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Building a developmental culture of feedback

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Abstract

Purpose – This paper draws from more than 25 years of research with aspiring and practicing educational leaders to present six strategies for building a culture of feedback in schools, teams, districts, professional learning opportunities, and other educational settings. These strategies reflect key elements of the authors’ new, developmental approach to feedback. The paper aims to discuss these issues.

Design/methodology/approach – Through the lens of adult developmental theory, the authors highlight foundational learnings from open-ended survey research with 14 educational leaders about their experiences giving and receiving feedback, and prior qualitative, mixed-method, and longitudinal research with principals, assistant principals, teachers, superintendents, and other educational leaders.

Findings – The authors share six developmentally oriented strategies for establishing trust and building conditions for authentic, generative feedback: finding value in mistakes, modeling vulnerability, caring for the (inter)personal, clarifying expectations, sharing developmental ideas, and building an infrastructure for collaboration.

Practical implications – This work has implications for leadership and leadership preparation, especially given contemporary emphases on collaboration and high-stakes evaluations as tools for ongoing improvement, enhancing professional capital, and internal, individual, and system-wide capacity building.

Originality/value – Because a developmental perspective has been noticeably missing from the wider feedback literature and leadership preparation curricula, this work extends and enhances tenets from different fields (e.g. business, developmental psychology, educational leadership and educational leadership preparation), while also addressing urgent calls for educational reform; leadership preparation, development, and practice; and professional capital building.

Keywords Trust, Leadership, Culture, Feedback, Adult development, Individual and organizational capacity building

Paper type Research paper

At every level of the system, educators are working to generate new solutions to complex challenges, address pressing issues of equity and diversity, and better support students’ well-being and academic achievement. Educational leaders, in particular, have been tasked with leading change with and for students and communities, supporting the diverse adults in their care, and growing their own leadership (Bogotch and Shields, 2014; Grogan, 2013; Jean-Marie et al., 2009; Khalifa et al., 2016). Within this contemporary milieu, professional feedback has emerged as a key lever for school improvement – and for building professional capital and internal capacity (Drago-Severson and Blum-DeStefano, 2016; MacDonald, 2011; Marshall, 2013; Stone and Heen, 2014). Likewise, policy and cultural shifts toward professional learning and collaboration permeate our “new normal” world, and underscore the critical importance of effective communication (Davis, 2009; DuFour and Marzano, 2011; Gates, 2013; Goddard et al., 2007; Hargreaves and O’Connor, 2017; Leithwood and Louis, 2012; Ronfeldt et al., 2015).

Yet, the mixed results of current reforms (e.g. Hallinger et al., 2014) beg the question: when, where, and how do educational leaders (broadly defined) learn to give feedback and support meaningful growth and collaboration in teams, schools, professional learning communities (PLCs), and performance evaluations? While this is essential in general, adult developmental theory shines an important light on the fact that educators – regardless of their roles in schools...
and systems—will make sense of feedback and relationships in qualitatively different ways. This is also a sentiment echoed by the adult leaders in our university classes, workshops, research, and professional learning initiatives, who regularly name feedback as one of their biggest challenges and hopes for learning. Accordingly, this paper presents aspects of a new developmental approach to feedback, called feedback for growth (by “growth” we mean the expansion of our internal capacities to better manage the complexities of learning, teaching, leading, and living, Drago-Severson and Blum-DeStefano, 2016). Drawing from Robert Kegan’s (1982, 1994, 2000) constructive developmental theory and more than 25 years of research and work with school leaders around the globe that extends the original theory (Drago-Severson, 1996, 2004a, b, 2009, 2012, 2016; Drago-Severson and Blum-DeStefano, 2016, 2018; Drago-Severson et al., 2013; Drago-Severson et al., 2015), the paper offers a close up look at a developmental approach to feedback and how it can make a difference.

Specifically, it emphasizes the promise of preparing leaders to build an effective, growth-enhancing culture of feedback in schools and organizations, and shares six developmentally oriented strategies for establishing trust and building conditions for authentic, generative feedback. Promisingly, we have discovered in our work, research, and teaching that this kind of genuine, authentic communication and collaboration is one of the most powerful ways we can help each other grow, improve instructional and leadership practices, examine assumptions, raise collective consciousness, and build professional and internal capacity. Below we share more about our theoretical framework, research base, and findings.

Theoretical framework

This paper is informed by two main bodies of literature: current feedback challenges in education, and constructive-developmental theory. As mentioned, and as we will describe in greater detail in our discussion of our research base, it is also informed by our longitudinal research and experiences supporting adult development in universities and K-12 professional learning initiatives.

Feedback challenges in education

Feedback is one of the primary ways we can support others’ development and grow the internal capacities needed to meet the complex demands of our educational world. Yet, throughout the education sector, there remains a growing sense that teachers and leaders need to do something different in terms of feedback, not just something more. While the field seems to be experiencing a proliferation of feedback—from supervisors, mentors, coaches, colleagues, parents, students, and performance reports; and via initiatives such as 360-degree feedback, S.M.A.R.T. goals, the Danielson framework, instructional “rounds” and learning walks, and nation-wide changes to teacher evaluation systems (Boudett et al., 2005; Danielson, 2010/2011)—the growing amount of feedback on our plates can feel overwhelming if we don’t have a clear plan for prioritizing and taking it in. It may come as no surprise, then, that research is beginning to suggest that many educators may be getting too much feedback, as feedback from different supervisors, colleagues, stakeholders, and assessment measures may be inconsistent or even conflicting (Lavigne and Good, 2013; Marshall, 2013). This can be especially challenging for educators already working as hard as they can, and who report that such an influx of feedback does not translate readily into improved performance (Kegan and Lahey, 2016; Weisberg et al., 2009).

For many other educators, however, a lack of quality feedback creates a different kind of challenge. By way of example, a recent study of twelve large, US districts found that 74 percent of teachers reported receiving virtually no feedback on their summative evaluations (Weisberg et al., 2009). Other research has found that formal feedback for
teachers often lacks actionable details and authentic invitations to reflect on and apply deep learning (Harris *et al.*, 2014; Sartain *et al.*, 2011; Sinnema and Robinson, 2007).

While these feedback challenges undoubtedly have multiple roots and causes, a developmental lens offers new insight into why feedback can be so hard – as well as how to set the conditions for feedback that really supports individual and organizational improvement.

**Constructive-developmental theory**

Drawing from more than 45 years of research about how people learn, make sense of their experiences, and develop across the lifespan (e.g. Drago-Severson, 2004a, b, 2009, 2012, 2016; Kegan, 1982, 1994, 2000; Basseches, 1984; Baxter-Magolda, 2009; Belenky *et al.*, 1997; Kegan and Lahey, 2009, 2016; Kohlberg, 1969, 1984; Perry, 1970; Piaget, 1952), constructive developmental theory posits that growth in adulthood occurs in qualitatively different stages – or ways of knowing. More specifically, constructive developmental theory identifies four qualitatively different ways of knowing more common in adulthood: the instrumental, socializing, self-authoring, and self-transforming. While each way of knowing has both strengths and limitations, and no one way of knowing is “better” than another, they do occur in a particular, sequential order, with a move from one way of knowing to the next reflecting a holistic and sequential expansion of our cognitive, affective, intrapersonal, and interpersonal capacities (Drago-Severson, 2004a, b, 2009, 2012, 2016). Put more simply, a developmental lens highlights the fact that adults will orient to and prioritize different things in their feedback and collaboration, such as meeting concrete needs (instrumental knowers), the expectations of valued others (socializing knowers), their own ideals and judgments (self-authoring knowers), or interconnection and mutuality (self-transforming knowers).

We often describe adults’ ways of knowing as the lenses – or filters – through which they interpret their worlds, as they fundamentally influence how we make sense of our experiences, professional commitments, and relationships. In the context of education, for example, our ways of knowing shape how we understand our roles and responsibilities as learners, teachers, leaders, administrators, collaborators – and more. They also influence our expectations about what makes a good principal, superintendent, director, head teacher, coach, professional learning leader, or colleague. In terms of feedback more specifically, it can also be helpful to think about our ways of knowing as the audio frequencies with which we hear (Drago-Severson and Blum-DeStefano, 2016). In other words, our ways of knowing predispose us to feedback styles we can tune into – and those we may inadvertently tune out. Accordingly, understanding ways of knowing can help us learn even more about how to create and sustain cultures of genuine communication with and for adults who will need different kinds of supports and holding (in the psychological sense).

Toward this end, Table I provides an overview of orienting concerns and developmental supports and challenges for adults who make meaning with the instrumental, socializing, self-authoring, and self-transforming ways of knowing.

Importantly, a person’s way of knowing is not random. Rather, it is a stable and consistent system of meaning making employed across contexts for a period of time. In fact, when we are “in” a way of knowing, it generally feels more like a part of who we are than something we have (Drago-Severson, 2004a, 2009, 2012; Kegan, 1982, 1994; Kegan *et al.*, 2001b). Still, the great helpfulness of constructive-developmental theory is the fact that – with the appropriate supports and challenges – our meaning making can continue to grow and evolve over time. It is also important to note that, according to research, a person’s way of knowing is not correlated with intelligence, kindness, happiness, or personality profile (Kegan *et al.*, 2001). Likewise, ways of knowing are not dictated by race, gender, sexual orientation, age, religion, socio-economic status or any other demographic marker. The fact is, adults from all walks of life can make meaning with any way of knowing – although, of course, different aspects of our
<table>
<thead>
<tr>
<th>Way of knowing</th>
<th>Preoccupying concerns</th>
<th>Supports and challenges for growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrumental</td>
<td>Orients to and is run by own self-interests, purposes, and concrete needs. Is most concerned with tangible consequences of own and others’ actions. Makes decisions based on what the self will acquire and on following the rules. Experiences other people as either helpers or obstacles to meeting one’s own concrete needs. Does not yet have the capacity for abstract thinking in the psychological sense, or for making generalizations from one context to another.</td>
<td>Supports concrete models, samples, suggestions, rubrics, protocols, and examples (e.g. findings from research that prove the effectiveness of initiatives; exemplary lesson plans and best practices; clear directives about processes, goals, or next steps). Discussions about what went right and wrong. Timelines with clear steps and deliverables.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Challenges managing leadership or teaching challenges that do not have a clear answer or solution. Making abstract connections. Seeing things from another’s point of view. Looking beyond own understandings of the “right” thing to do and how things “are” (or are “supposed” to be).</td>
</tr>
<tr>
<td>Socializing</td>
<td>Can take perspective on own needs, wants, and desires, but is “run” by (and therefore cannot reflect on or control) the expectations, values, and opinions of valued others (e.g. external authorities, loved ones, or society) ADOpts others’ standards, values, and judgments. Orients to internal world and inner states (feelings). Feels responsible for others’ feelings and holds others responsible for one’s own.</td>
<td>Supports demonstrations of appreciation. Affirmation of what’s going well (e.g. hard work, effort, progress). Recognition of growth and contributions. Feeling accepted as a person and a colleague.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Challenges sharing thoughts and feelings in a larger group, or when unsure of others’ ideas. Taking in critical feedback without feeling torn apart. Engaging in difficult conversations with valued others or supervisors. Turning toward conflict and high-risk situations.</td>
</tr>
<tr>
<td>Self-authoring</td>
<td>Orients to self’s values (internal authority) and the smooth running of own internal system. Can take perspective on relationships, mutuality. Evaluates criticism according to internal standards. Is ultimately concerned with own competence and performance. Can balance contradictory feelings simultaneously. Views conflict as a natural part of life, work, and leadership.</td>
<td>Supports autonomy and self-direction in goal setting and professional practice. Leadership roles. Recognition of competence and expertise. Opportunities to offer feedback and ideas to others.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Challenges considering and finding value in ideas and viewpoints that feel diametrically opposed to one’s own. Critically examining own carefully curated values, beliefs, and philosophies about teaching, leadership, and the world. Sharing leadership and/or authority with others.</td>
</tr>
</tbody>
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Table I. Ways of knowing: preoccupying concerns and supports and challenges for growth

(continued)
identities will influence our experiences in vital ways (as well as the supports and challenges we encounter in our lives) (Kegan et al., 2001).

