Jaeger-Miehls et al., 2009; Krause et al., 2009; Krause, Frank, Mason, Ulanowicz, & Taylor, 2003). The algorithm maximizes the within-subgroup density of relations relative to the between-

subgroup density, a criterion related to social network models such as exponential random graph models and p_2 (Frank, 1995; Lazega & Van Duijin, 1997; Snijders, Pattison, Robins, & Handcock, 2005; Wasserman & Pattison, 1996). Ultimately, we identified 34 subgroups across 11 schools, with the average subgroup containing 3 to 4 teachers who responded to teacher surveys in both 2004 and 2008 (13 teachers from 2008 were unassigned because they did not complete the 2004 survey). To define the subgroup norm, we averaged the extent to which the members of the subgroup implemented skills-based instruction in reading in 2007.

Covariates

See the technical appendix for details of each measure.

Direct exposure to colleagues' skills-based instruction. To estimate the extent to which school and subgroup effects could be attributed to direct exposure, we measured exposure as a function of interactions teachers had with others reported between 2007 and 2008, and the others' instructional practices reported in 2007.

Prior skills-based instruction in 2007. Of course, we recognize that those already engaged in a given practice may seek out specific professional development experiences, schools, or subgroups that emphasize similar practices. The implication is that any association between a teacher's practices and our focal independent variables may be due to initial practices. In response, we leverage our longitudinal data to control for teachers' *prior* tendencies to engage in skills-based reading practices, as measured in 2007. Indeed, recent results (Cook, Shadish, & Wong, 2008; Shadish, Clark, & Steiner, 2008) have shown that estimates of treatments from models that control for prior measures of the outcome closely approximate estimates from randomized experiments in which there is an expectation of no confounding.

Perceived value of evidence-based reform strategies in 2007. Consistent with classic diffusion models (Rogers, 1995; Wolfe, 1994), new institutionalism operates partly by changing perceptions through multiple subtle mechanisms. Therefore, we controlled for the perceived value of evidence-based strategies.

Highest grade taught in 2008. Most elementary schools serve grades K–5 or K–6, but the Reading First program made funding available only for grades K–3, such that teachers of upper elementary level students had more discretion with respect to curriculum and instruction. By controlling for highest grade taught, we recognize the potential for the formal

organization of the school, in terms of grade-level assignment, to influence behavior.

ANALYTIC STRATEGIES

We present correlations among our dependent variable and independent variables at the individual, subgroup, and school levels (where appropriate). We then specified our quantitative models in a multilevel framework, with teachers nested within subgroups nested within schools.[4] This allowed us to estimate the variance decomposition and effects at each level (Raudenbush & Bryk, 2002). Our first conditional model estimated effects of professional development, school, and subgroup influences, controlling for covariates (to test Hypotheses 1–3). Our second model evaluated the extent to which effects of subgroups or schools could be attributed to direct interactions with colleagues.[5] We also quantify the robustness of our inferences to potentially omitted variables and provide qualitative support for our inferences.

   To test Hypotheses 4 and 5, we decomposed the variance in basic skills practices among schools, subgroups, and individuals. We did this separately for 2007 and 2008 so that we could compare variance decompositions over time, using the shortened version of basic skills practices in 2008 to be comparable with the 2007 version. Skills-based instruction in 2008 was a composite of five items, whereas the skills-based instruction in 2007 was a composite of four items, because one of items in the 2007 survey was separated into two items in the 2008 survey. To standardize the scale and make the variances from these two years comparable, we divided each variable by the number of items.

   For independent variables that had missing data, we set the missing values to zero and included a flag in the model indicating that the original value had been missing (J. Cohen & Cohen, 1983). Two flags were included in the first model, one indicating missing data for exposure to reading-related professional development in 2008 and the other for perceived value of NCLB in 2007. In the second model, we added one additional flag for missing data on exposure to colleagues' skills-based reading instruction. In both models, we also flagged teachers who were not assigned to a subgroup by Frank's algorithm.

