J Educ Change (2015) 16:371–377
DOI 10.1007/s10833-015-9260-6

School system (re)design: Developing educational infrastructures to support school leadership and teaching practice

Megan Hopkins[1] · **Sarah L. Woulfin**[2]

Published online: 29 October 2015

Abstract A central challenge for local education agencies (i.e., school districts in the United States) undergoing reform is to design systems that facilitate instructional improvement. At the core of these systems are educational infrastructures that bolster capacity building efforts and support teaching and leadership practices. Our goal for this special issue is to apply infrastructure as a framework to understand educational change processes across a variety of contexts and levels of the education system (i.e., state, district, school, classroom). Taken together, the articles in this issue reveal how infrastructure can support and/or constrain educational change to the extent that it is deeply connected to, taken up in, and/or transformed by teaching and leadership practice.

Keywords Infrastructure · Educational change · Capacity building · Teaching and leadership practice

"Building formalities that work" (Stinchcombe 2001, p. 2) continues to be a fundamental issue for educational organizations in the United States and abroad, especially within national and local policy environments that push for instructional reform. In the United States, for example, a large number of school districts and schools are being called upon to implement Common Core Standards in English language arts and mathematics (National Governors Association 2010a, b), as well

✉ Megan Hopkins
meganh@uic.edu

Sarah L. Woulfin
sarah.woulfin@uconn.edu

[1] Department of Curriculum & Instruction, College of Education, University of Illinois at Chicago, 1040 W. Harrison Street, Chicago, IL 60607, USA

[2] Department of Educational Leadership, Neag School of Education, University of Connecticut, Storrs, 249 Glenbrook Road Unit 3093, Storrs, CT 06269, USA

as new standards-aligned high-stakes assessments. In many locales, the implementation of these standards and their associated assessments requires significant shifts in school leadership and teaching practices (Rothman 2013) that local education agencies (i.e., school districts in the United States) are working to support through coordination and capacity-building efforts (Kober and Rentner 2012) at both the system and school levels.

These coordination and capacity-building efforts need to be bolstered by educational infrastructures at the national, state, and local levels. Infrastructures are often thought of as scaffolds or networks that facilitate function (e.g., an interconnected highway system that supports transportation); thus, they are typically viewed as structures that are built and must be maintained, but that ultimately shift into the background (Star and Ruhleder 1996). This description, however, does not acknowledge the ever-changing relationship that exists between infrastructure and practice. Recent scholarship suggests that an infrastructure only emerges as people engage with networks of tools and relationships to accomplish their work, *and* the practices they engage in within these networks contribute to organizational change (Pipek and Wulf 2009).

Given this dynamic relationship between infrastructure and practice, we argue that any examination of educational infrastructure requires attention to both (1) the structures and tools that policymakers use to implement large-scale reforms (e.g., standards, curricula, professional development), and (2) how these structures and tools are taken up and reshaped by leaders and teachers in their particular local contexts. Indeed, much educational scholarship has made it clear that neither top-down nor bottom-up reform approaches are sufficient in isolation to facilitate the development of infrastructures that facilitate educational change and instructional improvement (Fullan 2000, 2007). Specifically, whereas top-down reform efforts aimed at supporting system-wide improvement often do not adequately account for variations in practice at the local level (Elmore 1996), bottom-up reforms that directly engage local actors and focus on contextualized practice often stop short of facilitating organizational (i.e., systems-level) change (Honig 2004).

And yet, given the complicated and oftentimes messy work of educational change, those involved in school system (re)design efforts may tend to focus on affecting change within just one component of the educational infrastructure, such as one set of actors (e.g., teachers or principals), one level of the educational system, or one tool (e.g., standards, assessments). Although these efforts are important with respect to understanding how various features of an infrastructure can shape leadership and teaching practice (and vice versa), taking a broader systems-level perspective allows us to examine how networks of actors and tools function in relation to one another across levels of the education system, and to consider how educational reform can support standards and continuity *while at the same time* allowing for flexibility and local responsiveness.

