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Megan Hopkins¹ and James P. Spillane²

Abstract

While few would disagree that a key component of educating teachers to teach happens on the job, research rarely explores the schoolhouse as a site for teacher education. This study thus focuses on inservice as distinct from preservice teacher education and explores how beginning teachers' learning about mathematics and literacy instruction was supported within 24 elementary schools in two midwestern school districts. A mixed methodology was used in this exploratory study, including social network and interview data analysis, to examine beginning teachers' advice- and information-seeking behaviors related to mathematics and literacy. Findings revealed that formal organizational structures inside schools were critical for shaping beginning teachers' opportunities to learn about instruction, including grade level teams and formal leadership positions.

Keywords

teacher learning, elementary teacher education, mixed methods, social network analysis

Teacher education in the United States is mostly associated with universities and other credentialing bodies that offer teacher certification programs. That seems sensible enough as these institutions specialize in the preparation of teachers (Shulman, 1986), and they are indeed responsible for the certification of about two thirds of teachers who enter the workforce (Feistritzer, 2011). Still, few would disagree that a key component of educating teachers to teach happens on the job, especially in those first few years of their careers. Yet, research rarely explores the schoolhouse as a teacher education site.

Several lines of research point to the importance of teacher's early years on the job and also that a large proportion of teachers leave within their first 3 years (Boyd, Lankford, Loeb, Rockoff, & Wyckoff, 2008; Darling-Hammond & Sykes, 2003). While some of this turnover may be beneficial (Abelson & Baysinger, 1984; Jackson, 2010), such persistent attrition and turnover is costly in terms of human and financial capital (Barnes, Crowe, & Schaefer, 2007) as well as student performance (Rivkin, Hanushek, & Kain, 2005; Ronfeldt, Loeb, & Wyckoff, 2013). The first few years are also a critical time for teacher learning, with the greatest growth in teacher productivity happening in their initial years in the classroom (Rivkin et al., 2005; Rockoff, 2004).

Although this research points to the importance of supporting beginning teachers, few studies explicitly examine how, or by whom, a teachers' education is supported during their first few years teaching. In this article, we focus on inservice as distinct from preservice teacher education and explore how beginning teachers' opportunities to learn about

mathematics and reading/language arts instruction (henceforth referred to as literacy instruction) are supported within elementary schools. We sought to address the following two research questions:

Research Question 1: Who is doing the work of beginning teacher education inside schools?

Research Question 2: How do these schoolhouse teacher educators provide beginning teachers with opportunities for learning?

Based on our exploratory analysis, we contend that formal organizational structures, specifically grade level teams and formal leadership positions, were important for shaping beginning teachers' opportunities to learn about instruction.

We begin by anchoring our study in literature on the school factors that support beginning teachers' learning and by motivating our examination of teachers' learning opportunities using instructional advice and information networks. Next, we describe the mixed methodology used in the analysis, which included surveys and interviews from teachers in 24 elementary schools in two school districts in a midwestern state. Turning to findings, we examine beginning teachers'

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advice- and information-seeking related to mathematics and literacy, showing that grade level teams and formal leaders afforded beginning teachers' opportunities to learn about instruction in both subjects. We then explore why these formal structures were drawn upon by beginning teachers and in what ways they facilitated learning opportunities. We conclude the article with a discussion of the implications of these findings for policy and practice.

Framing the Work

Our study is framed like this: First, we situate and support the study with literature that examines the school-related factors that support beginning teachers' learning and development. Second, we motivate and frame our work with research on advice and information interactions and subject-matter differences in elementary school teachers' work.

School Factors That Support Beginning Teachers' Learning and Development

While few studies focus specifically on schoolhouse teacher educators, a growing body of literature has examined the factors that support beginning teachers' learning and development and how they are related to teacher retention and long-term performance (Feiman-Nemser, 1983, 2003; McDonald & Elias, 1983). For one thing, research on teacher mentoring and induction has shown that providing beginning teachers with a formal mentor and supportive structures (e.g., orientation sessions and development workshops) is related to their classroom instruction, student achievement, and, in some cases, rates of retention (Ingersoll & Strong, 2011; Smith & Ingersoll, 2004; Sorensen, 2012). Informal mentors can also facilitate learning opportunities for beginning teachers in ways that complement formal mentors (Desimone et al., 2014).

More generally, research has documented the importance of a collaborative school culture for supporting beginning teachers (Flores & Day, 2006; Johnson & Birkeland, 2003; Rosenholtz, 1985; Williams, Prestage, & Bedward, 2001). A collaborative culture is especially important in schools that have historically reinforced autonomy and isolation among teachers (Little, 1999), where beginning teachers frequently plan and teach on their own, and their colleagues assume they are already proficient in their teaching abilities (Kardos & Johnson, 2007). In contrast, professional cultures in which teachers across all levels of experience work together and exchange ideas afford beginning teachers sustained opportunities to learn from more experienced colleagues (Johnson, 2004). To facilitate high levels of teacher collaboration, many school systems implement professional learning communities (PLCs), which afford teachers opportunities to learn through continuous inquiry with their colleagues (Stoll, Bolam, McMahon, Wallace, & Thomas, 2006). Importantly, the professional growth that results from these supports is often related to beginning teachers' job

satisfaction and sense of efficacy, which are key factors that motivate teachers to remain on the job (Johnson, 2004; Johnson & Birkeland, 2003).