It is also important to note that research suggests adults need – and are gradually developing – more inclusive, higher order capacities as a result of the increasing demands of leadership, education, and the world more broadly (Drago-Severson, 2004b, 2009, 2012; Kegan and Lahey, 2009, 2016). While meta-analyses of dissertations and other studies indicate that the socializing way of knowing remains the most common in adulthood (Kegan, 1994, 2000; Kegan and Lahey, 2009, 2016), current estimates posit that approximately 8-11 percent of adults in the USA now make meaning with at least some degree of self-transforming capacity (up from only 3-5 percent in 1994) (Kegan, 2013).

As this paper posits, feedback is one important way we can support each other in our efforts to grow – and to see more deeply into ourselves, others, and the urgent complexities of our schools and systems. Echoing Hargreaves and Fullan (2012), we argue that when we grow ourselves as individuals, we are better equipped to engage in and contribute to the collective processes that maximize teaching, leading, and learning – and foster real change. In other words, when we build internal capacity (i.e. move from one way of knowing to the next), we have more resources to draw from, and are better equipped to manage the complexity and ambiguity of contemporary education. Promisingly, feedback is one key way we can help each other develop – just as understanding adult development can help us give better feedback.

**Research base**

While in many ways a practice-oriented, conceptual paper, this paper also draws from a rich data pool, including in-depth (open-ended) survey research with 14 educational leaders about their experiences giving and receiving feedback, and more than 25 years of research (ie., surveys, interviews, and evaluations) and work with school leaders around the world. Below, we describe our methods of data collection and analysis, as well as some limitations and possible extensions.
Data collection
To help ground our ongoing exploration of feedback in the stories, examples, and reflections of on-the-ground educators, we invited 14 educational leaders in different roles (e.g. principals, assistant principals, superintendents, teacher leaders, educational consultants, university professors) – who we knew through various channels as teachers or colleagues to be generally effective at giving feedback – to reflect in writing about their feedback experiences. We asked, for example, about what they saw as the overall goals of feedback, their preferences and strategies for giving and receiving feedback, and the most important elements of feedback (from their perspective). As we say more about in our discussion of data analysis, these survey responses served to help concretize preliminary themes, and triangulate learnings from prior stages of our research. It is also important to note that, while we did have prior relationships with survey respondents, we were not currently supervising or teaching any of the participants at the time the survey was conducted, and participation was completely voluntary. In fact, in most cases where survey respondents were former students, many years had passed since the conclusion of the academic relationship (in one case, a current student of the first author with vast leadership experience learned about the survey and volunteered to contribute).

In addition to the open-ended survey data, this paper also draws from and extends qualitative findings about how 25 principals across the USA supported teachers’ learning and development within their schools (Drago-Severson, 2004b, 2009, 2012), and builds on an earlier, four-and-a-half-year ethnography (Drago-Severson, 1996) that investigated how one principal exercised leadership on behalf of teacher development. Since 2009, we have also conducted mixed-methods (survey) research with principals, assistant principals, teachers, superintendents, and other school leaders in the workshops, institutes, and classes we teach, and conducted a longitudinal, mixed-methods study (surveys \(n = 40\); in-depth interviews \(n = 20\)) exploring how graduate students who took these classes went on to use developmental ideas and practices in their work years later (Drago-Severson et al., 2013).

In each phase as applicable, we took careful steps to attend to the potential validity threats associated with conducting research with participants with whom we had prior relationships (i.e. to acknowledge and attend to the power dynamics of working with, in some cases, former students). For example, in the longitudinal study with former graduate students, interviews were completely voluntary, and were conducted after grades were submitted, and by a member of the research team who was not the lead instructor of the focal courses. That said, we recognize – and hope – that these and other prior relationships may have enhanced the data in important ways, too, as participants may have felt more comfortable sharing their thinking, successes, challenges, and experiences.

Data analysis
To develop our new approach to feedback, our team engaged in several phases of intensive data analysis, where we carefully explored and documented leaders’ experiences with feedback, and tracked what worked to support adult development (in participants’ practice and our own). The processes involved inductive and theoretical coding (Maxwell, 2013) of the feedback surveys (as the initial entry point into our guiding research question) – as well as the notes, feedback, and data from our university classes, professional development institutes, and prior surveys and interviews. We worked collaboratively to look across these different sets of data and experiences to develop, synthesize, and crosscheck codes (e.g. feedback support, feedback challenge, feedback purpose, feedback culture, developmental dimension, effective practice, etc.) (Merriam and Tisdell, 2016).

We met regularly to discuss emerging ideas and to collectively develop themes and practical strategies in relation to our data, coding, experience, and theoretical framework (Maxwell, 2013; Miles et al., 2013). Specifically, we sought to highlight representative and illustrative examples in
Our data (e.g. strategies leaders employed to build and sustain trust, relationships, and positive learning cultures) as well as typical cases that reflected common experiences shared by participants with each of the different ways of knowing (in their own work contexts and in relation to any professional learning experiences we had the honor of facilitating). Throughout this process, we attended to descriptive, interpretive and theoretical validity by: drawing from participants’ verbatim quotes, examining data for confirming and disconfirming instances of themes (Miles et al., 2013) (e.g. exploring multiple ways that adults who make meaning with a particular way of knowing orient to feedback as both givers and receivers; actively seeking out examples of contrary feelings about a particular practice or strategy), and engaging in regular interpretive meetings to conduct an in-depth, cross-comparative analysis of data, and to engage in cross checking codes and interpretations (Maxwell, 2013). In all phases, we employed a grounded theory approach (Corbin and Strauss, 2015) while incorporating various literatures (e.g. about feedback and adult development) into analysis. More specifically, the findings below – which encapsulate key learnings from across the larger scope of our ongoing inquiry – were developed in light of the following research question:

**RQ1.** How might a developmental lens offer new insights for creating a culture of feedback – particularly one that supports adults with diverse ways of knowing?

This question was part of a larger set of questions used to explore the potential connection between constructive-developmental theory and feedback when elucidating our developmental approach.

**Limitations**
In addition to the complexities of learning, in some cases, from participants we knew previously, we also acknowledge the limitations of drawing largely from survey and interview data as self-reported descriptions. While data collection for this phase of our research did not include formal observations of educators giving and/or receiving feedback, learning from participants through surveys and interviews allowed us to learn from a geographically diverse sample, and to also focus on the meaning making underlying participants’ understandings of feedback as a first step into this inquiry. We also worked, during our analytic process, to triangulate emerging themes and learnings with lessons and observations from our ongoing, on-the-ground work with educators in K-12 schools, as well as our own teaching and feedback practice. For future research, we recommend coupling interview and survey data with field observations and formal developmental assessments to add new nuance and depth to findings.

**Building a culture of feedback**
This section highlights key lessons synthesized from our research and practice, including strategies for building a culture of feedback. This is essential because, as many educators have shared with us, meaningful, effective feedback is largely dependent on the context in which it is offered. When, for example, “real” feedback falls outside of organizational norms, educators share that it can be hard to offer one’s authentic thinking with colleagues and directors, for fear of retribution or “rocking the boat.” In a similar way, when feedback is presented or shared in ways that heighten anxiety (or feel like “gotcha moments,” as many participants described), it can be hard to reframe feedback as a tool for growth, or an expression of trust and respect. As one principal from our survey research explained (and this is a common sentiment leaders voice):

*most feedback to which we’re initially introduced is negative: parents/teachers/ coaches/directors telling us what we did wrong, police telling us we broke the law, employers telling us we will be fired […]. These are not great introductions to feedback.*
Fortunately, there are things that leaders across all levels can do to strengthen what we see as the essential preconditions of trust, safety, and respect (Drago-Severson et al., 2013), and to build what we refer to as a culture of feedback. As our research and work reveal, attending to these vital, affective dimensions before, during, and after feedback can help shape one-on-one relationships, teams, schools, and districts as growth-enhancing contexts. For example, our research illuminates that employing and embodying six strategies over time can help leaders alleviate worry, instill a sense of confidence and security, and contribute to a shared understanding of and purpose for feedback — for adults with all ways of knowing (Drago-Severson and Blum-DeStefano, 2016). We discuss each of these in the sections that follow, and weave in parallel learnings from the wider literature to complement key points:

- recognizing the value of mistakes;
- modeling vulnerability and a learning stance;
- honoring the (inter)personal;
- making expectations clear — from both sides;
- sharing developmental theory and practices; and
- employing and strengthening collaborative structures.

While these strategies are not mutually exclusive (and, in fact, are connected by a developmental through-line), we tease them apart here to help shine a light on key feedback “moves” that participants in our research — and we — have found very effective over time. We also describe how these strategies can be employed and differentiated to support adults across the developmental continuum.

Recognizing the value of mistakes

Often, adults in our research equated “being professional” with putting their best foot forward, demonstrating competency and success, and proving their worth to supervisors and stakeholders. Adults in leadership roles, too — such as principals, assistant principals, superintendents, coaches, and team leaders — confided feeling like they needed to “have all the answers” and hide any signs of weakness. Yet, as our research (and others’) suggests, acknowledging our growing edges and vulnerabilities can actually help us understand and address them — and continue our developmental journeys of learning and growing (e.g. Ackerman and Maslin-Ostrowski, 2002; Brown, 2012; Kegan and Lahey, 2016). Just as safely acknowledging errors in student work can lead to the richest academic performance (Hattie, 2012b), addressing mistakes and missteps in adults’ practice (and our own) — in supportive, developmental ways — can also foster deep learning and change.

For example, in the for profit sector, Kegan et al. (2014) have highlighted the promise of a new kind of company, called deliberately developmental organizations, which prioritize the fact that adults are “still valuable even as they are screwing up — potentially even more valuable, if they can overcome the limitations they are exposing” (p. 6). Like children and youth, adults need opportunities to experiment, learn from mistakes, and experience growth as a process (rather than a product or demand). While formal evaluations — like capstone projects and summative ratings — play a very important role in teacher feedback (and while everyone will of course want to do their best on these “permanent record” kinds of measures), creating opportunities for ongoing formative feedback — vertically, between supervisors and supervisees, and horizontally, between colleagues — can help create a context in which asking for help is a sign of strength and self-awareness, and a powerful, collaborative norm.