To that end, the articles in this special issue draw on the concept of infrastructure to explore school system (re)design efforts across a variety of contexts and levels of the education system (i.e., state, school district, school, classroom). Each article applies infrastructure as a framework to understand how school leaders and teachers engaged in and with various policies, tools, and structures, and how their resulting

leadership and teaching practices (re)shaped dimensions of the educational infrastructure. In doing so, the articles each tell a unique story about how infrastructure can support and/or constrain educational change to the extent that it is deeply connected to, taken up in, and/or transformed by teaching and leadership practice.

Although the ideas presented in this issue are particularly relevant in the current US reform context, education systems across the globe face similar challenges in developing infrastructures that support and maintain improvements to leadership and teaching practice. While those taking primary responsibility for developing different aspects of the educational infrastructure will necessarily vary (e.g., the school, local government, state, national ministry), identifying the key components and characteristics of these infrastructures will enable cross-national comparisons that contribute to our understanding of how educational reform can facilitate instructional improvement in ways that are responsive to and contextualized within particular localities.

The first article in this issue, "Mixing metaphors: Building infrastructure to support large-scale school turnaround," by Donald Peurach and Christine Neumerski, provides a detailed account of the school and systems-level infrastructures that were developed in the context of a comprehensive school reform model, Success for All. School for All has been identified as a lead turnaround partner in the United States, contracting with states or local districts to manage instructional improvement in clusters of schools identified as low-performing under federal accountability provisions. Peurach and Neumerski highlight Success for All's attention to both organizational- and classroom-level routines, which cultivated supportive school cultures, attended to teachers' and leaders' capabilities, and infused structures for collaboration.

Perhaps more importantly, the authors show how, key to the design and development of these routines, was the way in which Success for All leveraged its systems-level infrastructure to move schools through a developmental sequence that, over time, supported leaders and teachers in assuming ownership of program resources and using them to identify and address local needs. In light of their findings, Peurach and Neumerski raise important questions about the extent to which turnaround policies, which are increasingly favored in US educational policy discourses, realistically support the goal of instructional improvement. Whereas school turnaround policies favor rapid changes in school staffing and governance, Peurach and Neumerski's account shows that designing and developing infrastructures to support instructional improvement must be undertaken as a long-term process.

While Peurach and Neumerski illustrate the ways in which a national organization can support infrastructure development within and between schools, the next two articles in this special issue describe infrastructure development inside US school districts. The first, entitled "Conceptualizing relations between instructional guidance infrastructure (IGI) and teachers' beliefs about mathematics instruction: Regulative, normative, and cultural-cognitive considerations," by Megan Hopkins and James Spillane, offers a comparative case study of two school districts as they (re)designed and implemented infrastructures around reform-based mathematics curricula. Using institutional theory (Scott 2007), the authors describe

how regulative, normative, and cultural-cognitive dimensions of each district worked in tandem (or tension) to enable (or constrain) the development of instructional guidance infrastructures that influenced, and were influenced by, teachers' beliefs about elementary mathematics instruction.

Echoing Peurach and Neumerski's findings, Hopkins and Spillane's account illustrates the importance of attending to culture and norms, as well as leader and teacher capacity, in ways that align with an overarching curricular vision. Unique to Hopkins and Spillane's article is its consideration of curriculum and curricular resources, the ways in which school districts designed infrastructure components around them, and how this infrastructure facilitated collective sense-making among local actors. To this end, the article's findings show how infrastructure design efforts must pay careful attention to practice—not just classroom practice but also the everyday work practices that leaders and teachers engage into support instruction and its improvement—for it is within these practices that infrastructure emerges, as local actors work to make sense of regulations and mandates and incorporate them into norms and cognitive scripts.

The next article, "The cohort model: Lessons learned when principals collaborate," by Lisa Umekubo, Janet Chrispeels, and Alan Daly, similarly shows how, when leaders and teachers engage in collective work practices, they exchange knowledge and resources and create opportunities for learning. The authors describe how the cohort model, a formal organizational structure designed to support collaboration among school leaders in a large, urban US school district, fostered both professional and organizational learning. Drawing on Senge's (2006) five disciplines of organizational learning (e.g., personal mastery and team learning), they demonstrate the ways in which the cohort model facilitated informal learning opportunities for leaders between and within schools, as well as between schools and the district's central office.