There is also some evidence that formal leaders, including school principals and instructional coaches, play important roles in developing and maintaining a collaborative culture that supports beginning teachers (Brown & Wynn, 2009; Kardos, Johnson, Peske, Kauffman, & Liu, 2001; Youngs, 2007). Principals' provision of opportunities and resources that facilitate collaboration and mentoring has been shown to influence teachers' decisions to stay or leave (Brown & Wynn, 2009; Hord, 1997; Smith & Ingersoll, 2004). Principals support beginning teachers by structuring the schedule so that expert teachers and instructional coaches can model lessons and by organizing common meeting and planning times between beginning and experienced teachers (Johnson & Kardos, 2002). In addition, principals who are invested in beginning teachers' development often pair beginning teachers with mentors who help them improve (Kardos et al., 2001). Instructional coaches often take on this mentoring role by conducting in-class observations and providing feedback to beginning teachers (Veenman, De Laat, & Staring, 2006), and such coaching has been shown to facilitate changes in classroom practice and reform implementation among all teachers (Coburn & Russell, 2008; Coburn & Woulfin, 2012; Hopkins, Spillane, Jakopovic, & Heaton, 2013).

Overall, the existing research suggests that a supportive school culture that is developed and maintained by the formal leaders is essential for fostering teacher learning opportunities. These factors are especially important for beginning teachers, as they are related to their decisions to stay or leave teaching. Still, outside of formal mentoring and induction programs (e.g., Kapadia, Coca, & Easton, 2007), little is known about how beginning teachers' learning opportunities are structured, or who facilitates beginning teachers' learning inside schools.

Advice and Information Interactions and the School Subject

Scholars have shown that social interactions, and advice- and information-seeking interactions specifically, facilitate the transfer of information that is essential for learning and knowledge development (Frank, Zhao, & Borman, 2004; Reagans & McEvily, 2003). Given that knowledge development is a critical ingredient for instructional improvement (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009; Elmore, 1996; Hill, 2004), the exchange of advice and information—a precursor to learning and knowledge development—is essential inside schools. While research on teacher knowledge development often focuses on formal learning opportunities (e.g., Desimone, Porter, Garet, Yoon, & Birman, 2002; Garet, Porter, Desimone, Birman, & Yoon, 2001; Hill, 2004), teachers also develop knowledge through informal interactions with colleagues on the job (Parise &

Spillane, 2010), including when they exchange information and observe one another (Eraut & Hirsh, 2007; Frank et al., 2004; Little, 1993; Smylie, 1995). When teachers share expertise, talk about new material, and discuss effective teaching strategies, they create opportunities to learn (Brownell, Yeager, Rennells, & Riley, 1997; Davis, 2003; Little, 2003; Smylie, 1995). Notably, schools that encourage knowledge sharing among teachers are often best positioned to promote instructional change and improve student achievement (Bryk, Camburn, & Louis, 1999; Darling-Hammond & Richardson, 2009; Louis & Marks, 1998). Given the importance of advice and information sharing, we explicitly examine these interactions to identify from whom beginning teachers have opportunities to learn about elementary school mathematics and literacy instruction.

We examine advice and information interactions among elementary school staff members by the school subject. Several studies suggest that the school subject matters for shaping the ways in which teachers and school leaders interact, even though elementary teachers are typically generalists without subject-matter specializations (Spillane, 2005). Specifically, elementary school staff members are more likely to share advice and information about literacy than about mathematics instruction (Spillane, 2005; Spillane & Hopkins, 2013), and school leaders are more likely to participate in organizational routines that focus on literacy than those that focus on mathematics (Hayton & Spillane, 2008). Because elementary teachers tend to interact with one another differently depending on the school subject, we examine beginning teachers' advice- and information-seeking in both of the core elementary school subjects: mathematics and literacy.

Methodological Approach

To examine beginning teachers' learning opportunities, we used social network analysis (Wasserman & Faust, 1994), a methodological approach that allows for the explicit examination of school staff interactions about instruction. Data for the present study were drawn from a school staff survey collected in two school districts in one midwestern state. We first used survey data collected from all teaching and administrative staff to examine beginning teachers' advice and information interactions. We then used interview data from a purposeful sample of schools and staff to develop emergent understandings of how and why beginning teachers sought out particular individuals for instructional advice.

District Contexts

Each school district represents a unique context. While both are mid-sized districts, Auburn Park is a predominantly White, affluent suburb of the largest city in the state, and Twin Rivers¹ is a manufacturing center that serves a long-standing White population as well as a recent immigrant population. Twin Rivers' schools are thus more diverse and

serve more English language learners (ELLs) and students receiving free and reduced-priced lunches than schools in Auburn Park (see Table 1).

We collected data from elementary school staff members within each district and examined data from the 24 schools where teachers in their first 3 years on the job were present, as research has shown that the first 3 years are critical in terms of teacher retention (Boyd et al., 2008; Darling-Hammond & Sykes, 2003). These data included 13 of the 14 elementary schools in Auburn Park and 11 of the 14 elementary schools in Twin Rivers. During the 2012-2013 school year, the schools in the sample ranged in size from 243 to 601 students (see Table 1). We included only general education teachers who reported teaching literacy and mathematics in our analysis, given that these teachers are primarily responsible for literacy and mathematics instruction in elementary schools. The number of these teachers varied across schools from 8 to 21, with a total of 399 general education teachers, 240 from Auburn Park and 159 from Twin Rivers. Of the 240 general education teachers in Auburn Park, 49 (20%) were beginning teachers. In Twin Rivers, 33 out of 159 teachers (21%) were beginning teachers.

School Staff Surveys

In spring 2013, all teaching and administrative staff in both districts completed a School Staff Questionnaire that focused on advice- and information-seeking interactions in literacy and mathematics as well as on aspects of the school organization, such as school culture and teacher work practice. Among the 24 schools included in the analysis, response rates ranged from 73% to 100%, with an average response rate of 84%.