Understanding ways of knowing and developmental diversity can also help leaders (broadly defined) adopt this kind of learning-oriented stance in relation to feedback.
For example, leaders could: help instrumental knowers understand that valuing mistakes is the “right” thing to do according to research (and that it will be valued and rewarded professionally), assure socializing knowers that mistakes are a natural part of growth, and that they will still be valued, liked, and respected if they share the “rough spots” of their practice and thinking, invite self-authoring knowers to assess their own areas for growth and look, as well, toward larger, school-wide needs and challenges, and engage self-transforming knowers as partners in learning, collaboration, and feedback. Meeting adults where they are in these ways can – as one seasoned principal representatively explained in one of our institutes – “help new ideas get absorbed and soaked in.”

**Modeling vulnerability and a learning stance**

Powerfully, one of the most effective ways to demonstrate the value of learning as a process – and of mistakes as steps toward growth – is to model these commitments in one’s own actions and behaviors. While leading with this kind of vulnerability takes both courage and practice, aligning your “audio” with your “visuals” – and looking within just as without – can set a powerful example for others. Indeed, acknowledging that you do not have all the answers (as either a feedback giver or receiver), seeking out and learning from feedback on your practice and leadership, and being transparent about your own growing edges can all help foster a more genuine culture of feedback over time – and deepen colleagues’ essential feelings of trust, safety, and respect in relation to sharing their own needs for growth.

Yet, as a developmental lens helps make clear, educators – and all adults, for that matter – will orient differently to expressing vulnerability, and to modeling it in their leadership. What, for example, might it feel like for an instrumental knower to share his or her growing edge, when an orienting concern is getting it “right”? What might be at risk for a socializing knower asked to share a problem of practice or classroom challenge with a valued colleague or evaluator? How might it be hard for a self-authoring knower to relinquish the allure of personal mastery or competence, when it’s so closely aligned with personal identity? To be sure, modeling vulnerability requires complex internal capacities, as well as a leadership stance that reaches beyond traditional, managerial approaches (Drago-Severson, 2012; Drago-Severson and Blum-DeStefano, 2018; Petrie, 2014; Shoho et al., 2010).

Despite the internal and external challenges of being vulnerable and modeling vulnerability, our research suggests that this promising practice can be more fully embodied over time. Like building a muscle, it takes both time and practice. Moreover, we have found that when leaders model vulnerability and a commitment to self-development, more people are willing to acknowledge the parts of themselves that are still developing – and to recognize that we all have these. Ultimately, disguising, hiding, or ignoring our growing edges – whether personal, professional, developmental, or organizational – only gives them more weight in our lives, so creating contexts in which we can share these more tender parts of ourselves is really a gift we can give to one another.

**Honoring the (inter)personal**

Genuinely caring for and about the ways colleagues’ internal capacities and life circumstances influence their performance can make a tremendous difference in how feedback is received, and can help leaders differentiate their feedback so others can hear. Importantly, this kind of individualized and personal care is a principle many educators in our research describe embracing readily for children and youth, yet unintentionally overlooking when working with adults. While, as you know, adults’ developmental capacities will likely influence how they orient to interpersonal connections (e.g. as a means to an end, as the foundation of one’s sense of self, as an affirmation of their competence, or as a context for mutuality), the fact is – at the end of the day – most everyone likes to be liked and to feel cared for. Understanding more, then, about what feels supportive and matters
most to the individuals in your care (be it developmentally, culturally, or simply personally) can help create a safe and supportive context for both collaboration and feedback.

Knowing that many leaders we’ve worked with and learned from lament the slippery slope of “supervising friends” (as they call it), it’s vital to emphasize here that this strategy of caring for the (inter)personal isn’t about friendships, per se, but about relationships more holistically. It’s about caring for and learning ever more about who colleagues are – as teachers, leaders, individuals, community members, and growing individuals. And, it’s about approaching conversations and feedback as opportunities to deepen knowledge of and care for one another over time. As one principal recently explained, feedback works best in her school when she offers it “to the whole of the teacher, not just to the teacher parts of them.” Ultimately, caring for the (inter)personal in these ways is about grounding the work in the preconditions of trust, safety, and respect – for when people feel known, supported, seen, and heard, real feedback can flourish as an expectation rather than an exception. It can also help you integrate developmental feedback into the more holistic fabric of ongoing relationships, so that it feels purposeful and built-in, rather than tangential (Fullan, 2014).

**Checking in and out.** One practice that we have found to be very helpful in building trust and relationships in one-on-one and group contexts is checking in and out (Drago-Severson, 2009, 2012; Drago-Severson and Blum-DeStefano, 2016). Put most simply, setting aside time at the beginning and end of meetings for individuals to share (if they’d like to) something that feels important in that moment (i.e. personally, professionally, or both) can help deepen connections and interpersonal understandings that serve as the foundation for meaningful feedback and collaboration. Thus, checking in and out is a flexible and promising practice you can employ with emerging and established groups, and with individuals who make meaning with any way of knowing.

Likewise, it can be helpful to think about how check-ins can be employed and adapted for both new and established teams/relationships. For newer or emerging groups, for instance, it can be helpful to check in around getting-to-know-you topics like weekend or vacation plans, special occasions (e.g. birthdays or anniversaries), or important day-to-day occurrences that feel pressing or pertinent. Learning and caring more about colleagues in these ways, many participants have shared with us, helps them better appreciate and navigate the beautiful diversity (developmental or otherwise) present in nearly any team or relationship. While these foci can work for more established teams, too, check-ins can also evolve to also address work-related updates and announcements, and reflections on collaborative processes themselves (e.g. “How do you think we’ve been doing as a team? Does anyone have any reflections on our last meeting?”) (Drago-Severson, 2009; Drago-Severson and Blum-DeStefano, 2016).

**Making expectations clear – from both sides.** Clarifying expectations from both sides (meaning from feedback giver and receiver) before feedback and revisiting these core agreements over time is also essential – especially since adults will bring different understandings of feedback to the table depending upon their ways of knowing and prior experiences. Here, especially, an understanding of adult development and ways of knowing is key. Indeed, explicitly discussing and developing shared understandings of feedback preferences, hopes, processes, confidentiality, and logistics upfront can help relieve anxiety, enhance the process, and minimize miscommunication. After all, there is so much about feedback that can be taken for granted, and that warrants consideration ahead of and over time. For example, will the feedback be formative or summative? Confidential or public? Formal or informal? With what style and tone will the feedback be delivered? What would feel most important and comfortable to everyone involved? What happens when stakeholders disagree? Talking about these important logistics, hopes, expectations, and developmental preferences can help alleviate some of the ambiguity often associated with feedback, and also equip us to
better meet colleagues where they are without “misfiring the message” (as one leader in our research termed it).

To help illustrate the importance of sharing expectations upfront, please consider the story of Denise and Sylvia[1], two teachers who were engaged in a mentoring relationship. As a newer teacher, Denise was excited when Sylvia – a highly experienced and effective veteran colleague – was assigned as her mentor. Because (in her estimation) Denise was more socializing in her way of knowing at the time, what she was really wanted from Sylvia was a safe context in which to talk and learn, and a trusted ally who could support her growth in an expert and caring way. This dynamic was important to Denise because she often felt vulnerable when she made what she saw as “mistakes” in her teaching, and felt nervous about “messing up” in front of Sylvia, who she saw as a “super star teacher.” Sylvia, however, was more self-authoring in her meaning making at the time, and what she felt would be of best support to Denise was straightforward feedback about what she needed to fix or improve (as this was the kind of mentoring she herself would have preferred).

So, while Sylvia offered her critiques to Denise in the spirit of genuine support, Denise – on the inside – was feeling hurt and discouraged by Sylvia’s focus on what she saw as her “negatives,” and failed to make much progress on her goals. As you might imagine, Denise’s limited progress was frustrating for Sylvia, too, who in turn “amped up” her efforts by offering more and more feedback. It wasn’t until Sylvia and Denise learned about ways of knowing in a workshop that they were able to recognize the inadvertent “mismatch” – and mutual good intentions – of their efforts. “Why didn’t you ever tell me how you were feeling?” Sylvia asked Denise, genuinely sorry that she hadn’t known about Denise’s needs and experiences. “I didn’t want to disappoint you,” Denise confided honestly – and, from there, they were able to talk more openly about what would feel like a safe and productive mentorship for both of them.

As this example helps makes clear, prioritizing time and space to engage in these kinds of conversations upfront – or at any point they seem needed – can help you anticipate and proactively address potential miscommunications and frustrations in your feedback and collaboration. In light of this, below is a list of sample questions you can explore with colleagues to learn more about educators’ feedback hopes, preferences and expectations:

• What are your hopes for our feedback session?

• Can you please help me understand what worked well for you when receiving feedback in the past? In other words, can you think of a time when someone offered feedback to you and you found that you were able to take it in and then act upon it? Who gave you the feedback? What was your relationship like with that person? What was it about what the person said or did that helped you?

• From your perspective, what is the purpose of feedback? What do you see as most important – or, what do you see as a hoped for outcome?

• When you think about a productive feedback session, what would feel most helpful and supportive to you?

• Please take a moment to consider what, if anything, makes receiving feedback hard or challenging for you. Can you think of a time – recently – when you received feedback that was difficult to take in, or that you didn’t think worked? What made it hard or painful for you? Why do you think it was challenging for you?

• Most of all, can you please help me understand what I can do to make our feedback sessions more meaningful and useful for you? I ask because I want to support you – and because I want to get better at offering you feedback that can help you.

As you may already suspect, not all colleagues will feel comfortable answering these questions in the same way (e.g. socializing knowers may need time to consider their own
responses before hearing valued others’), so providing opportunities for private reflection and/or small-group sharing can be very helpful when working to clarify expectations (in addition to asking these questions directly).

**Sharing developmental theory and practices**

While, as mentioned, deepening understandings of developmental theory can help all leaders improve their feedback (as both givers and receivers), our systematic research illuminates the promise of sharing developmental ideas with others, too. Rather than keeping a developmental lens in one’s proverbial back pocket (as a private tool to better understand others), openly sharing central ideas from constructive-developmental theory can help colleagues develop a shared language for talking about growth – as well as the feedback supports and challenges that would be most helpful for individuals and groups. As one aspiring school leader recently shared after learning about ways of knowing in a graduate course, “I’ve learned about the various stages of child development in my role as a teacher, but have had little exposure to the idea of there being stages to adult development. I am excited to bring this back to my school!” As she continued, this would be a new way to “spread the love.”

Like leadership itself, giving and receiving feedback is a responsibility and process that is collaborative, interactive, and often emotional, so inviting more adults to the developmental table (so to speak) will only increase the number of colleagues ready to engage intentionally in a culture of feedback. No one person could (or should have to) provide all the supports in a learning community, so sharing developmental ideas with the colleagues in your care (e.g. to help them prepare for and/or enhance mentoring relationships, grade level teams, curriculum committees, professional development sessions, parent and community meetings, and more) can help them work even more productively together in the spirit of mutual support and recognition.

Related to all of this, we’ve found that – when introducing developmental ideas – it is very important to share them not as a grading system or diagnostic test, but as an invitation to think differently about our own learning needs and those of our colleagues. As mentioned earlier, all ways of knowing have both strengths and limitations, and there is no one “right” way to make meaning. Rather, what is most important is the goodness of fit between what a person feels ready to do and what is being asked of him or her (Drago-Severson, 2009, 2012). Likewise, and just as with difference of all kinds, there is great beauty in what we call developmental diversity, and in honoring the needs and experiences diverse knowers will bring to a relationship or group. Could you imagine, for instance, working in a school or on a team made up entirely of self-authoring knowers, especially if they did not agree on key issues?