RESULTS

Table 2 shows strong correlations between individual teachers' level of skills-based based instruction in 2008 and each of our independent variables: skills-based instruction in 2007 ($r = .611$); exposure to reading-

related professional development ($r = .350$); direct exposure to colleagues' emphasis on skills-based practices ($r = .442$); perceived value of NCLB ($r = .311$); and highest grade taught ($r = -.584$). In addition, as indicated in Table 3, subgroup mean of skills-based instruction in 2008 was strongly correlated with subgroup mean of skills-based instruction in

Table 2. Correlation Among Teacher Level Predictors

	Mean	Standard deviation	Skills-based instruction in 2008	Exposure to reading-content-focused professional development in 2008	Direct exposure to colleagues' skills-based instruction	Prior skills-based instruction in 2007	Perceived value of evidence-based reform strategies in 2007	Highest grade taught in 2008
Skills-based instruction in 2008	29.839	8.464	1.000					
Exposure to reading-content-focused professional development in 2008	1.228	0.943	0.350***	1.000				
Direct exposure to colleagues' skills-based instruction	396.189	415.121	0.442***	0.170*	1.000			
Prior skills-based instruction in 2007	13.973	4.228	0.611***	0.195*	0.263**	1.000		
Perceived value of evidence-based reform strategies in 2007	2.320	1.053	0.311***	0.090	0.091	0.178*	1.000	
Highest grade taught in 2008	4.390	2.294	-0.584***	-0.168*	-0.302***	-0.487***	-0.069	1.000

$n = 136$
$p \leq .1.$ *$p \leq .05.$ **$p \leq .01.$ ***$p \leq .001.$

2007 (r = .801), and school mean of skills-based instruction in 2008 was strongly correlated with school mean of skills-based instruction in 2007 (r = .926). These results suggest that we have identified some of the most important covariates for our analysis.

Table 3. Correlation Among Subgroup and School-Level Predictors

	Mean	Standard deviation	Subgroup mean of skills-based instruction in 2008	Subgroup mean of skills-based instruction in 2007	School mean of skills-based instruction in 2008	School mean of skills-based instruction in 2007
Subgroup mean of skills-based instruction in 2008 (n = 47)	29.907	7.779	1.000			
Subgroup mean of skills-based instruction in 2007 (n = 47)	13.506	3.396	0.801***	1.000		
School mean of skills-based instruction in 2008 (n = 11)	12.776	2.981			1.000	
School mean of skills-based instruction in 2007 (n = 11)	13.009	2.705			0.926***	1.000

$p \le 0.1.$ $^*p \le .05.$ $^{**}p \le .01.$ $^{***}p \le .001.$

Results of the multilevel model are shown in Table 4. Consistent with our first hypothesis, the more a teacher was exposed to reading-based professional development, the more she emphasized skills-based practices. Teachers emphasized .16 more units of basic skills for each unit increase in the amount of reading professional development (roughly 8 hours). Consistent with our second hypothesis, teachers were influenced by their school norms: For each unit increase in the 2007 school mean of skills-based instruction, teachers included .74 more units of basic skills in 2008. Our third hypothesis is similarly supported: For each unit increase in the 2007 subgroup mean of skills-based instruction, teachers included .63 more units of skills-based instruction in 2008. As a basis of comparison, the standardized coefficients for the teacher's own prior level of

skills-based practices, that of her subgroup, and that of her school are similar (.216, .279, and .232 respectively), suggesting that the influences of colleagues are roughly as important a teacher's own prior behaviors.