Social network measures. To examine beginning teachers' advice- and information-seeking in literacy and mathematics, we used social network items that were previously developed and validated (Pitts & Spillane, 2009; Pustejovsky & Spillane, 2009). Survey respondents were asked, "During this school year, to whom have you turned to for advice and/or information about curriculum, teaching, and student learning?" Respondents listed up to 12 individuals, and these names were auto-populated in a follow-up question that asked respondents to indicate the content area for which they sought advice and/or information from each person: mathematics, reading/language arts, and other. For the purposes of our analysis, we focused on teachers' social network data related in mathematics and reading/language arts (i.e., literacy). These data allowed us to identify who beginning teachers sought out for advice or information in each subject, or who served as teacher educators inside the schools in our study.

We examined the social network data in two phases. First, we examined overall patterns in beginning teachers' advice- and information-seeking and calculated each teacher's *out-degree centrality* in literacy and mathematics.

Table 1. Demographics for Districts and Schools in the Sample, 2012-2013.

District	School	Total students enrolled	% White	% African American	% Latino	% ELL	% free/reduced-price lunch	General education teachers	Beginning teachers
Twin Rivers		9,098	45	1.3	48	21	69	159	34
	Birch	243	30	0.4	65	42	84	8	1
	Pear	432	16	1	81	66	94	18	2
	Maple	335	68	4	22	9	49	16	4
	Elm	433	89	0.2	7	—	16	16	3
	Hickory	453	66	6	25	14	60	15	3
	Beech	457	38	3	53	29	78	15	3
	Walnut	267	26	6	64	42	89	15	4
	Ash	329	7	4	87	54	95	16	2
	Oak	326	64	1	30	16	48	16	2
	Pine	306	34	2	59	38	84	14	5
	Palm	262	45	4	46	23	75	11	4
Auburn Park		10,737	83	5	6	2	22	240	49
	Chamberlain	531	89	4	2	—	5	21	4
	Bryant	457	81	6	7	—	39	20	6
	Brooks	425	86	2	5	—	7	20	2
	Kingsley	601	86	4	4	—	8	25	3
	Torres	413	75	7	11	8	45	16	3
	Warner	468	83	8	4	4	15	19	3
	Cisneros	375	87	3	5	—	18	17	6
	Northvale	470	86	3	4	—	10	19	7
	Riley	370	91	3	2	—	24	18	1
	Ashton	448	74	5	11	7	37	20	5
	Chavez	362	67	11	16	12	59	16	6
	Abbott	403	92	2	4	—	23	19	2
	Stevenson	279	71	13	8	8	47	10	1

Note. Interview sites are in bold. ELL = English language learner.

A teacher's out-degree centrality refers to the number of school staff members he or she sought for instructional advice. We compared average out-degree centrality for beginning teachers in each district and tested differences for significance using independent *t* tests. We also compared the out-degree centralities of beginning and more experienced teachers. Due to the dependence of social network data, we used UCINET's (Borgatti, Everett, & Freeman, 2002) node-level *t* test to generate significance levels based on 5,000 permutations so that assumptions of independence and random sampling were not required (Carrington, Scott, & Wasserman, 2005).

Then, we identified the school staff members who beginning teachers named as individuals they turned to for advice related to each subject and characterized these sources of advice by position. We categorized general and special education teachers by the grades they taught and identified school leaders by part-time and full-time status. In addition, we generated visual displays of school staff interactions in Netdraw (Borgatti, 2002), focusing on beginning teachers' networks in literacy and mathematics within each school. We compared these findings between the two school subjects and between the two districts.

Work practice measures. To understand the practices that school staff members engaged in to support beginning teachers' learning and development, we used additional survey items that captured joint work practices. Specifically, we examined teachers' responses to the following questions: "During this school year, how often did the following people observe you teach?" and "How often did the following people give you feedback after observing you teach?" Teachers responded to each question for instructional leaders (e.g., literacy or math coaches) and school principals. Response options included never, once, a few times, monthly, weekly, or daily, and these were coded on a scale from 0 to 5. We compared responses between beginning and more experienced teachers within each district and tested differences for significance in Stata 13 using a Wilcoxin–Mann–Whitney test because the independent variables were ordinal.

School Staff Interviews

In spring and fall 2012, we conducted semi-structured interviews with school staff members in each district. We selected five schools in Auburn Park and two schools in Twin Rivers to represent the range of schools in the sample,

from those that were highly diverse to those with predominantly White student populations. The schools also represented the range of organizational structures, where some schools had full-time instructional coaches, while others had part-time instructional leaders, or individuals who spent 50% or more of their time teaching but also held leadership positions. We interviewed the principal and between two to seven teachers in each school for a total of 42 interviews, 33 in Auburn Park and 9 in Twin Rivers. We included teachers from different grades and positions (e.g., special education and English-as-a-second-language [ESL] teachers), as well as teachers who were integrated and some who were isolated in their schools' networks. We also interviewed three district office administrators, including the elementary mathematics instructional leader in Twin Rivers and the elementary curriculum coordinator and instructional facilitator in Auburn Park.

While we used the interview data here to examine teachers' learning opportunities in literacy and mathematics, the interviews were originally designed for different purposes. In Auburn Park, interviews focused primarily on school staff interactions in mathematics, and questions elicited information about how and why they turned to others for advice in that subject. In Twin Rivers, interviews explored school staff members' advice-seeking in both literacy and mathematics and asked them to describe how they worked to meet the needs of their diverse student population. Interviews lasted between 30 and 50 min and were audio recorded, transcribed, and imported into NVivo 9 for coding and analysis.