Ultimately, while understanding more about ways of knowing can help leaders provide developmentally appropriate supports and challenges to those in their care, teaching these same colleagues about adult development can also help them see more deeply into their own strengths and growing edges, and to recognize the promise and potential of those around them. This may be one of the most powerful supports – and gifts – a leader could offer.

**Employing and strengthening collaborative structures**

As suggested in our discussion of the prior strategy, it is essential – when working to build a culture of feedback – to intentionally diffuse and infuse opportunities for support throughout an organization, rather than conceptualize feedback as stemming from a central leader/feedback giver. Related to this, prior research (Drago-Severson, 2004b, 2009, 2012, 2016) has illuminated the promise of four pillar practices for growth – teaming, collegial inquiry, mentoring, and providing leadership roles – that can serve as powerful, developmental structures for building capacity and exchanging ideas in teams, schools, districts, and beyond. These practices are referred to as “pillars” because, independently and in combination,
they can create and hold up an infrastructure for rich, authentic collaboration (Drago-Severson, 2004b, 2009) and meaningful feedback system-wide (Drago-Severson and Blum-DeStefano, 2016).

While we discuss these practices in greater detail elsewhere (please see Drago-Severson, 2004b, 2009, 2012, 2016; Drago-Severson et al., 2013; Drago-Severson and Blum-DeStefano, 2018), their most central intention involves reframing collaborative practices — that you may already be familiar with or engaging in — as intentional, developmental contexts for growth. In this way, the pillars are not about adding more to an already initiative-heavy landscape, but about doing what we are already doing even better, and with larger purpose, scope, and developmental intentionality. In this way, educators can benefit from peer support and collegial feedback, which we know is a powerful driver for student success in K-12 contexts (Hattie, 2012b). With this in mind, we offer in Table II a series of research-based tips and takeaways for engaging in the pillars as developmental practices for internal capacity building curated from our larger body of research (Drago-Severson, 2004b, 2009, 2012, 2016; Drago-Severson et al., 2013; Drago-Severson and Blum-DeStefano, 2018).

Across the system, individuals and teams are yearning for more effective ways to collaborate with colleagues and grow together (Edmonson, 2014; Tomlinson and Murphy, 2015; Troen and Boles, 2011). This is true for educators hoping to enhance their feedback and collaborative processes more generally — and also in relation to working across lines of difference (e.g. race, religion, gender identity, sexual orientation, socio-economic status and more). Promisingly, the pillar practices can help bring adults together to examine assumptions, broaden perspectives, explore pressing issues of practice, and see more deeply into themselves and others. This, as you know, is the “stuff” of internal and organizational capacity building. As a seasoned principal, whose school went on to win numerous student achievement awards after implementing the pillar practices, recently shared with us, “These structures make the magic happen.” We hope that for you, too, employing collaborative structures will help set the stage for even more meaningful growth and feedback in your context.

<table>
<thead>
<tr>
<th>Pillar practice</th>
<th>Developmental tips and takeaways</th>
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| Teaming         | Create time and space for colleagues to work together  
|                 | Share hopes and expectations for the collaboration  
|                 | Differentiate opportunities for participation  
|                 | Open and close by “checking in and out” — and/or inviting team members to share and reflect on their experiences in and out of the team |
| Providing leadership roles | Offer both private and open invitations into roles (as this can help widen the breadth of participation)  
|                 | Consider the match between a person and a potential leadership role  
|                 | Ask how you can help  
|                 | Remain in place over time to offer support as the person takes on new responsibilities and leadership |
| Collegial inquiry | Establish norms and confidentiality agreements  
|                 | Start with small, safe topics  
|                 | Practice with the less personal  
|                 | Model vulnerability and openness to feedback when introducing the practice to colleagues (this can help set a safe and trusting foundation) |
| Mentoring       | Consider the developmental match between the mentor and mentee  
|                 | Clarify expectations (from both sides)  
|                 | Discuss expectations and hopes for a productive mentoring experience  
|                 | Invite mentee to share preferences for supports, challenges, and feedback  
|                 | Establish mutual understanding about what is on-the-record/evaluative, and what is formative/confidential |

Table II.  
Developmental tips and takeaways for the pillar practices

Source: Adapted from Drago-Severson (2009) and Drago-Severson and Blum-DeStefano (2018)
Conclusion and significance
For many years, John Hattie (2012a) has argued that teacher feedback is one of the most powerful influences on student achievement – although this influence can be either positive or negative. Research about professional feedback in both the education and business sectors similarly points to the banes and boons of the feedback adults give and receive (e.g. Hargreaves and O’Connor, 2017; MacDonald, 2011; Marshall, 2013; Stone and Heen, 2014), yet a developmental perspective has been largely missing from this literature. In this paper, we described the importance of building a culture of feedback that supports meaningful collaboration and connection as the foundation for any meaningful change. The fact is, we all need to feel well held (Drago-Severson, 2012) in our work and learning to lean into the risk and exhilaration of growth – and to share our honest thinking, feeling, and feedback with others. Toward this end, this paper outlined six promising, developmental strategies for nurturing the preconditions of trust, safety, and respect that set the stage for what educators in our research describe as “real” feedback: recognizing the value of mistakes, modeling vulnerability and a learning stance, honoring the (inter)personal, making expectations clear from both sides, sharing developmental theory and practices, and employing and strengthening collaborative structures (Drago-Severson and Blum-DeStefano, 2016). We hope that these strategies – which bring together learnings from adult developmental psychology and our collective work and research with educators over more than two decades—will be helpful to you when supporting adults with different ways of knowing in your own feedback contexts, as they have been in professional learning initiatives in K-12 schools, districts, university/leadership preparation programs, PLCs, leadership institutes, and mentoring and coaching relationships. Given the urgent practical and moral imperatives in our classrooms, schools, and society – as well as the well-documented challenges of preparing educators to support a diverse (in every way) student body (Milner, 2010; Nieto, 2010) – authentic and effective feedback has never been more needed or more necessary. We have found that building a growth-oriented, developmental culture of feedback can help aspiring and practicing educators develop the internal capacities needed to take a greater perspective on themselves, others, and the system; support each other and their students in new and beautiful ways; and venture forward courageously with their vital feedback and collaborations. Promisingly, all of this enhances and strengthens the professional capital – and magic – we create with and for one another.

Note
1. We present the story of Denise and Sylvia (pseudonyms) as a representative, composite example that draws together details from our ongoing research and work with educators.

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Further reading


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Transforming school culture through inquiry-driven learning and iPads

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Abstract
Purpose – The purpose of this paper is to provide an overview of a commissioned research study that analyzed a schooling initiative with the ambitious goal of transforming learning environments across the district by advancing innovative, inquiry-driven pedagogical practices combined with 1:1 iPad distribution. The paper explores impacts of the initiative on pedagogical innovation, twenty-first century learning, and related impacts on professional learning, collaboration, and culture change in the pilot schools analyzed in the study.

Design/methodology/approach – A multi-dimensional case study approach was used to analyze how the initiative was implemented, and to what extent teaching, learning, and professional cultures were transformed, based on action plan inputs and “change drivers”. Research methods included structured, open-ended interviews conducted with randomly selected teachers and key informants in leadership roles, focus groups held with students, as well as analysis of policy documents, student work samples, and other data sources.

Findings – The authors found evidence of a synergistic relationship between innovations in inquiry-driven pedagogy and professional learning cultures, with evidence of increased collaboration, deepened engagement and persistence, and a climate of collegiality and risk-taking at both classroom and organizational levels. Based on initiative inputs, the authors found that innovations in collaborative technology/pedagogy practices in classrooms paralleled similar innovations and transformations in professional learning cultures and capacity-building networks.

Practical implications – This initiative analyzed in this paper provides a case study in large-scale system change, offering a compelling model for transformative policies and initiatives where interwoven innovations in pedagogy and technology mobilization are supported by multiple drivers for formal and informal professional learning/development and networked collaboration. Challenges and recommendations are highlighted in the concluding discussion.

Originality/value – The transformative initiative analyzed in this paper provides a very timely case-model for innovations in twenty-first century learning and, specifically, for enacting and sustaining large-scale system change where inquiry-driven learning and technology tools are being mobilized to support “deep learning”, “new learning partnerships”, and multilevel transformations in professional learning (Fullan and Donnelly, 2013). This research advances scholarly work in the areas of twenty-first century learning, identifying relationships between technology/pedagogy innovation and professional capital building (Hargreaves and Fullan, 2012).

Keywords Professional learning, Collaboration, Professional capital, Whole system transformation, Technology innovation, Inquiry-based learning, Pedagogical innovation

Paper type Research paper

Recent educational literature asserts that traditional forms of education designed to meet late twentieth century purposes are no longer adequate to the opportunities and challenges facing twenty-first century learners – particularly in relation to changing practices in the domains of communication, work, citizenship, and cultural participation (Cope and Kalantzis, 2009; Fullan and Donnelly, 2013). Threads linking this literature include descriptions of dramatically-transformed sociotechnical landscapes that require schools to adapt to a wide array of digital tools, and to respond strategically to changing forms of literacy and learning today, as well as respond to the increasing cultural and linguistic diversity characterizing contemporary societies (Lotherington and Jenson, 2011). Terms like “knowledge economy” and “creative...
economy” (Peters and Araya, 2010) are frequently invoked to identify not simply new forms of economic value, but emerging knowledge-making practices and new forms of collaborative, creative cultural design: these are the powerful dispositions and competencies required for learners to flourish in the twenty-first century. At the same time, social justice matters are interwoven within these changing landscapes, as twenty-first century literacies are becoming, increasingly, new axes of inequality and social differentiation. And while powerful twenty-first century competences are central to individual and collective success in globalized economies, they are also the very tools for critiquing and transforming the structures and systems that students may find themselves within (Cope and Kalantzis, 2009). As other theorists (Luke et al., 2017; Thumlert, 2015) remind us, ecological, social justice, and ethical exigencies, today, require us to rethink education not as a developmental system that gradually “prepares” student for later life, but as a dynamic vehicle for situating learners in agentive roles in the present, where students are (re)understood as actors capable of engaging real-world controversies and critical learning adventures using authentic tools in real-world contexts.

In response to these challenges, scholars have identified new pedagogies and deep learning forms, including models of collaborative, inquiry-driven learning responsive to new tools and emerging media ecologies (Dede, 2014; Fullan and Langworthy, 2014), as well as rich learning tasks “connected” to networked communities of practice proliferating outside of schools (Ito et al., 2013). Still, in an era when proponents of educational innovation are advancing digitally-mediated learning environments supportive of new pedagogies where knowledge construction is central, standardizing accountability mandates may continue to work, antagonistically, to undercut the potential of these novel technology/pedagogy models, even as student disengagement within schools becomes a matter of increasing concern (Jenson et al., 2016; Hébert, 2015). In this context, Chris Dede (2015) suggests that “the most dangerous experiment we can perform is to keep our current systems of schooling in place.”