Note that each of the effects reported in Table 4 is net of a teacher's own tendency to teach skills-based practices in 2007. That is, the effects

Table 4. Multilevel Model of Extent of Skills-Based Instruction in 2008

Variable	Model 1		Model 2	
	Unstandardized Coefficient	Standardized Coefficient	Unstandardized Coefficient	Standardized Coefficient
Level 1: Individual Teacher (N =136)				
Exposure to reading-content-focused professional development in 2008	1.591**	0.114	1.623**	0.116
	(0.484)		(0.489)	
Direct exposure to colleagues' skills-based instruction	____		0.003*	0.143
			(0.001)	
Prior skills-based instruction in 2007	0.441**	0.216	0.457***	0.225
	(0.135)		(0.134)	
Perceived value of evidence-based reform strategies in 2007	1.384**	0.168	1.510**	0.183
	(0.521)		(0.509)	
Highest grade taught in 2008	-0.859***	-0.235	-0.783**	-0.214
	(0.251)		(0.243)	
Level 2: Subgroup (N = 47)				
Subgroup mean of skills-based instruction in 2007	0.632**	0.279	0.447	0.197
	(0.251)		(0.249)	
Level 3: School (N =11)				
School mean of skills-based instruction in 2007	0.738*	0.232	0.752*	0.236
	(0.308)		(0.292)	

Note. We estimated fixed effects for schools by adding dummy variables for schools at the subgroup level of a two-level model. In particular, we controlled for the four most extreme schools using four dummy variables, because a full set of fixed effects created collinearities that increased our standard errors substantially (more than 10%). In this alternative model, the coefficients of our Level 1 and Level 2 predictors did not change substantially, and using school fixed effects did not alter any of our inferences. Standard errors are included in parentheses.

$p \leq 0.1$. $^{*}p \leq .05$. $^{**}p \leq .01$. $^{***}p \leq .001$.

of professional development, school peers, and subgroup members are estimated, holding constant prior levels of emphasis on basic skills. This reduces the likelihood that the estimated effects can be attributed to the tendency for teachers to seek experiences and work contexts consistent with their previous practices. Furthermore, the effects of our focal predictors are also estimated, holding constant perceived value of evidence-based reform strategies (which had the anticipated positive effect on skills-based instruction) and highest grade level taught (which had the anticipated negative effect on skills based instruction).

Together, the support for Hypotheses 1–3 suggests that institutions diffuse through interactions with others outside the organization (e.g., through professional development outside the school) and through interactions within the organization (e.g., with school colleagues and subgroup members). Therefore, these results imply that differential exposure to others' practices will create differences in responses to external institutions; response is not uniform.

Model 2 includes the effect of direct exposure, evaluating the extent to which school and subgroup effects can be attributed to direct interactions. Indeed, direct interactions are partly responsible for subgroup effects. Including the direct exposure term in the model reduced the subgroup effect by roughly 30%, although it did not alter the estimates for professional development, or schools to any appreciable degree. It is important to note that there is still a meaningful coefficient associated with subgroups even after controlling for exposure via direct interactions (coefficient =.45, $p \le .10$). This suggests that subgroup effects are due in part to the dense concentration of interactions contained within their boundaries but that subgroups (and schools) generate norms that cannot be attributed fully to direct interactions.

QUANTIFYING THE ROBUSTNESS OF OUR INFERENCES

Any policy or theoretical interpretations we make in our study will depend on the robustness of our inferences. Recognizing the importance of causal inference, we control for the prior level of skills-based instruction. Furthermore, we also controlled for other key covariates. However, our inferences may be invalid because our covariates may be inadequate as controls.

To express robustness that accounts for the relationship between an omitted confounding variable and the predictor of interest *and* between the confounding variable and the outcome, Frank (2000) defined the impact of a confounding variable on an estimated regression coefficient

as impact= $r_{yv} \times r_{xv}$. In this expression r_{yv} is the correlation between the outcome y (e.g., skills-based instructional practices) and a confounding variable, v (e.g., motivation), and r_{xv} is the correlation between the predictor of interest, x (e.g., hours of reading-content-focused professional development) and the confound.

Using the definition impact = $r_{yv} \times r_{xv}$, Frank (2000) quantified how large the impact of an unobserved confound must be to invalidate an inference. Applied to our study, the impact of an unmeasured confound would have to be greater than .13 to invalidate our inference of an effect of professional development on use of skills-based instructional practices (the impact would have to be greater than .10, with the multivariate correction controlling for prior implementation of skills-based practices). Each component correlation r_{yv}, (correlation between skills-based instruction and the confound), and r_{xv} (correlation between professional development and the confound) would have to be greater than 0.36 to invalidate our inference of an effect of professional development on skills-based instruction.