Three researchers coded the interview data using a hybrid approach (Maxwell, 1998; Strauss & Corbin, 1998) to uncover how and by whom beginning teachers' opportunities to learn were supported, why beginning teachers sought out particular individuals, and what they talked about in those interactions. We first close-coded all interviews around three broad codes—*how* teachers interacted, *why* they interacted, and about *what* they interacted. Then, we open coded a subset of the interviews under these three codes to generate substantive categories, to identify salient themes, and to develop a coding scheme, which we then applied to the entire dataset. To establish inter-rater reliability, researchers coded one third of the interviews independently, met to discuss their coding, and recoded the data until high Kappa coefficients were achieved, ranging from .72 to .99 (Carey, Morgan, & Oxtoby, 1996; Fleiss, 1981). We then explored the prominence of particular codes for beginning teachers compared with more experienced teachers.

Study Limitations

The findings of our exploratory study are limited to the schools and districts examined here, and we make no attempt to generalize beyond these contexts. Still, given the diversity of contexts in the sample, we believe the findings will be

useful to district and school leaders more broadly. Moreover, the social network data allowed us to determine the presence or absence of advice and information interactions among school staff and to identify who interacted directly with beginning teachers, and the interview data gave us some sense as to the content of these interactions; however, we cannot draw conclusions about the quality of that advice or information or if it supported beginning teachers' instructional improvement.

Findings: Schoolhouse Teacher Educators

Our findings revealed that formal organizational structures inside schools were important for affording beginning teachers opportunities for learning. Specifically, the schools we studied were structured in such a way that beginning teachers had frequent and consistent access to grade level team members, instructional leaders, and school principals, and beginning teachers sought out these individuals more than anyone else for advice and information related to both literacy and mathematics. Below, we use social network data to describe these advice-seeking patterns and how schools structured opportunities for interaction among teachers; then, we use interview data to explore why beginning teachers chose to reach out to particular individuals and the substance of these interactions.

Formal Structures and Beginning Teachers' Advice- and Information-Seeking

Advice and information are important for developing teachers' knowledge about instruction (Frank et al., 2004; Reagans & McEvily, 2003); as such, we view these interactions as a necessary if insufficient condition for teacher learning—they are opportunities for teachers to learn. First, to give a general sense of the patterns in beginning teachers' advice-seeking, these teachers in both districts sought out about the same number of school staff members for advice about literacy, although those in Twin Rivers sought out slightly more school staff members for advice about mathematics. Specifically, beginning teachers sought out between one and eight school staff members for literacy advice, and the average out-degree centrality in literacy for beginning teachers was 3.50 in Auburn Park and 3.79 in Twin Rivers. With respect to mathematics, beginning teachers' out-degree centrality in both districts ranged from 1 to 6, meaning that they sought out between 1 and 6 other school staff members for math advice; however, the average out-degree for beginning teachers in Auburn Park was 2.54, compared with 3.27 in Twin Rivers. Still, beginning teachers sought out more sources of advice than experienced teachers in both school subjects, as experienced teachers sought out an average of three others for literacy advice and two others for mathematics advice.

Table 2. School Staff Members Sought Out for Instructional Advice and Information by Beginning Teachers in Each District.

	Grade level team members	School principal	Other formal leaders	None
Auburn Park (<i>n</i> = 49)				
Literacy	91.8% (45)	34.7% (17)	83.7% (41)	0.0% (0)
Mathematics	88.9 (40)	32.7 (16)	28.6 (14)	8.2 (4)
Twin Rivers (<i>n</i> = 33)				
Literacy	93.9 (31)	54.5 (18)	72.7 (24)	0.0 (0)
Mathematics	93.9 (31)	54.5 (18)	42.4 (14)	0.0 (0)

Beginning teachers turned to three primary sources of literacy and mathematics advice that were closely aligned with two elements of the formal organizational structure: grade level teams and formal leadership positions. Grade level teams included general education, special education, and ESL teachers. Formal leaders included instructional leaders, such as curriculum specialists and mathematics and literacy coaches, as well as school principals.² These three types of school staff members composed nearly all of beginning teachers' advice sources, with no beginning teachers in either district seeking out other types of individuals for literacy advice, and only four beginning teachers in Auburn Park seeking out other types of school staff members for mathematics advice (see Table 2).

Grade level teams. Among these three groups, grade level team members were the most frequent sources of advice about both literacy and mathematics instruction for beginning teachers. In Auburn Park, 92% of beginning teachers turned to grade level team members for literacy advice, and 89% of teachers turned to them for mathematics advice (see Table 2). These figures were slightly higher in Twin Rivers, where 94% of beginning teachers turned to grade level team members for both literacy and mathematics advice. Nevertheless, the number of grade level team members each beginning teacher sought out for advice varied, in part due to variation in the number of teachers assigned to each grade level. While the majority of beginning teachers sought out one or two grade level team members, some beginning teachers sought out as many as four or five grade level team members.

To get a sense of how beginning teachers' learning opportunities were shaped by grade level teams, consider the sociograms in Figure 1. Each diagram shows beginning teachers' mathematics advice network, with Ashton Elementary in Auburn Park on the left and Ash Elementary in Twin Rivers on the right. The black squares, or nodes, represent beginning teachers, and the white nodes represent school staff members at other career stages with whom they interacted about mathematics. The label next to each node indicates the staff member's position, where, for example, a

"1" indicates a first-grade teacher, and "SPED" indicates a special education teacher. At Ashton Elementary, there were five beginning teachers, and each interacted about mathematics primarily with other teachers at their grade levels, both general and special education teachers. While grade level teams were clustered together, the first- and fourth-grade level teams were connected through special education teachers, and the fourth- and fifth-grade teams were connected through a member of each team. At Ash Elementary, however, grade level teams were not connected. The beginning fourth-grade teacher's math network included just the other two fourth-grade teachers, and the beginning third-grade teacher's network included the other two third-grade teachers and the special education teacher at that grade level. Thus, while in the vast majority of cases beginning teachers' advice networks were structured around grade level teams, some school advice networks were comprised of interconnected grade level teams, and others were more fragmented with grade level teams disconnected from one another.