In this paper, we examine an ambitious attempt to challenge “current systems of schooling,” with the aim of fundamentally transforming teaching and learning through a holistic, multilateral, and evidence-based approach to district-wide system change. Specifically, we provide snapshots from a commissioned research study that analyzed the first two-years of a board-wide schooling initiative in Ontario: an initiative with the ambitious goal of transforming learning environments and professional cultures across the district by connecting innovative pedagogical practices with innovative tool use.

Unlike educational reform pushing “technology integration” as a single driver to enhance existing forms of instruction, this large-scale initiative activated multiple drivers to support transformative change in pilot schools, including: personalized 1:1 technology integration in combination with inquiry-based learning (IBL), support for professional learning/development, and “new leadership” strategies that invited teacher agency and collaboration as an enabler for building professional capital and new learning cultures (Hargreaves and Fullan, 2012). Key pedagogical aims of the initiative, outlined in the action plan, were to support deep learning pedagogies, student knowledge creation, and twenty-first century digital competences, so as to ensure all students meet the challenges of rapidly changing environments outside of school (Action Plan, 2014[1]).

As an effort to enact transformative change, focusing on multiple institutional variables simultaneously and multilaterally, this initiative provides a case study for other transformative initiatives where technical innovation is interwoven with innovations in pedagogy. In what follows, we critically explore how, and to what extent, transformative technology/pedagogy practices were communicated and positioned for scaling and sustainability. As a study in system change, we hope our analysis can feed-forward to support further innovations in policy. Equally importantly, how might lessons from this innovative initiative help us forestall the eventual erosion of transformed practices?
Positioning our study: transformative ecologies

Scholars working in the area of technology and education have, over the past decades, pointed out that technology-based reform initiatives often position digital technologies as “additive” resources or “objective,” “neutral” tools that can accelerate and enhance instructional practices (de Castell et al., 2002; Dawson and Heinecke, 2004). The logic of enhancement informing such initiatives may thus take for granted extant curricular suppositions, teaching roles, and the very “technologies of practice” that script how actual material tools/technologies are used, and to what ends (Nordkvelle, 2004; Thumlert et al., 2015). As Christensen et al. (2008) have popularized this discussion, digital innovations are frequently incorporated as “sustaining technologies” which are organizationally adapted to streamline prevailing methods without challenging inherited aims and routines, standardized role-functions among actors, or governing assessment models. Such technology-based reform innovations may, paradoxically, contribute to reproducing traditional educational forms.

By contrast, many scholars have challenged the view that transformative uses of technology can take hold in schools without coordinated efforts to support innovative pedagogies, professional learning, and wider ecological changes in school culture (Owston, 2007; Fullan and Donnelly, 2013; Hargreaves and Fullan, 2013). As Toohey and Dagenais (2015) assert, meaningful transformation involves addressing the sociotechnical “assemblages” and conditions that reproduce accepted realities in schools or, alternately, become affordances of change: drivers that stage novel configurations of practice – from innovative policies and narratives about teaching and learning to their embodiment in everyday teaching practices and professional learning cultures (along with new orientations to technology tools, and the different learning practices and assessments that emerge, or become conceivable, under transformed conditions). By implication, large-scale efforts to transform schooling systems need attend to the same complex “assemblages” that condition beliefs and realities in schools. If the “drivers” of system reproduction are ecological and holistic, embodied and encultured, then so need be the drivers and affordances of system change.

Helpfully, scholars focusing on system transformation in schools have noted that the command-and-control forms of administration characterizing twentieth century schools are shifting toward more heterarchical leadership models (Peters and Araya, 2010; Kontopoulos, 1993) – models that encourage networked professional learning, collaborative teacher inquiry, and the agentive dispositions necessary for teachers to take risks and share responsibility in reshaping their own professional cultures (Hargreaves and O’Connor, 2017; Hargreaves and Fullan, 2012; Donohoo, 2017; Hattie, 2015; Fullan and Donnelly, 2013). Here, Zeichner (2002) and Drew et al. (2016) suggest that “successful innovation” in schools requires a “culture of inquiry” that permeates not just classroom learning, but professional learning as well: a culture that recognizes “teachers’ voices” and their creative capacities as active partners in system change. Indeed, as research has shown (Fullan and Langworthy, 2014; Drew et al., 2016), conditions for sustainable innovation are enacted when professional inquiry and professional learning are enacted as part of an ongoing, collaborative feedback cycle.

At the same time, Fullan and Langworthy (2014) also point out that the “contexts outside of schools” are, today, more compatible with “the confluence of new pedagogies (new partnerships, deep learning tasks, and pervasive digital resources)” (p. 49). In these networked settings, traditional “instructionist modes” of pedagogy critiqued decades ago by Papert and Harel (1991) and the New London Group (1996) are being increasingly challenged by educational policies responsive to sociotechnical shifts outside of schools, as well as by innovative technology-supported pedagogies that position actors, within schools, as authentic knowledge makers.
Study context and research questions

It is in these shifting contexts that we situate our study, conducted during the second half of the 2015-2016 school year. This paper provides an analysis of the first phases of a five-year initiative, one with the ambitious goal of transforming learning across the district by integrating new pedagogical practices (IBL) with innovative technology use, including 1:1 iPad distribution. The focus of our research was a family of seven pilot schools which were in the second full year of initiative implementation (grades 4 through 8). The schools were located in an urban area of the district characterized by low average incomes, a high percentage of single-parent families, high unemployment levels, a high proportion of residents with low educational levels, and relatively low home ownership rates. Our goals were to examine early impacts of the initiative on transforming teaching practices and deepening student learning through inquiry-driven practices organically interwoven with digital tool use and twenty-first century competences (AP). While 1:1 iPad mobilization and technology infrastructure played a central part in the initiative action plan, it was clear that pedagogical transformation was the cornerstone of the initiative, informed by the view that significant innovation can only happen when new structures are holistically established (AP; Canuel, 2013).

The initiative’s theory of action was informed by the work of Ontario educational scholars like Michael Fullan and Ontario Ministry of Education (2013) documents advancing personalized, student-directed, IBL. To contextualize our analysis below, the theory of action instantiated or translated many aspects of Fullan and Langworthy’s (2014) and Fullan and Donnelly’s (2013) work on deep learning (rich tasks, new pedagogical capacities and learning partnerships, the “Six Cs,” and multilevel change theory).

Research questions

We developed a research model based on the board’s theory of action (AP). Our research model focused on the relationship between five enablers of change, including: support for professional learning/development and culture change, professional support for administrators, digital hardware and software for classrooms, technical support for schools and teachers, and funding from the board and Ontario Ministry of Education actors. Specific research questions focused on if, how, and to what extent the implementation of the action plan, IBL and the infusion of technology through 1:1 iPad distribution was effective in enacting initiative goals.

In our original report, we reviewed existing literature and empirical research relating to initiative rationale: in particular, we reviewed research on different forms of IBL and one-to-one technology use in schools. Our literature review, interviews with key actors and leadership staff, and analyses of the action plan and related policy documents indicated that the school board had developed an initiative that was supported by the research and literature, including Ministry documents. Extensive research within and outside of Ontario and Canada suggests that IBL, supported by 1:1 technology tools, provides an excellent footing for supporting twenty-first century competences. However, there is the need to ensure that there is fidelity of implementation when inquiry-driven pedagogies are put into practice, and that technology tools are used in innovative ways that encourage deep learning and knowledge construction, and are not being used to merely reproduce standardized instructional forms.

Our research questions were organized by their domains of action in relation to holistic school change: the school/leadership level, the teacher level, and the student level, though we ultimately found these categories to be interactive and mutually-imbricated in terms of telescoping initiative goals.

System level questions

How did key leaders and principals promote a culture where actors at all levels of the board could begin to form new learning partnerships (Fullan and Langworthy, 2014) and begin to take agentive roles in implementing and furthering initiative aims?
Teacher level
To what extent did teachers adopt the action plan and transform their pedagogies, becoming designers and “activators” of deep learning as well as “change agents” (AP; Fullan and Donnelly, 2013; Hattie, 2009)? In particular, how and to what extent did teachers promote deep learning and collaboratively participate in building a new learning culture (AP)?

Student level questions
What evidence was present of transformed learning environments, new teacher/student partnerships (Fullan and Langworthy, 2014), and rich inquiry-driven tasks supporting fluency with twenty-first century tools and competences; and what evidence was there of increased student engagement, persistence, and deeper learning?

Given the scale of our original research report, and for the purposes of this paper, we will narrow the scope of our present discussion to the initial impact of the initiative on school culture, professional learning/development and professional capital building (Hargreaves and Fullan, 2012), with related evidence of impacts on teaching and learning practices using IBL and iPads. Detailed analysis of administrative drivers, funding/external institutional supports, and initiative “roll-out” will be examined elsewhere. Analyses of student work samples will be referenced, below, only in relation to evidence of transformed learning cultures, pedagogical innovation, and related challenges and recommendations.

Research methodology
We investigated our research questions using case study methodology. This approach to inquiry addresses both descriptive and explanatory questions, and the rich data it generates makes possible a detailed, nuanced, and well-contextualized understanding of how and why a program works in a particular setting (Yin, 2006). Multiple data sources were chosen to provide converging lines of evidence that triangulate in order to make our findings as robust as possible (Patton, 1990). These sources included teacher and key informant interviews, student focus groups, teacher and student surveys, publicly-available policy and planning documents, and student work products and artifacts. Our data collection was integrated with that undertaken by the school district as part of their own ongoing research and monitoring of the initiative. This had a significant impact on the extent and types of data we were able to collect. The impact is discussed next in the description of the procedures followed for each group of participants.

Participants
Teachers. In total, 14 teachers from six of the seven schools were interviewed on site. The teachers interviewed were selected randomly using a stratified sampling procedure to ensure that two teachers from each of the five grades (grades 4-8) were part of the sample. The two remaining teachers interviewed had no specific grade teaching responsibilities: a special education teacher who worked in other teachers’ classrooms and also withdrew students for special instruction; and a champion/resource teacher who collaborated with and coached other teachers around IBL and iPad applications to teaching, and provided digital citizenship and research skills instruction. All but two of the teachers were in their second full year of being in classrooms with a complete set of iPads; and all but two had been teaching for seven or more years. Nearly all had spent half or more of their teaching careers at their current school.

Semi-structured interviews probed all aspects of teachers’ use of IBL pedagogy through the phases of students’ inquiry work, from project initiation to student presentations and summative evaluations. They also addressed teachers’ observations of students’ work practices in inquiry learning, and its impacts of student engagement, persistence, knowledge building, and twenty-first century skills development. Teachers’ perspectives on the role, value, and affordances of iPad technology in IBL and other forms of learning,
how iPads were employed in their classrooms, and their effect on student learning practices, twenty-first century skills development, and learning outcomes were also examined in depth. Teachers were also asked about if and how IBL and 1:1 technology infusion had augmented or transformed their pedagogical practices and professional growth. Perceptions of the educational advantages and the limitations of IBL and iPad integration were taken up, and their professional learning experiences supporting initiative goals explored. All interviews were recorded and transcribed for subsequent analysis.