For interpretation, it is helpful to compare the impact thresholds calculated in the preceding paragraphs to the impacts of measured covariates (Frank, 2000). From Table 2, the covariate with the greatest impact on the coefficient for professional development is highest grade taught, with an impact of .098 (impact =$r_{\text{highest grade} \cdot \text{professional development}} \times r_{\text{highest grade} \cdot \text{basic skills 2008}}$ = -.168 × -.584 =.098). Thus the impact of an unobserved confound would have to be 30% larger than the impact of our strongest observed covariate to invalidate our inference of an effect of professional development on skills-based instruction.

Similar calculations show that the impact of an unobserved confound would have to be .09 (with component correlations of .31) to invalidate our inference of an effect of the prior subgroup mean of instructional practices. Similarly, the impact of an unobserved confound would have to be .12 (with component correlations of .36) to invalidate our inference of an effect of the prior school mean (although calculations would be more complex if the observations were highly unbalanced across subgroups or schools; Seltzer, Kim, & Frank, 2006). Although these calculations do not make the inferences irrefutable, they do establish that an unobserved confound would have to have a strong impact to invalidate our inferences.

An important note is that, adjusting for prior skills-based instruction (as was done in the models we report in Table 4), the impacts of highest grade taught and perceived value of evidence-based reform strategies were essentially zero (or negative); controlling for the prior negates much of the impact of observed covariates (e.g., Shadish et al., 2008).

Because the prior may also absorb some of the impact of unobserved confounds, the unadjusted impact of an unobserved confound would likely have to be considerably greater than the impact thresholds of .13, .09, and .12 to invalidate any inferences made while controlling for the prior.

CHANGE IN VARIANCES AT DIFFERENT LEVELS OF THE MODEL

To help us understand the extent to which skills-based instruction was diverging or converging, we modeled change in the variance structure. Convergence would be predicted if normative pressure penetrates across schools and within schools uniformly. Divergence would offer a puzzle for policy makers because it would indicate that a general institutional pressure had an unintended effect of increasing, rather than reducing, variability in teaching practices.

Table 5. Variance Components of Skills-Based Instruction in 2007 and 2008

Levels	Spring 2007	Spring 2008	Percent Change
Individual teacher	0.789 (70%)	0.546 (58%)	-30.80%
Subgroup	0.332^{***} (30%)	0.381^{***} (41%)	14.76%
School	0.0003 (0%)	0.012 (1%)	3900.00%
Total	1.121	.939	-16%

Note. The percentages for the years are included in parentheses.
$p \leq 0.2$. $^{*}p \leq .05$. $^{**}p \leq .01$. $^{***}p \leq .001$.

As Table 5 shows, we saw evidence of both convergence and divergence. The total estimated variance decreased slightly (from 1.21 to .939, a decline of 16%). But variance due to schools increased from .0003 ($p \geq .5$) to .012 ($p \leq .20$). The change was 3900% (although relative to such a small baseline, this % change may not be meaningful). Furthermore, though the coefficient in 2008 is not statistically significant, the p-value of .20 suggests that this effect warrants further study given the limited degrees of freedom at the school level to detect an effect. Overall, we conclude that the evidence is not inconsistent with Hypothesis 4, although there is insufficient data to make a strong inference.

Consistent with Hypothesis 5, the estimated variance due to subgroups increased from .332 ($p \leq .001$) to .381 ($p \leq .001$), an increase of 15%. This change can also be understood as a percentage relative to each year. In 2007, 30% of the variance was at the subgroup level, with the remainder at the teacher level. In 2008, 41% of the variance was at the subgroup level (with 58% at the teacher level and 1% at the school level). These results again support Hypothesis 5; the proportion of variance due to subgroups increased from 2007 to 2008.