Formal leaders. Thirty-five percent of beginning teachers in Auburn Park sought out their principal for literacy advice, and 33% sought out their principal for math advice (see Table 2). In Twin Rivers, 55% of beginning teachers sought out their principal for advice related to both literacy and mathematics. While more beginning teachers sought out their principal in Twin Rivers than in Auburn Park, the principal was sought out by beginning teachers in seven schools in each district.

Turning to other formal leaders (e.g., instructional coaches), beginning teachers in both districts sought out these leaders more frequently for advice related to literacy than mathematics. In Auburn Park, 84% turned to leaders other than the principal for literacy advice, compared with just 27% in mathematics (see Table 2). In Twin Rivers, 73% of beginning teachers turned to these leaders for literacy advice, whereas 42% of beginning teachers turned to them for math advice. Most beginning teachers turned to just one of these formal leaders, although seven beginning teachers turned to two of these leaders for literacy advice, and one turned to two of these leaders for math advice.

Nonetheless, of the three types of school staff members that beginning teachers sought out for advice, they were only significantly more likely to seek out their school principal for both literacy and mathematics advice than their more experienced counterparts. Whereas 35% of beginning teachers in Auburn Park turned to their principals for literacy advice, just 15% of teachers with between 4 and 6 years of experience did so, $F(1, 234) = 3.18, p = .02$. In mathematics, 33% of beginning teachers in Auburn Park sought out their principal, compared with 18% of teachers with more experience, $F(1, 234) = 3.33, p = .01$. These differences were similar though slightly larger in Twin Rivers. Thus, the school principal was more likely to facilitate learning opportunities for beginning teachers than more experienced teachers.

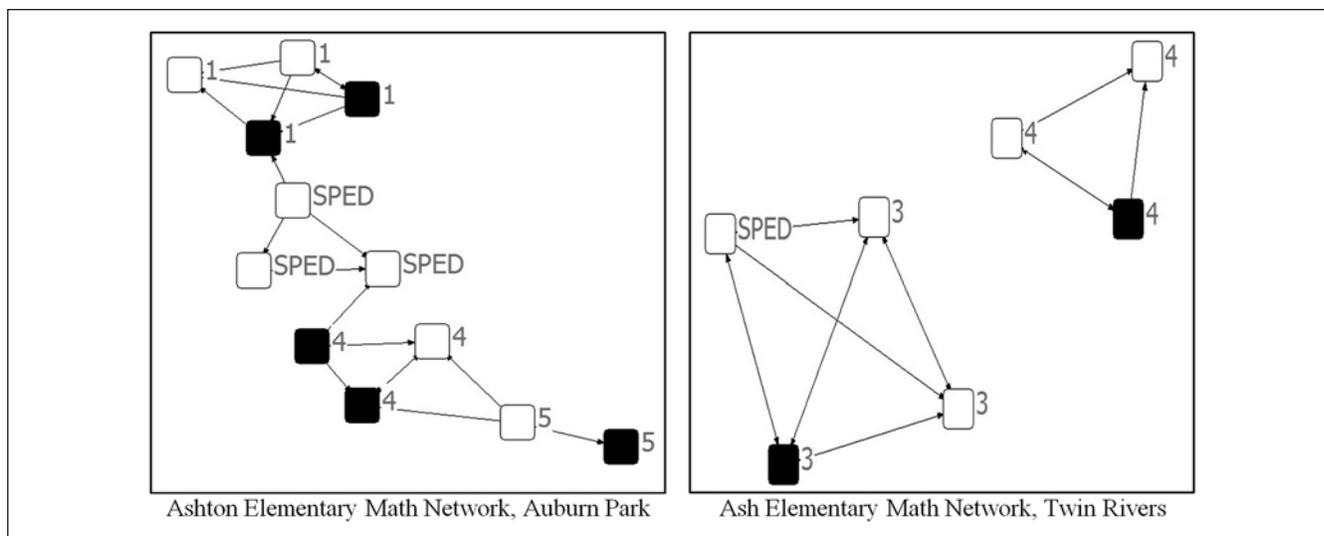


Figure 1. Beginning teachers' learning opportunities shaped by grade level teams.

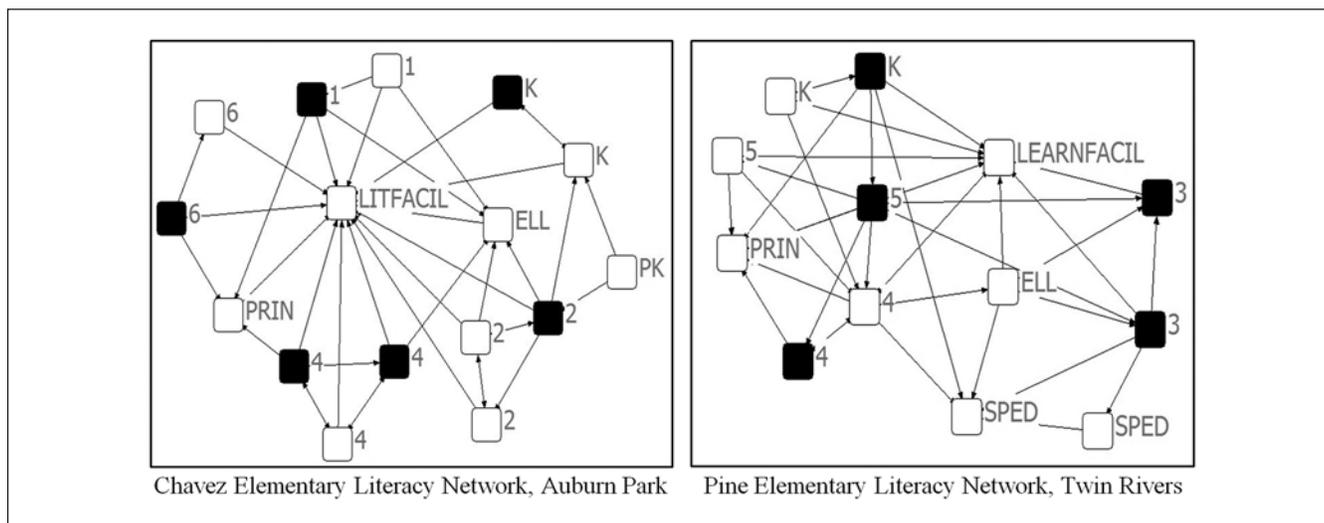


Figure 2. Beginning teachers' learning opportunities shaped by formal leadership positions.