Additional data about teacher attitudes and perspectives on IBL and iPad integration and related professional development were gathered from an online survey of teachers that the school district conducts on an annual basis. Only the data from the 39 respondents teaching in 1:1 classrooms in grades 4-8 in the seven schools studied were considered. The survey questions largely consisted of Likert-scaled items, with a few having open-ended answer options. We had initially planned to conduct our own teacher survey but this was not permitted by the school board. We were allowed to submit additional questions for the district survey, and some of them were accepted. These addressed teacher attitudes about having iPads in their classrooms; the learning purposes and formats digital tools were applied to; and professional development activities and opportunities and support for iPad use.

**Key informants.** While we were not permitted to conduct our own interviews of program leaders and district and school administrators about the initiative (with one exception), a few additional questions we proposed were added to the protocol for an annual interview conducted by district researchers of those deemed "key informants" on the initiative. The five key informants interviewed included three principals from the seven schools, a senior consultant responsible for project implementation, and the superintendent responsible for the family of schools which included our seven sites. These open-ended semi-structured interviews were provided to us in anonymized form and we had them transcribed. The key informants were asked what they considered to be the major successes and challenges of the initiative over the past year; their understanding of the theory of action; changes seen in instructional practices; strategies used by teachers to integrate technology into their classrooms; changes in student learning; and the nature and extent of professional learning activities and capacity building over the year. In order to obtain more details on the specifics of the project action plan and implementation policies, an additional telephone interview of the executive superintendent with overall responsibility for the project was conducted by two evaluation team members. This interview was also recorded and transcribed.

**Students.** As mentioned above, a discussion of the findings on student outcomes is beyond the scope of this paper. Nevertheless, a brief overview of the procedures followed to collect student data is pertinent. A total of 44 students from 11 grade 4-8 classes in six of the schools participated in focus groups led by a member of the research team and consisting of four participants in each. We obtained student responses to the district’s annual online student survey that was administered in late spring 2016. Student work samples collected from the classes of the teachers interviewed were collected and subjected to both a narrative and a holistic analysis. These were obtained at the end of the school year; teachers were asked to submit samples of long-term (i.e. longer than one week) student inquiry products or learning demonstrations such as a presentation or other artifact.

**Document collection**

Relevant publically-available documents related to the initiative were collected, coded, and analyzed. Documents included the district action plan for the project, school board minutes, project reports, policy documents, memos, and various papers describing the project from early stages of implementation. Government policy documents that were referenced in project reports were also reviewed.
Work samples analysis

Samples of student project work were collected. Teachers were asked only to submit student work that was based on projects that lasted a week or more. The work consisted of written reports and multimedia presentations. Work was coded using criteria developed by SRI International (www.itlresearch.com/research-a-reports/2011-itl-research-design-and-methods) to specifically assess student work products for evidence of twenty-first century learning competences. Coding was carried out by a team of three teachers from a different school board who were trained by the principle investigator. Training continued until the teachers had close to 100 percent inter-rater reliability. All teachers coded all of the samples and average scores of the three ratings were used.

Qualitative data analysis

All qualitative data were analyzed using constant comparative procedures (Strauss and Corbin, 1990) aided by the qualitative analysis software program, NVivo. The process involved reading and re-reading the transcripts and documents and coding relevant themes that emerged. As the coding continued, new codes were added and some were merged. The process continued until all coding categories were saturated. At this point summaries were written of the categories upon which the final write-up was based.

Findings: enacting ecological transformations

We begin with findings relating to professional learning and transformations in school culture. We then explore findings on the initiative’s impacts on transforming pedagogy/technology and assessment practices; on new learning partnerships, student engagement, and twenty-first century competences; following this we address how 1:1 iPads and pedagogical innovations supported a culture of inclusivity and participation.

Competency drivers: professional learning/development and culture change

In a comprehensive analysis of 59 cases studies, Owston (2007) identified “essential conditions” for sustaining large-scale innovations. These conditions included teacher and student enthusiasm for initiatives, strong support for teacher professional development/learning, and active support of initiatives by principals. Owston’s conclusions are shared by Coburn (2003) and Dede (2016), who further state that in order to sustain/scale transformative initiatives, they must result in deep and lasting change in culture: the beliefs, norms, and valued principles of the initiative need be established across many schools; and ownership of the initiative must shift from central board authority to schools and teachers. Fullan and Donnelly (2013) add that continuous formal professional learning – with specific goals to ensure change – need be organized and embedded in practice; and there must be follow-up professional learning/development supportive of a culture of learning characterized by collegiality, sharing, and risk-taking.

These essential conditions for change in fact aligned well with the action plan’s fundamental strategic inputs, and in our findings, all of these conditions were largely in play or emergent. Here, as a discursive device (Latour, 2005), the initiative’s action plan was clear and rhetorically compelling in articulating vision and rationale in direct relation to twenty-first century learning aims and purposes.

Using data from policy documents, interviews with key actors and teachers, and teacher surveys, we identified a constellation of “competency drivers” (Fixsen, Blase, Naoom, and Duda, 2015) – the professional learning opportunities and policies – that were implemented to support changes in professional learning and the uptake of new technology/pedagogy practices. From these sources, we mapped a rich variety of formal professional learning
opportunities; we also identified a very healthy climate for informal, ad hoc collegial sharing, supported by new technology networks.

Specifically, the formal professional development supports and strategies identified in our findings below are, in the literature, generally regarded as best practices for teacher development, and included PA day events; school-organized professional learning activities; lunch-and-learn sessions; formal collaboration with external partners and twenty-first century learning experts; and discussion/debriefing at staff meetings and other knowledge-sharing opportunities. Initiative-focused conferences and workshops were also organized, dedicated to modeling and sharing IBL and/or iPad best practices and resources. Embedded coaching by initiative champions and mentoring by twenty-first century learning experts were also distinguishing features of the initiative: here, teachers identified embedded mentoring and continuous coaching as very valuable for ongoing professional learning.

Additionally, instances of Ed Camps, run for teachers on PA days, allowed teachers to collaborate extensively in breakout groups, with the support of twenty-first century learning mentors. These events were very well received by teachers. As one teacher reported: “It’s fabulous because [these events allow] someone who really understands the inquiry model and technology to be a part of a conversation and provide insights. It also allows someone who doesn’t [yet understand] to be able to learn from that, but without any particular person being deemed the expert in the center of that conversation.”

Internal conferences and workshops also proved valuable for teachers who found it beneficial to hear other colleagues present concrete examples of how iPads were being activated in content areas. Other workshops organized by the board (e.g. Digital Media through the Arts) demonstrated applied use of multimodal iPad tools in content areas, and were lauded by teachers. Said one teacher: “[The workshop] gets you thinking about how to engage the kids in your subject matter, but through an arts umbrella and it could be anything, music, drama and dance […] it’s fantastic.”

The board’s action plan recognized the basic principles of contemporary literature on professional learning. Wei et al. (2009) summarize these, stating that professional learning should be intensive, ongoing, and connected to practice; should focus on student learning and address specific content aims (in IBL, this also means supporting students to make deep connections with “vital ideas” in the curriculum); and building strong collaborative relationships among teachers.

Indeed, there was broad agreement that new network tools (Google Drive, Google Classroom, Apple TV) had made collaborating with colleagues and external experts much easier. Though teachers generally shied away from using the board’s official social media tool, we found ample evidence of teachers mobilizing social media like Twitter to establish their own informal learning communities. As part of this networked professional learning ecology, some teachers also used social media, YouTube, and their own blogs to showcase student works (e.g. culminating inquiry products, student-produced videos, and so on). One teacher who had presented at a district-wide initiative conference developed a “personal learning circle” using Twitter, and reported that “within a month I’d been able to build a professional learning community of at least 15 reliable peers.”

While teachers reported a very favorable climate in their schools surrounding the initiative in terms of professional learning/development, teachers unanimously desired more formal professional learning focusing directly on IBL and iPads, and specifically on how to better mobilize new technologies in relation to IBL in their content areas, so as to “realize the full potential” of these new pedagogical capacities.

Beyond formal professional learning, there was strong evidence of teachers forging collaborative connections with other teachers, or enlisting the support of champions, to build and circulate professional capital (Hargreaves and Fullan, 2012), to seek out and share models and resources (e.g. teacher book clubs focusing on IBL; informal app sharing;
showcasing student-projects through social media), and move initiative aims forward. Initiative champions and embedded coaches were valuable in helping teachers make the transition from traditional instructional methods to IBL. Initiative champions themselves reported that they were not simply teaching teachers, but were actively engaged in ongoing professional development and academic conferences, and then modeling new opportunities like “maker spaces” and coding literacies.

These examples of self-directed professional learning articulate Hargreaves and Fullan’s (2013) concept of professional capital, which advances that more than “human capital” – knowledge, skills, practical know-how – are required to mobilize deep changes in systems. Innovations need be further abetted and amplified by forms of social and decisional capital: continuous practices of learning, inquiry and communication where teachers assume roles as researchers, connecting local, formative feedback to emerging opportunities and new models, and where new knowledge/resources are circulated within the community.

If human capital refers to the given stock of practitioner knowledge and skills, these other dimensions of professional capital (social and decisional) are vehicles for enacting ongoing change, for making informed judgments/critical decisions within shifting contexts, and for building wider cultures of learning, communication, and expertise. In these contexts, teachers analyze evidence of student learning, modify pedagogies, and create a multilevel culture of learning where these dimensions of capital building and professional learning/development operate organically to reciprocally transform professional learning cultures.

Clear evidence of professional capital building was present in the first years of project implementation, and it encouraged deeper relationships between formal professional learning/development and informal networks supportive of the emergent collaborative learning cultures. Significantly, as we will explore in following sections, we found indications of a synergistic relationship where student inquiry and collaborative knowledge-making in classrooms was just one domain, or relay, in a wider emergent culture of learning permeating the entire pilot-school ecology.

Indeed, for most of the teachers interviewed, collaboration with colleagues was of critical importance in developing new pedagogical capacities and learning cultures: as one teacher stated:

You have to collaborate when doing [the initiative]. You have to. You can’t be an expert on everything and you certainly can’t be an expert on [every aspect of] technology. So, it naturally forces you to say, “Hey, what app are you using in science? How would this work for me in geography? Or how can I take Explain Everything but use it differently?

In interviews and surveys, it was found that the desire for new knowledge/models led most teachers to markedly increase their degree of collaboration with peers relative to past practices. One school principal observed that teachers who previously felt they had little to offer felt they had more to share after developing knowledge and skill with iPads and IBL, and with a common goal in place, there was more collegial participation and sharing among teachers.

Finally, Owston (2007) found that principal advocacy was a distinguishing feature in the most innovative districts – and an essential condition if innovative initiatives are to be sustained. In interviews with principals and teachers, it was clear that this condition for initiative uptake and sustainability was met: strong principal support was reported in all pilot schools – with related efforts by local administrators to “lead from the middle” (Hargreaves and Ainscow, 2015). Not only did we find evidence that principals in pilot schools championed the initiative, they were also able to shape the direction of new pedagogy/technology practices alongside teachers. Many teachers described how their principals and vice-principals provided them time to research and communicate ideas with colleagues, how they supported risk-taking, and teachers noted that principals were actively engaged in their own professional learning throughout the year.
It was clear from teacher interviews that principals were highly supportive of teachers taking collaborative “change agent” roles in co-implementing the initiative, and creating “new learning partnerships” with students and other teachers.