DISCUSSION AND CONCLUSIONS

We have extended Scott's (2008) conception of the "normative pillar" of institutional theory by accounting for the intraorganizational processes that affect behaviors targeted by institutions. We found that teachers were influenced by interactions with others at the boundary of the organization through professional development and within the school itself. It may seem obvious that opportunities for professional development and local social contexts would matter in a complex production process like teaching (Frank, Zhao, Penuel, Ellefson, & Porter, 2011), yet policies and programs of the new regulatory regime in reading did not direct attention to their importance (McKenna & Walpole, 2010). Instead, the new policy regime presumed that a coherent vision for instruction in reading at the national level and sanctions imposed at the school level would give sufficient incentive for all individual teachers to adopt practices consistent with the new regime.

Our attention to local networks is part of recent explorations into the microfoundations of new institutionalism (Lounsbury, 2001; Lounsbury & Ventresca, 2003; Powell, 1991). Consistent with these developments, we find that institutions trace their effects through local interactions, as knowledge and pressure flow through and are transformed by local interactions. The importance of these local networks particularly extends Williamson's (1981) conceptualization of the organization: As intraorganizational networks mediate the implementation of national norms for teaching reading, schools as organizations become part of the institutional milieu.

The importance of intraorganizational networks has implications for how schools as organizations are likely to respond to new policy regimes, however coherently articulated at the level of the state. First, teachers may be more likely to adopt an institution if they are exposed to professional development and school colleagues whose practices are consistent with the external institution and who can provide a knowledge base on which they can draw. Some professional development programs' design emphasizes providing professional development to teachers who are then expected to support their colleagues in changing their own practices. When the professional development goals are aligned with a subgroup's existing goals, teachers' practices may converge, and receiving help from colleagues who attended professional development can augment the overall effect of professional development on the school as intended (Sun, Penuel, Frank, Gallagher, & Youngs, 2011). In contrast, when the messages of professional development conflict with a school's directions, and when there is internal disagreement over the vision of how instruc-

tion should improve, schools may not adopt reforms, or subgroups of teachers may decide not to adopt them (Penuel et al., 2010). This can explain divergence of organizational response to external institutions (Scott, 2008).

Within the school, differences among existing subgroups can increase over time as actors conform to subgroup norms. This divergence in practice amplifies coordination challenges for the school as an organization to implement both current practices and future innovations. For example, subgroup differences that emerge in response to the external reading institution might become exacerbated in response to institutional pressures for technology (Frank & Zhao, 2005). The divergence between subgroup norms then becomes part of the organizational response: Either the very core functions of the organization are compromised, or the organization resists external forces to maintain coordination. Indeed, Catholic schools have resisted the influences of external institutions precisely to maintain organizational coherency (Bryk, Lee, & Holland, 1993).

These within-school differences were evident even within schools with similar demographics in our study. One might have expected teachers in the Title I schools in our sample to have adopted more skills-based approaches to reading because they are exposed to more pressure to conform to policy regimes by virtue of their accountability to federal mandates. Our quantitative analysis, however, found that teachers in Title I schools did not respond differently than teachers in more advantaged schools. Moreover, in earlier published qualitative analyses of two demographically similar schools in our study (Penuel et al., 2009), two Title I schools adopted different approaches to teaching reading even though both were under scrutiny from the state for low reading scores. One school succeeded in improving outcomes using a balanced approach to literacy; the other promoted fidelity to a skills-based state-adopted curriculum but did not improve results. A key difference between the schools was internal social dynamics that created a cohesive community in the first school and a fractured community in the second.

More generally, our study findings provide strong evidence that local dynamics such as the ones we illuminate here are key in shaping the course of any instructional practice or reform. Policies may set the stage for adopting particular practices and direct resources toward certain kinds of supports and not others through the kinds of curriculum and professional development programs they incentivize. Interactions with colleagues, however, mediate the response to these directions and incentives in ways that can produce outcomes that diverge widely from policy makers' intentions. In our study, a set of policy pressures intended to

direct production toward a particular kind of reading instruction did reduce overall variance in teaching practices, as the policy intended; however, we also observed divergence among subgroups in schools with respect to reading instruction. Subgroup dynamics contributed to this divergence, and policy makers would be wise to consider such dynamics in devising supports for implementation of policies and programs.