Figure 2 offers two examples of beginning teachers' literacy networks capturing the role of formal leaders, Chavez Elementary in Auburn Park and Pine Elementary in Twin Rivers. At Chavez Elementary, while all six beginning teachers interacted about literacy with their grade level team members, the literacy coach or facilitator ("LITFACIL") also shared advice with them. In addition, the principal was connected to three beginning teachers. For the other three beginning teachers, the literacy facilitator brokered relations between them and the principal. Moreover, both the literacy facilitator and the principal served as brokers of literacy advice between grade level teams that contained beginning teachers. Similarly, at Pine Elementary, beginning teachers exchanged literacy advice with members of their grade level teams, and the learning facilitator ("LEARNFACIL") shared

advice with four of five beginning teachers. In addition, the principal interacted with three of five beginning teachers. As at Chavez Elementary, the learning facilitator at Pine was a broker of literacy advice between the principal and the other two beginning teachers, and both the learning facilitator and the principal were brokers of literacy advice between grade levels.

Organizational Routines, Transactive Memory, and Beginning Teacher Learning

Our account to this point shows that the formal organizational structure influenced beginning teachers' instructional advice- and information-seeking behaviors. These instructional interactions represent learning opportunities for teachers, or

potential sites for teacher learning, as advice and information are building blocks for developing new knowledge. Our findings suggest that grade level team members and formal leaders were the primary facilitators of these learning opportunities for beginning teachers. Below, we explore why beginning teachers chose to seek out these individuals and what types of knowledge they reported developing in these interactions. We begin by describing two factors that beginning teachers reported influencing their advice- and information-seeking: organizational routines and transactive memory. Then, we describe how the advice givers' position in the school influenced the substance of these interactions.

Organizational routines and transactive memory. Embedded structures that allowed for common planning times for grade level teams afforded beginning teachers opportunities to seek out their grade level colleagues for advice and information. In Auburn Park, grade level teams were organized around PLCs, where teachers met weekly with other teachers at their grade level, including general and special education teachers. Each meeting focused on one topic as decided by the district, and four topics were covered per month. Andrea, a third-grade teacher, described her PLC:

I meet once a week with my co-teachers. We go on a rotation basis, one meeting for student concerns and interventions, then we look ahead and plan for curriculum, one meeting for math and one for language arts. And then there's a general meeting for us.

For Andrea, the PLC followed a predictable pattern that guided her team's work. In this way, the PLC was an organizational routine, "a repetitive, recognizable pattern of interdependent actions, involving multiple actors" (Feldman & Pentland, 2003, p. 95). This routine was adopted district-wide, and each of the 33 staff members we spoke to in the district described the PLC as a shared experience that allowed for ongoing interaction about instruction. Grade level team meetings in Twin Rivers also brought teachers together, affording opportunities for teachers to learn from one another, although they did not occur with the same regularity and predictability as in Auburn Park. Time was set aside for grade level team meetings in all schools, and these meetings primarily included general education teachers and, on occasion, ESL teachers, as the principal at Pine Elementary described: "Every Wednesday afternoon kids get out at 2:00. At two o'clock you'll go in and you'll see grade levels working together."

In both districts, grade level meetings or PLCs provided a space for beginning teachers to seek advice from their teammates. For Kristin, team meetings were a place to ask questions of her more experienced colleagues: "We have team meetings, the four fifth-grade teachers. We don't always talk about curriculum at that time, but that would be a time, like if I had questions about an assessment or activities, to get them answered." In addition, because they shared a common curriculum and taught students at the same level, grade level

team members were seen as good sources of advice. Karen, a first-grade teacher, described how the curriculum was a shared tool that supported interactions with her teammate:

Well, she's my teaching partner, so she's teaching the same thing, our curriculum guide is pretty set out as far as the pacing of it, when we teach, what we teach, so we're always teaching within a couple days of each other.

As they taught the same content at a similar pace, Karen turned to her grade level colleague for instructional advice. Teachers also described common understandings in terms of their students' abilities as a factor that supported interaction. Mandy, a second-grade teacher, explained,

[I go to my teammates for advice] because they are the ones that actually know the abilities of our kids, because we all do the same thing. I know previously when we did classroom goals with other grade levels, that was a struggle. When you're in a group of one second grade, one kindergarten and one fourth grade, and the PE teacher, I found myself spending more time . . . like, they would give me suggestions of activities, but I felt more like I was spending time discussing the abilities of my kids where they'd suggest something to me and I'd be like, no that's too high, my kids are down here.

For Mandy, it was more productive to meet with her grade level team members and ask them for advice, as they went to their planning meetings with common understandings about students' abilities and needs. These common understandings were not present in mixed-grade meetings, which required teachers to negotiate their differences before engaging in meaningful conversations about instruction.