Impacts of inquiry-driven learning: transformed roles and practices
We utilized data from multiple interview sources (teachers, administrators, champions, and student focus groups) as well as teacher and student surveys to inform our analysis of IBL implementation and related use of technology tools, addressing the possible effects and outcomes in classroom practice, as well as impacts on learning cultures in pilot schools.

In assessing the adoption of IBL, we examined if IBL was being implemented in ways that remained true to best practices described in the literature. In examining fidelity of implementation, we wanted to determine not only if IBL was being utilized, but to what extent it was being adopted in optimal forms of practice – forms that might realize the potential of IBL not simply to engage students, but to support students’ capacities to engage living research questions and controversies, maximize knowledge-making and self-efficacy, as well as support continuous reflection upon inquiry methods and processes (Friesen and Scott, 2013).

Teachers indicated that the conjunction of 1:1 iPads and IBL induced a general, if sometimes gradual, shift away from more traditional forms of direct instruction – due not only to innovations in pedagogy, but also due to the affordances and capabilities of new media. Technology/pedagogy innovations were seen to activate more student-directed, collaborative and project-based learning, and teachers indicated that they themselves were assuming new identities as co-learners while moving away from traditional roles as conduits of predetermined content knowledge. At the same time, teachers perceived, and were thrilled to perceive, students assuming new roles as knowledge makers, becoming “teachers” and “experts” themselves (e.g. when presenting research or culminating IBL projects to peers or wider audiences). Almost every teacher reported that students were taking leadership roles in teaching teachers and peers how to utilize, or maximize, iPad applications.

When teachers were asked how their teaching practices had shifted with the use of new technology/pedagogy practices, and what changes they made in their conceptions of teaching as a result of their experiences, they most often talked about the process of relinquishing control and letting students take roles as collaborative knowledge makers “responsible for their own learning”. Saliently, one teacher enthusiastically stated: “I love teaching what I don’t know.” This statement, and others like it found in our data, indicated that new epistemological relations were emerging in learning communities. And while some teachers indicated varying degrees of (dis)comfort in giving up “control,” almost all had to some extent embraced new epistemological suppositions and were enacting “new learning partnerships” (Fullan and Langworthy, 2014) with students. These learning partnerships were validated when teachers observed how students were taking creative ownership of their learning: as one teacher affirmed, “you have to let a 12 year old be the expert in that moment and you have to be the one willing to learn.”

Nevertheless, some teachers indicated that students – at least initially – required modeling, guidance or direct instructional intervention, particularly in relation to IBL methods: e.g., how to formulate “good research questions”; how to critically evaluate web-based resources; how to “dig deeper”; how to plan, organize, and analyze; and how to “think for themselves” or “take initiative” in settings requiring students to shift into more autonomous roles.

In changing contexts, teachers were also able to identify tensions between the initiative’s new aims and values and the more regulative practices or priorities of traditional schooling which continued to hail them. For example, some teachers identified concerns about: struggling with the need to “cover curriculum”; seeing IBL as a difficult “fit” for math; the need to suspend inquiry-driven learning when preparing students for provincial accountability tests; as well as (in rarer cases), situations where students themselves, habituated to more passive forms of
instruction, signaled uncertainty regarding inquiry-driven practices. We suggest that these kinds of tensions be confronted, in professional development/learning contexts, and collaboratively worked through, lest they attenuate efforts to sustain innovations.

While incongruities like these were sometimes identified as obstacles, importantly, in teacher interviews, almost every teacher had adopted the discourse of the action plan, its language of change. Even when some teachers signaled concerns surrounding shifting roles and priorities, they were still fluently speaking within and through the initiative’s language of transformation, inquiry, and collaboration. We found this formation of a shared discourse community to be a significant indicator that cultural transformations were indeed taking place, and that new professional identities were emerging. Here, the embodiment of changing “discourse practices” (Gee, 1996) and the creation of a common discourse community might be viewed as an important condition for sustainable changes in professional cultures (Jenson et al., 2010).

Engagement and persistence through knowledge-making
Evidence of new learning partnership, new pedagogical capacities, and transformed learning outcomes (AP, Fullan and Langworthy, 2014) were often inextricable from teacher and student reports on engagement and increased agency. Almost every teacher saw the greatest advantage of innovative technology/pedagogy practices as lying in the richer tasks undertaken and the heightened engagement they generated, which fostered persistence in the face of challenges as well as greater initiative on the part of learners. When IBL practices were in play, almost every teacher interviewed indicated increased engagement (by contrast with traditional instruction methods), with many teachers signaling that engagement was “very high” or even “off the charts” (this held true for both high-performing students and students who typically struggled). Several teacher comments illustrate this:

- You could hear a pin drop sometimes when they're researching and to kind of poke yourself in there and interrupt them is not conducive to their thinking. I find that they're so focused when they're researching something, I don't have anybody this year who is off track.
- I can't tell you enough about the enthusiasm that they have and the focus that they have and just I really don't ever see anybody look bored or off track when it's inquiry based.
- So instead of finding an answer and being done, they're learning that there's more to be found out, and to stick with it.

Interwoven with heightened engagement was an accompanying expansion of students’ sense of investment in learning as they were afforded greater latitude to codirect their own courses of inquiry. By a large margin, students also preferred engaging in inquiry projects: they found IBL projects were “more involving,” “more interesting,” “more challenging,” and were connected with “problems in the world.”

Indeed, engagement was reported to be very strong when students were researching “problems in the world.” Almost two-thirds of inquiry projects invited students to address contemporary social issues at either a local or global level. Several focused on broad environmental issues such as pollution, species extinction, and global warming; a few were concerned with local social issues like indigenous activism and reconciliation. In one class, students were invited to identify social justice issues in their community or country, to research solutions, and then undertake some form of community action to address the matter politically. These kinds of projects – with corresponding reports of deepened engagement – provided evidence of student investment in learning practices where knowledge-making was situated in relation to authentic “matters of concern” (Latour, 2005; Ratto, 2011).
Teachers and students were also using network tools to research and share knowledge (on blogs or social media), as well as connect with other schools in North America to share perspectives and dialogue in real-time, or to bring external experts to the classroom. Further, having authentic audiences was part of new dynamic that charged rich tasks with value: students responded very positively when given opportunities to publish their work for external audiences. One teacher commented that the elation generated when some of his students had their videos posted on his YouTube channel was “like Christmas day [...] students loved the responses they got, and wanted to post more.”

In surveys and interviews, most teachers felt that the majority of their students, when engaged in IBL, developed richer understandings of the topics they researched than they would have under more conventional conditions. Teachers reported that students learned more deeply when involved in inquiry-driven projects, and that technology-mediated IBL provided opportunities for students to create knowledge and demonstrate more sophisticated competences than through standardized assessments. As one teacher reported: “[Students] feel as though they own their learnings and that is a strength that they’ve now developed for themselves. I think that is one of the biggest strengths [of the initiative].”

iPads, collaborative learning, and new assessment forms
In the data, reported increases in learning and engagement in IBL contexts were often inextricable from iPad use, and new ways of mobilizing technologies. Teachers reported that iPads, as research vehicles and creative tools, contributed to increased engagement/enthusiasm and provided opportunities for students to enact multiple digital literacies in situ.

Students, too, strongly favored the creation of dynamic multimedia artifacts over text reports or posterboard presentations. While teachers permitted students to utilize non-digital media to demonstrate learning, many chose to use multimodal tools/literacies to represent knowledge or create alternative means of applying learning: the most commonly referenced apps included production-based tools like Explain Everything, iMovie, iBook-making software, multimodal slide decks (sometimes converted to video essays with voiceover or music soundtracks), with some use of games, simulations, and modeling tools (e.g., Minecraft). iPads were sometimes used as an imaginative medium for digital storytelling and artwork creation, as well as to facilitate multimodal artifact creation in interdisciplinary projects.

As evidence of a more heterarchical culture of learning, it was evident in interviews and in the student samples analyzed that students were very often invited to be active contributors to their own formative and summative “success criteria,” indicating a shift away from the rigid, externally-imposed rubrics associated with standardized assessments. Jenson et al. (2016) have argued that, “if assessment systems largely prefigure what learning looks like, what is measurable, and therefore what is pedagogically possible, then transformations in learning environments must arrive with equally innovative assessment tools” (p. 21). Here, expressing new assessment practices, students were in the majority of classes taking roles as co-designers of their own outcomes, participating in developing formative “success criteria” (sometimes embedded in multimedia project themselves), and critically shaping project expectations (as and for learning). Upon completion of projects, students critically co-assessed their work in partnership with teacher/s and peers. In interviews and in samples analyzed, it was clear that summative assessment forms were also being mobilized, formatively, to refine future inquiry iterations. New tools were seen to provide richer opportunities for teachers to make observational assessments on the fly, with tools like Sesame Snap and GoogleDocs used to dialogue with students about progress in all stages of the IBL cycle. This offered evidence that teachers were devising new systems of assessment that were congruent with transformed practices and learning cultures.
Consistent with Fullan and Langworthy’s (2014) conceptualization of new learning partnerships, once student artifacts were completed, they would almost always be presented to the whole class. Students would then take the “role of the expert” to present their varying inquiry topics, findings and conclusions, and peers would offer critique. It was clear in most teacher interviews that collaboration and formative dialogue permeated almost every phase of inquiry—a key feature of twenty-first century competences.

When reflecting upon IBL and iPad use, many teachers reported that they were pleasantly surprised by unexpected outcomes, particularly when students were using new media to collaborate on, produce, and share culminating projects. Appreciation of “unexpected” results indicated that the predicted behavioral outcomes associated with traditional instruction were being gradually supplanted by more dynamic and personalized learning (a central goal of the action plan). In this context, one teacher reported that the initiative was “helping her become the teacher she always wanted to be.” Another teacher, who was already using IBL, remarked that this was simply “good pedagogy.” Importantly, teachers who were found to be the most enthusiastic about student engagement and the transformed products of learning were often the teachers most likely to be involved in building professional capital. Excitement about what students were doing and making appeared to feed-forward to drive further teacher networking, inquiry, and informal professional learning. Significantly, we saw evidence of a recursive, interactive relationship between classroom innovation and a wider collaborative professional-learning culture.

**Affordances of inclusivity**

Almost all of the teachers reported that 1:1 iPad use increased inclusivity and broadened who could participate in learning and communicative practices. Limitations in spoken and written language no longer discouraged student communication as those with needs in these areas often used assistive technologies to overcome barriers and share their learning. During research phases of inquiry, students with language-learning difficulties were often steered to apps that enabled them to circumvent dependence upon print-literacies. iPad-based digital books/texts were also used to bridge language boundaries for ELL students through interactive affordances that plaited text, image, sound, and audio in multimodal ensembles (Jewitt, 2008). In nearly every classroom, students were given latitude to select the tools/modalities for representing learning and constructing culminating artifacts. Some teachers reported that this enabled a wider range of students, including those who may have formerly been excluded or assigned different work, to collaborate in whole-class learning processes, and this had an impact on their reported levels of engagement. IBL, too, was seen in some cases to support inclusion: as one teacher reported: “It’s a huge advantage for knowledge development. We’ve got kids at different entry points with regards to their background knowledge and what they know, so kids having that freedom to go from wherever their own background knowledge is and explore from there is huge”.