LIMITATIONS

Several limitations emerge from our novel analysis of longitudinal network data in 11 separate schools. First, we do not know the extent to which our findings will generalize to organizations in other industries. Our theory assumes that production is locally adapted, not hierarchically controlled, and that the organization is essentially cooperative. This might apply to small businesses or nonprofit organizations, but less so to large firms that employ industrialized production and hierarchical control and monitoring of work processes. We do note, however, that even if schools themselves did not represent other organizations, our results apply to a large industry; there are approximately 2.6 million elementary teachers in about 99,000 schools in the United States (National Center for Education Statistics, 2010).

Second, we have taken the social structure of an organization, including the presence of subgroups, as given. But informal and formal social structures are shaped as organizations learn and respond to external forces (e.g., Levitt & March, 1988). Furthermore, intraorganizational networks may be shaped by internal structures of organizations, including physical layout (Wineman, Kabo, & Davis, 2009). Thus, it would be valuable to know how stable relationships such as close collegial ties and subgroups emerge. The exploration of such interactions should begin with theories of how individuals choose with whom to interact and share resources (for examples in schools, see Frank, 2009; Frank & Zhao, 2005). From there, one can build to the emergence of organizational-level structure through induction or simulation techniques such as agent-based modeling (e.g., Maroulis et al., 2010; Wilensky & Resnick, 1999).

Third, we did not address the role of formal leadership in shaping organizational responses to external institutions. Quantitatively, we controlled for school differences, including those attributable to leadership, using multilevel models (and confirmed using fixed effects for schools). But qualitative data (not reported here, but reported in Penuel et al., 2009, 2010) suggest that principals did indeed interpret external institutions and then orchestrated their school's responses by allocating resources and signaling the importance of particular issues. Future

research should explore the links between the behavior of formal organizational leaders and the types of network processes we have modeled in this study.

Fourth, with regard to the measure of exposure to reading-content-focused professional development, we did not have quantitative data on the specific kinds of skills that professional development providers emphasized in their programs. Such data might have provided us with more compelling evidence regarding the specific kinds of instructional practices that providers emphasized. At the same time, professional development that is effective in changing practice tends to be aligned with district and state reform goals (Garet, Porter, Desimone, Birman, & Yoon, 2001), which themselves are shaped by current policy regimes and directions. Though we can hardly assume that the content of reading-related professional development was skills based, it is likely that a significant portion was, given the timing of our study.

Even with these limitations, our study makes important empirical and theoretical contributions. Empirically, we have collected and analyzed an unusual, difficult-to-obtain data set featuring longitudinal social network data in 11 organizations in a single industry. With respect to theory, we attended to the intraorganizational dynamics that affect institutional penetration (Brass et al., 2004; Kilduff & Tsai 2003; Kilduff et al., 2006), with the counterintuitive finding that an institutional press for uniform behavior can create inter- and intraorganizational divergence in behavior.

Notes

1.   We considered recoding to days per year, but this exaggerated the most frequent behaviors, skewing the distribution of responses. The original survey scale used here is roughly the log of days per year.

2.   This type of professional development is in contrast to professional development programs that focused on other subject areas (such as social science, mathematics, and writing), or on using achievement data for decision-making, or on general strategies of working with students with disabilities or from different ethnic/cultural subgroups.

3.   In the 2008 data, the four-item version of the measure of focus on basic skills was strongly correlated with the full measure ($r = 0.94$). Therefore, this shortened measure is sufficient as a measure of prior emphasis on skills-based practices.

4.   Inferences were verified using fixed effects. See Table 4.

5.   Given our inclusion of nested normative effects and grand mean centering of predictors, the estimated effect of mean prior skills-based instruction at the school level is adjusted for the mean prior skills-based instruction of the subgroup of the respondent, and therefore represents the normative influence of those *not* in the respondent's subgroup. Similarly, because we controlled for the respondent's own prior level of practices, the mean of the subgroup represents the effect of subgroup members other than of the respondent. Thus each estimate pertains to effects of different colleagues (school members who are not members of the subgroup; subgroup members besides oneself).