While regular participation in the same organizational routines was important for facilitating interactions among grade level teams, proximity was also a factor that supported advice and information sharing between grade level team members. Grade level colleagues with connected or adjoining classrooms could more easily seek out advice from one another. Rebecca, a fifth-grade teacher, said, "Our rooms are connected so it's kinda nice, it's easy to be like 'Okay, so my kids are doing this today in math, and what are your kids doing?' So it's nice to ask for ideas." With Rebecca and her teammate, it was the combination of being next door and using the same curricular materials that fostered their advice and information sharing. Similarly, Carol, a first-grade teacher, described how proximity to her grade level teammate gave her the opportunity to hear her teach:

I'm so fortunate to be so close, sometimes I can just hear my teammate teaching something and I hear it, I hear say something like ah, that's a great idea and then, just asking her about it I can learn so much and get so many ideas.

Thus, proximity was important for Carol because she could observe and ask her for specific advice about how she taught a lesson.

Organizational routines also facilitated beginning teachers' opportunities to learn from formal leaders. Beginning teachers reported that their principals as well as other instructional leaders observed them and provided feedback on their teaching significantly more often than did more experienced teachers ($p < .05$). While this observation–feedback cycle occurred about monthly for beginning teachers, it occurred only a few times per year for more experienced teachers. Indeed, six of the seven principals we interviewed spoke about working one-on-one with beginning teachers in their classrooms. The principal at Chavez Elementary explained,

With the new teachers, I try to weekly spend time in their rooms. I try to give them positive feedback about the things that I observe them doing well and reinforcing those things, making sure that they understand and know where all the curriculum pieces are. Sometimes that's not easy, and just helping them locate all the resources that are available to them.

This principal reported spending time weekly in beginning teachers' classrooms to observe and make sure they had the necessary resources.

Most principals also put routines in place for beginning teachers to interact with other instructional leaders. The principal at Chamberlain Elementary, for example, established an organizational routine around lesson modeling:

I have Mary [the math coach] getting into those [new teachers'] classrooms and helping to demonstrate and model what that classroom climate should look like in math—what kinds of questions, how do you get kids to do the thinking versus you telling them, how to hold up and guide and use math talk moves and all of those things.

A math coach in Twin Rivers also described how principals asked her to model lessons for beginning teachers: “Principals ask me to work more with new teachers than anybody else in math, going in [to the classroom] and doing some modeling and those kinds of things.” Whereas principals tended to focus their time with beginning teachers on observing in classrooms, they asked math coaches to engage more actively with beginning teachers' instructional practice through modeling lessons. With principals sending instructional leaders into beginning teachers' classrooms, these leaders served as intermediaries between beginning teachers and school principals, as evident in Figure 2 above.

In addition, transactive memory was an influential factor in beginning teachers' decisions to seek out formal leaders. Transactive memory as a construct refers to the way in which individuals use information encoded *externally* (e.g., in formal positions) to gain access to knowledge and expertise within an organization (Moreland & Argote, 2003; Wegner, 1987, 1995). For beginning teachers in our study, formal leaders' positions and levels of expertise indicated to them that they should seek out these individuals for instructional advice or information. This trend was especially true for

subject-specific leaders, who beginning teachers sought out for advice in their curricular content specialty. Jessica, a second-grade teacher, stated, “We have a literacy coach, so if we have a question in reading or writing we just go to her.” Similarly, Kelly, a second-grade teacher, explained,

If I have a question about math, well my number one person is Mary of course, being the math coach. She's been through a lot of the training, she's had the desire and the passion for math . . . I go to her primarily.

Kelly described seeking out the math coach for advice because she held a formal position, and because she associated that position with additional training in math. The same was true for Linda, a fourth-grade teacher, except she sought out her school principal for math advice because she viewed her as having expertise in that subject:

I go to [Kelly, the principal] a lot about math because she's an expert. I also know that philosophically we are similar in that inquiry-based model and working for deep understanding. So [Kelly's] probably the most readily available for me.

Because Linda viewed Kelly as a math “expert,” and because she knew her approach aligned with her own, she found Kelly the most “available” to her in terms of gaining advice or information about math instruction. Linda's transactive memory thus included both formal position and expertise, in addition to knowledge of who would use a comparable instructional approach.

Formal leaders' positions also meant that they had cross-grade level curricular knowledge that was valuable to beginning teachers. As Rachel, a kindergarten teacher, stated,

She [Emily, the math coach] knows a lot more about the curriculum. So I guess when we would come to a unit and we'd give out the ideas, I think she knows a lot more about the reason behind . . . I mean I know the whole math thing but it's like she, I think she has a more . . . a better grasp on where to take it. Because I only know kindergarten, but she knows, “Well this is really important because when they get to third grade they're doing this . . .” or, “When they get to second grade they do this to add on to this so this is a really important concept.”

For Rachel, the math coach was in a position that allowed her to understand the math curriculum across multiple grade levels, which meant that she had expertise that Rachel valued. Rachel went on to say that she used the information she received from her coach to ensure that she did not skip over any important concepts in her math teaching.

Beginning teachers' learning. Our account to this point identified who served as teacher educators for beginning teachers inside schools. A related but different matter concerns the substance or focus of these interactions between beginning teachers and their schoolhouse teacher educators. Our

exploratory analysis revealed that the substance of beginning teachers' learning opportunities depended on the teacher educator's position. To begin, for beginning teachers, grade level team meetings were opportunities to learn new instructional strategies. For example, Rachel, a kindergarten teacher, spoke about how she learned new teaching strategies during grade level team meetings:

After school when we're planning as a team, we do a lot just, "Well here's what I did. You might see if that works for you. You could try that tomorrow." So yeah, most of it's just me asking "Hey, so how did you do this? How did you teach this lesson to your kids? How did it work?"

Similarly, Andrea, a third-grade teacher, described how her grade level team meetings gave her access to more experienced teachers who could give her teaching ideas:

She's an experienced teacher and it's always good to get a different point of view. If I've tried this and it's not working, I might ask her, "Okay tell me what you're doing. Let me see if I can, you know, pick anything out of there that I can try."