As school leaders collaborated and developed higher levels of within-cohort trust, more robust learning opportunities were afforded to school-based leadership teams, where professional development and other collaborative structures were developed to support each school's vision for teaching and learning. Overall, Umekubo and colleagues' findings reveal how an infrastructure in which district centralization and site-based autonomy work in tandem can support leadership practice. By describing how both district office administrators and site-based leaders engaged in infrastructure design activities, the article provides an excellent example of how a combination of top-down and bottom-up approaches can allow infrastructure to emerge.

In different ways, the three following articles in this issue unpack infrastructures inside schools and explore how various aspects of school-level infrastructures support teacher learning. First, "Bringing values back in: How purposes shape practices in coherent school designs," by Jal Mehta and Sarah Fine, examines various dimensions of infrastructure that guide teacher learning and instruction in two charter high schools in the United States. Although the two schools developed infrastructures around distinct instructional visions, with one focused on a "no excuses" approach in which instruction was "tightly micromanaged," and the other on interdisciplinary project-based pedagogies, the authors describe how aspects of

each school's infrastructure cohered in ways that allowed them to be successful at realizing these visions.

Still, the authors caution us to consider the contextual factors around which this coherence occurred. At the "no excuses" school, where the majority of students were Latina/o or African American and lived in socioeconomically-depressed neighborhoods, a high level of control was exercised over teachers, and those looking for more autonomy and the ability to express their ideas tended to leave the school. Conversely, at the project-based school, where the student body was more racially and socioeconomically diverse, teachers were given considerable independence and expected to take initiative in instructional planning, contributing to higher levels of teacher retention. The authors thus lead us to question for whom different infrastructures are developed, and how they might reify inequities with respect to the learning opportunities afforded to particular groups of students.

Whereas Mehta and Fine's article points to the benefits of infrastructures that support collaborative learning environments for teachers, the next article by Eric Camburn and Seong Won Han, entitled "Infrastructure for teacher reflection and instructional change: An exploratory study," explicitly examines the relationships between teacher collaboration and practice in an urban US school district. In particular, the authors show that learning experiences that occurred through social interactions were related to teachers' engagement in reflective practice, as well as to changes in their classroom instruction. Their findings speak to the importance of developing infrastructures that provide opportunities for teacher learning that are both highly contextualized and focused on issues relevant to instruction (as opposed to schoolwide issues). Still, echoing Peurach and Neumerski, Camburn and Han suggest that supporting large-scale instructional change is difficult and must be undertaken as a long-term endeavor, and those engaged in infrastructure design and development should attend to teacher learning with this in mind.

The final paper, "Highway to reform: The coupling of district reading policy and instructional practice," by Sarah Woulfin, narrows in on particular features of a school district's infrastructure for reading instruction, and how these features worked (or did not work) as mechanisms to couple policy and practice in three US elementary schools. By portraying the various ways in which infrastructure was taken up in teachers' instructional routines, Woulfin reveals key differences between how the infrastructure was designed and how it was enacted in practice. Moreover, the article uses Qualitative Comparative Analysis (QCA) to show that the extent to which district reading policy made its way into practice depended on how teachers took up and combined different dimensions of the infrastructure. Echoing other articles in the issue, Woulfin's findings point to the importance of developing infrastructures that cohere around a particular instructional vision and that offer support for capacity building as teachers work to incorporate various features of the infrastructure into their instructional practice.

Taken together, the articles in this special issue point to the dynamic relationship between infrastructure and practice, and the importance of attending to this relationship in educational change processes. They suggest that, rather than serving as fixed scaffolds or supports that fade into the background, infrastructures emerge only when they are built up, tinkered with, and leaned on in teaching and leadership

practice. As such, instead of asking "*What* is infrastructure?", the articles in this issue push us to ask, "*When*, or even *how*, is something an infrastructure?" Specifically, the articles draw attention to the ways in which infrastructures surface through contextually-appropriate capacity-building efforts. That is, as teachers and leaders are afforded opportunities to interact with and learn from one another around a locally-defined instructional vision, they engage in practices that allow them to make sense of the network of tools (e.g., standards, curriculum, resources, professional development) at their disposal and to adapt them for their particular contexts and student populations.