6.   In the 2008 data, the four item version of the measure of focus on basic skills was strongly correlated with the full measure (r =0.94). Therefore this shortened measure is sufficient as a measure of prior emphasis on skills based practices.

7.   We also considered how the change of grade levels might affect the change in level of skills-based instruction from 2007 to 2008. Therefore, we created an indicator of whether a teacher was teaching in a higher grade than the previous year and another indicator of whether a teacher was teaching in a lower grade. However, neither indicator was a statistically significant predictor of skills-based instruction, and inclusion in our models did not affect the inferences of other predictors. Therefore we excluded these two indicators from the final analysis.

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Technical Appendix: Measures of Covariates

Direct Exposure to Colleagues' Skills-Based Instructional Practices. We measured direct exposure by multiplying the frequency of the interaction teacher i reported with i' between 2007 and 2008 (1 = *once or twice a year*; 2 = *monthly*; 3 = *weekly*; 4 = *daily*) by the skills-based instructional behavior of teacher i' in 2007. For example, if Bob reported interacting with Alice weekly (3) during the 2007–2008 school year, and Alice engaged in the constellation of skills-based instructional practices almost every day (4) in 2007, then Bob's exposure (via Alice) is $3 \times 4 = 12$.

We also account for the ability of teachers to convey their practices

through interactions. Following Frank, Zhao, and Borman (2004), we use the number of times a teacher is nominated as helpful by others as a proxy for that teacher's ability to convey norms or knowledge related to her approach. Continuing the example from the previous paragraph, if Alice is nominated as providing help by two others, then Bob's exposure to skills-based practices via Alice, accounting for the extent to which Alice was nominated by others, is $3 \times 4 \times 2 = 24$.

To combine information across a teacher's network, we take the average exposure across all teachers whom teacher i nominated in 2008 (referring to interactions during the 2007–2008 school year):

direct exposure to skills based practices$_i$ =

$$\frac{1}{n_i} \sum_{i=1}^{n_i} (help_{ii'}) \times (\text{skills based practices in 2007})_{i'} \times (\text{number of others helped})_{i'}$$

where $help_{ii'}$ represents the frequency with which teacher i (e.g., Bob) reported receiving help from i' in the past year (e.g., Alice), and n_i is the number of teachers i indicated as providing help with reading instruction.

Prior Skills-Based Instruction in 2007. Our measure of prior skills-based practices in 2007 consisted of a composite of a subset of item prompts from the dependent measure used during the baseline year, with slightly different rating scales for each prompt (1 = *not at all*; 2 = *1 or 2 times per month*; 3 = *3 or 4 times per month*; 4 = *5 or 6 times per month*; 5 = *more than 6 times per month*). The items were: read stories or other imaginative texts; use phonics-based or letter-sound relationships to read words in sentences; use context, pictures, and/or sentence meaning and structure to read words;and blend sounds to make words or segment the sounds in words ($\alpha = 0.87$).[6]

Perceived Value of Evidence-Based Reform Strategies in 2007. In our 2007 survey, we asked teachers to rate the importance of the following activities for improving student achievement: requiring schools to use research-based curriculum materials; holding schools accountable for improving achievement of all subgroups at the school; giving parents the choice to change schools if the school is failing; and giving parents the choice to purchase tutoring services with a school's federal funds if the school is failing. Each of these represents one of the core "pillars" of accountability-based reform of the early 2000s (Hess & Petrilli, 2006). Responses ranged from 0 to 4 (0 = *not at all important*; 1 = *not very important*; 2 = *neutral*; 3 = s*omewhat important*; 4 = *very important*); the measure is based on a composite of the items ($\alpha = 0.70$).

Highest Grade Taught in 2008. This was measured from a set of indicators of the grade levels each teacher taught.[7]

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