As another example, Tracy, a second-grade teacher, described how important it was to be able to seek support from her grade level team:

I think the team that I have is key. If I get stuck it's okay to ask for help. I've had a few bumps in the road already, and my team was always there and saying, "Try this. Try that." And it's not just, "Oh, you should look into this." It's "Here, this is what I have." It's just great support coming to work and knowing that I have someone that has my back.

For Tracy, it was important that grade level team members were open to sharing advice, as this collaborative approach made Tracy feel supported.

Our analysis also suggested that for beginning teachers, interactions with instructional coaches were opportunities to learn about the implementation of new curricular materials and to develop pedagogical content knowledge. Carmen, a math coach, described her interactions with a beginning teacher at her school:

If he doesn't understand something in the curriculum—it's a whole new curriculum that he's not used to, so mostly if he has a question about something he doesn't understand, like an activity they're doing, or they have to use these big ten thousand charts and he wasn't sure if he was using it correctly, he asked me how to do it.

Carmen's interactions with this beginning teacher were focused on how he could teach in ways that aligned with and supported the district's inquiry-based mathematics curriculum.

Likewise, Loretta, an instructional leader, talked about how the curriculum challenged beginning teachers' understanding of math, and so they came to her for advice:

We've had a lot of new beginning teachers that maybe did their student teaching in another district and the new curriculum is very different to them; they're used to more direct instruction. So they just ask how math inquiry works, those conversations . . . they have some of that vocabulary but are working on deeper understanding.

Loretta indicated that the mathematics curriculum was a tool that motivated beginning teachers to seek her out for advice, and that those interactions were helpful in building beginning teachers' mathematics conceptual knowledge. The development of this type of pedagogical content knowledge was described by Angie, a third-grade teacher:

I've always like wondered, okay how do, what does it look like to break numbers apart. So I ask the coach and she'll model and show you, okay, this is what it, like even though sometimes you read it in a book it's not book friendly so I'm like, "Show me, I'm stuck on this." And she'll show you how to break a number apart, so it's influential because then I go and I get it and I can teach it to kids.

For Angie, being able to ask the math coach about how to enact a particular math practice was important not only for her learning but also for her teaching.

Furthermore, beginning teachers' interactions with school principals tended to focus on supporting instructional alignment within and across grade level teams. Carol, a first-grade teacher, described how her conversations with her principal centered on making sure she and the other members of her grade level team were using practices that deepened students' mathematical thinking:

The last thing I asked about was the graph, we were doing a graphing activity and the students graphed and we were discussing the graph out in the hallway and then I just asked her for some feedback on how my conversation went and what we as a grade could do to deepen the kids' understanding.

In this case, Carol sought information from the principal that was not focused solely on her classroom, but that would support instruction for all of her grade level team members. In another case, Clarissa, another first-grade teacher, described how her interactions with the principal centered on alignment both within and across grade levels:

He is out watching and seeing what we're doing and questioning what we're doing. Not questioning to say that we're doing it wrong but questioning to understand why. And we ask him about what other grades are doing, so I think it makes a cohesiveness for the whole school.

Thus, while beginning teachers' interactions with grade level teammates and instructional coaches focused on their classroom instruction, interactions with the principal focused on more holistic issues related to curricular and instructional coherence.

Discussion and Conclusion

In an effort to broaden the conversation about teacher education, we move beyond the near exclusive focus on preservice teacher education to examine beginning teachers' opportunities to learn during their first few years on the job. Our findings revealed that formal organizational structures inside schools, in particular grade level teams and their accompanying organizational routines, as well as formal leadership positions, were important in shaping who beginning teachers sought out for advice and information related to mathematics and literacy instruction. That colleagues in the same grade level would be important for beginning teachers makes sense; after all, they have to teach a particular curriculum in mathematics or literacy, and most preservice teacher preparation programs do not prepare teachers to teach particular curricula. Thus, turning to colleagues in the same grade who have experience with teaching the prescribed curricula is a reasonable behavior for beginning teachers. Still, beginning teachers sought out these individuals not because they had to, but because opportunities were structured in a way that they had access to these other teachers, and they chose to ask them for advice and information, especially related to instructional strategies.

Our analysis also identified another aspect of the formal organizational structure as important in beginning teachers' on-the-job education: formal school leaders. To begin with, school principals were engaged in supporting opportunities for beginning teachers' learning. Prior research suggests that the school principal is especially responsible for creating a school culture and organizing arrangements that support teacher learning; yet, our findings suggest that principals themselves are involved in the work of educating elementary teachers in the areas of literacy and mathematics. They did so in two ways. First, in more than half of the schools in our sample, principals worked directly with beginning teachers to provide them with advice and information about mathematics and literacy instruction. Second, by brokering relations between beginning teachers and other formal leaders, such as instructional coaches, school principals indirectly enabled teacher learning about mathematics and literacy instruction.

These findings have important implications for practice and policy. For one, given that school principals play an important role in supporting beginning teachers' learning, it is important to consider the extent to which school principals are trained in the work of teacher education. In addition, given that formal organizational structures shaped opportunities for beginning teacher learning, our findings suggest the importance of district and school design work. That is, local school and district policies that support the development of organizational routines among teachers and between teachers and leaders can influence the opportunities that teachers have to learn in their first few years on the job. Moreover, the creation of formal positions and an investment in leaders' expertise can shape beginning

teachers' transactive memory in meaningful ways. Including these components in the design of district and school infrastructures would be an important step toward supporting beginning teachers' learning and ensuring that these teachers remain on the job beyond their first few years.

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Notes

1. All district and school names are pseudonyms.
2. No assistant principals were present in any of the schools in the sample.

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