Thus, while policymakers are oftentimes viewed in some circles as professional designers of infrastructure, the articles in this issue suggest that system users (i.e., leaders and teachers) should also be considered designers, since they will inevitably reshape an infrastructure as they take it up in practice or pull down various components in ways that help guide their practice (Star and Ruhleder 1996). In order to deepen our understandings in the field of educational change, then, we must take a more comprehensive view of the design activities in which both policymakers and practitioners engage as they (re)design systems to support instructional improvement. This view would take a participatory design approach (Pipek and Wulf 2009), in which the term *infrastructuring* (Star and Ruhleder 1996) might be more appropriate to capture the processes through which school systems create the conditions necessary for educational change. As the studies in this issue focus on school districts and schools in the United States, more work is needed that explores infrastructuring in school systems across the globe, allowing us to continue to build theory related to how infrastructure contributes to educational change as a field across and within diverse international contexts.

And yet, a participatory design approach to infrastructuring suggests that the activities of all stakeholders should contribute to systems development. While the articles in this special issue unpack the activities of stakeholders residing within formal organizations (i.e., school districts and schools), more scholarship is needed to examine how networks of actors and tools engage in infrastructuring across formal and informal boundaries (Russell et al. 2013). Specifically, infrastructure can be a useful conceptual tool for examining cross-sector collaborations in education, as well as community-based education reform efforts. Moreover, while the articles in this issue hint at the ways in which school systems might engage in infrastructuring efforts focused on equity, particularly with respect to the challenges and opportunities that emerge when designing systems that attend to the needs of particular student populations, more scholarship is needed that pays explicit attention to how issues of race, ethnicity, language, and immigration and socioeconomic status are taken up by designers in and through the educational infrastructure. Given the changing nature of our population both locally and globally, it behooves us to understand when and how—and across what boundaries—infrastructures that support educational equity emerge, and how we can build capacity to support its growth and change over the long term.

References

Elmore, R. F. (1996). Getting to scale with good educational practice. *Harvard Educational Review, 66*(1), 1–26.

Fullan, M. (2000). The return of large-scale reform. *Journal of Educational Change, 1*(1), 5–28.

Fullan, M. (2007). *The new meaning of educational change* (4th ed.). New York: Teachers College Press.

Honig, M. I. (2004). Where's the "up" in bottom-up reform? *Educational Policy, 18*(4), 527–561.

Kober, N., & Rentner, D. S. (2012). *Year two of implementing the Common Core State Standards: States' progress and challenges*. Washington, DC: Center on Education Policy.

National Governors Association Center for Best Practices and Council of Chief State School Officers. (2010a). *The Common Core State Standards for English language arts and literacy in history/social studies, science, and technical subjects*. Washington, DC: Authors.

National Governors Association Center for Best Practices and Council of Chief State School Officers. (2010b). *The Common Core State Standards for mathematics*. Washington, DC: Authors.

Pipek, V., & Wulf, V. (2009). Infrastructuring: Toward an integrated perspective on the design and use of information technology. *Journal of the Association for Information Systems, 10*(5). http://aisel.aisnet.org/jais/vol10/iss5/1.

Rothman, R. (2013). *Fewer, clearer, higher: How the Common Core State Standards can change classroom practice*. Cambridge, MA: Harvard Education Press.

Russell, J. L., Knutson, K., & Crowley, K. (2013). Informal learning organizations as part of an educational ecology: Lessons from collaboration across the formal-informal divide. *Journal of Educational Change, 14*(3), 259–281.

Scott, W. R. (2007). *Institutions and organizations: Ideas and interests*. Thousand Oaks, CA: Sage Publications.

Senge, P. M. (2006). *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday.

Star, S. L., & Ruhleder, K. (1996). Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information Systems Research, 7*(1), 111–134.

Stinchcombe, A. L. (2001). *When formality works: Authority and abstraction in law and organizations*. Chicago, IL: The University of Chicago Press.