In these findings, we see an enactment of Jenson’s *et al.* (2010) recommendation that “reform be built around the principles of inclusivity, equitable access, and the meaningful integration of ICT” (p. 19). Indeed, in relation to the district demographic data noted above (low income; a high percentage of residents with low post-secondary education), this initiative provides a compelling critical model for interrupting “the longstanding correlation between economic income and educational outcome” (de Castell, 2016), particularly for underserved communities, as these inclusive technology/pedagogy practices were supporting all learners with powerful twenty-first century competences.

Significantly, the initiative was increasing not just equitable access to digital tools/literacies, but also inviting wider collaborative relations for all actors within pilot schools. Just as teachers reported that student collaboration was flourishing under new conditions,

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it was evident from teacher interviews that informal professional collaboration and networked learning communities were also emerging, performatively mirroring the new pedagogies and learning partnerships being enacted in classrooms at the student level.

Discussion: opportunities and challenges
Research has shown that one condition for sustainable system change is eventuated when professional development/learning is embodied “as a holistic, ongoing formative feedback cycle with continuous collaboration at its center” (Fullan and Langworthy, 2014, p. 57). Based on our findings, we suggest, further, that pedagogical innovation and inquiry-driven work in classrooms – real changes in the practice of teaching and learning – can promulgate wider collaborative cultures, at every level of professional action. The very attributes of the pedagogical innovation, here, can become drivers of wider cultural shifts and transformed professional learning practices, led by inquiry-driven professional learning. In short, innovative pedagogies model dynamic forms of professional capital building (human, social, and decisional) which in turn, recursively, refine and extend opportunities for transformed classroom practices. If teachers reported that inquiry-driven technology/pedagogy practices, with knowledge-making at its core, fostered increased engagement, persistence, agency, and self-efficacy at the student level, then professional learning should be energized by the same supports and affordances.

By and large, we found compelling evidence of a synergistic relation between innovations in pedagogy and professional learning cultures, with evidence of increased collaborative actor agency – as well as increased engagement and a climate of risk-taking at all levels of pilot-school organization. At the same time, teachers were devising innovative assessment practices responsive to IBL and 1:1 iPad use, and innovations in pedagogy/technology practices were seen, overall, to promote richer, more inclusive applications of twenty-first century competences.

This is not to say that every actor in pilot schools uniformly embraced initiative aims: a small sample of teachers expressed some difficulties, especially during initial stages of implementation, with activating new tools and practices, or navigating tensions between new and old commitments. Also, among the teachers we interviewed, the extent and fidelity of IBL pedagogy implementation varied and, in our analysis, we found some evidence that deeper inquiry-driven learning was being mitigated by less adventurous, template-driven forms of IBL. This apparent templating of IBL tasks indicated that learning innovations were, in rarer cases, being neutralized and recuperated by traditional routines (with notably shallower results), especially when IBL processes were being translated into mechanical procedures for doing “web-searches” and reproducing propositional facts.

Here, we signal that one obstacle to transformative initiatives like the one reported here is a routinization of innovative pedagogy/technology practices. If deep learning forms are translated into mechanical processes, with more standardized assessments, professional learning, too, may become similarly attenuated. That is, if deep learning pedagogies are formularized, then professional capital building, as well as the excitement surrounding transformations, may also be enervated. In this context, healthy critical debate among practitioners on what system change might look like is preferable – and indeed valuable – by contrast with any formulaic ratification of new pedagogies.

To address this concern, we looked to those teachers in pilot schools who were, themselves, taking change-agent roles as researchers, and engaging the initiative as a collaborative, inquiry-driven enterprise (e.g. locating external models for practice while broadening their own capacities as teacher-researchers). In interviews, teachers clearly desired more professional support for optimizing inquiry-driven pedagogies, using iPads, and here we suggest that teachers might be supported to take roles as researchers, making linkages
between new pedagogies and their content areas, and communicating their findings across classrooms and schools. By “doing” inquiry themselves, teachers will be in a stronger position to apprentice more sophisticated forms of inquiry for students – as well as introduce other forms of inquiry and knowledge-making interventions, for example, action-research, arts-based research, and/or ethnographic community explorations where learners might take researcher roles, equipped with more powerful investigative instruments and methods.

Further, if teachers become more fluent in inquiry practices, they will be able to intervene more strategically when it comes to instruction (e.g. they will be able to identify when/where direct instructional interventions are necessary, when/where background content knowledge is required, and consequently how to support connection-making to between IBL and the curriculum, as well as support student metacognitive reflection upon the competences students have acquired).

In the context our study, the alignment of inquiry-driven student learning with teacher-directed professional inquiry is reflexively consistent with initiative aims (AP). Inquiry-driven professional research, supported by networked technology tools, may offer a strategic practice for ongoing professional development/learning, where administrators, teachers and students collaborate, as a community, in amplifying the opportunities of pedagogical innovations.

**Conclusion: sustaining and scaling transformative initiatives**

If the drivers of system reproduction are ecological, embodied and encultured, then so must be the affordances of system transformation, if innovations are to be sustained. Indeed, as many researchers assert, today, schooling systems will likely reproduce themselves as long as teaching conforms to standardized forms of content instruction and assessment, and students remain mere reproducers of static knowledge and compartmentalized skills. Owston (2007) adds that, for innovations to take hold, teachers need to not only adopt new practices, they also must “unlearn” legacy beliefs about teaching and learning (p. 70). In the twenty-first century, this means creating pedagogical conditions, supported by technology tools, that position learners as capable and connected makers of knowledge and culture – in new learning partnerships with teachers.

While we found, in our analysis, obstacles that attenuated innovation, we found ample evidence of a transformed culture of learning, an embrace of new discourses and innovative practices, and a widespread enthusiasm for the initiative and its vision. We should note, too, that the kinds of holistic transformations articulated in the action plan do not occur overnight, and challenges are to be expected, particularly in the short term, when 1:1 technology tools and innovative pedagogies are first being engaged. That said, we found a vital learning culture was emerging in the pilot schools, supported by enthusiastic principals, teachers and students, who in turn were transforming teaching and learning in ways that significantly advanced the initiative’s aims – even in its early stages.

Promisingly, our analysis indicated that students were indeed being positioned as knowledge co-creators – and teachers were similarly assuming new roles in building a dynamic professional learning culture. As a model for policy, what need be supported to sustain and scale initiatives like this one is this vibrant culture of professional capital building reported above: a culture that is actively supported by formal professional learning events and policies and, at the same time, is actively reenergizing itself through small-scale informal professional learning communities that build upon the excitement surrounding what students are imagining, making and doing. Finally, as with the best forms of inquiry-driven learning, transformative initiatives like this one, we feel, should be engaged not as a set of outcomes to be obtained, but enacted as an ongoing, creative process in which all actors in the ecology take part in collaboratively enriching initiatives they scale and circulate.
Note

References


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Abstract

Purpose – The purpose of this paper is to examine early career teachers’ Socialized Knowledge Communities (SKCs) as they relate to the pursuit of mathematics knowledge and teaching. The authors investigate Pinterest, a living data archive, as an opportunity to view teachers’ sense-making and construction of instructional resources. Through this lens, the authors examine how teachers form and share mathematical meaning individually and collectively through professional collaboration.

Design/methodology/approach – This work characterizes teachers’ curation of mathematical resources both in the kinds of mathematics teachers are choosing and the quality therein. Finally, the authors examine through epistemic network analysis how teachers are sense-making through a statistical approach to identifying their organization of mathematics curation by typology and cognitive process demand.

Findings – Results show that sampled teachers predominantly curate instructional resources that require students to perform standard algorithm and represent mathematics relationships in visualization within Pinterest. Additionally, the authors find the resources curated by teachers have lower cognitive demand. Finally, epistemic networks show teachers make connections among instructional resources with particular types as well as with different levels of cognitive demand as they sense-make their curated curriculum. In particular, difference in teachers’ internal consideration of the quality of tasks is associated with their years of experience.

Originality/value – Twenty-first century classrooms and teachers engage frequently in curation of instructional resources online. The work contributes to an emergent understanding of teachers’ professional engagement in virtual spaces by characterizing the instructional resources being accessed, shared, and diffused. Understanding the nature of the content permeating teachers’ SKCs is essential to increase teachers’ professional capital in the digital age.

Keywords Social capital, Social media, Mathematics resource curation, Socialized Knowledge Communities

Paper type Research paper

Introduction

In a digital age, social media has become part of teachers’ daily routines. Across the profession, technology is an ever-present component of individuals’ lives, bonding and bridging people and providing space for collaboration and networking. For schools,
technology presents great potential and great challenge, as students and teachers attempt to navigate twenty-first century teaching and learning in classrooms. This requires a unique skillset such that teachers must have subject matter knowledge, teaching knowledge, and the collaborative capacity to integrate instruction into a dynamic schooling context (Hargreaves and Fullan, 2012).

Social media, Web 2.0, and rapid technology submersion has changed the conceptualization of classrooms, learning, and teaching within and outside of the school day (Greenhow et al., 2009). Online, teachers may engage in discourse surrounding their profession in Socialized Knowledge Communities (SKCs) (Hu and Torphy, 2018). We conceptualize SKCs as a unique type of personal/professional learning community network within and around virtual spaces, connecting teachers' physical experiences to virtual engagement. Bridging cloud to class, we theorize SKCs as communities of teachers sharing information and resources as they direct the trajectory of their classrooms. This paper examines early career teachers' (ECTs) pursuit of mathematics knowledge and teaching in such communities. In particular, we investigate Pinterest, a living data archive, as an opportunity to view teachers' sense-making and construction of instructional resources. Pinterest is an image-based platform that allows users to pin pictures of things of interest or that they wish to save for future reference. Pinning a resource identifies something worth revisiting or sharing with others. Likewise, teachers' pinning signals their thinking on different aspects of teaching and intended curriculum. Teachers learn as they consider and reflect on their teaching practices, acquire and construct teaching knowledge (Cochran-Smith and Lytle, 1999), and refine their professional identity (Wenger, 1999). The heuristic processes teachers use online represent informal learning (Schugurensky, 2000) as teachers engage within Pinterest, primarily in self-directed and incidental ways. Self-directed, teachers may actively seek out information on teaching a particular topic or subject. Incidentally, teachers routinely checking social media may also encounter useful resources or information for their profession.

In this paper, we examine how teachers form and share resources and knowledge related to their teaching, individually and collectively, through professional collaboration. Within Pinterest, how teachers frame their curriculum and resources and organize these components across topic-based boards presents a unique window to view their conceptualization of mathematics instruction across time. In order to understand these digital dimensions of professional collaboration, our study asks the following research questions:

- **RQ1.** What do teachers share within Pinterest?
- **RQ2.** How do they make sense of curated curricula?

**Teachers' engagement in social media and virtual resource pools**

We situate our study within teachers' overarching social context as we examine their virtual engagement. In this section, we present state-of-the-field statistics on social media use to support our focus on Pinterest, rather than Twitter, Facebook, or other forms of social media. By demonstrating the scarcity of research on Pinterest, despite the fact that teachers frequently consult this platform for teaching and learning more than others, we present a gap in the literature on social media and education.

Social media is an exponentially growing space in which individuals may connect and build social capital. The scale and influence of those educational interactions within social media are unprecedented. A growing body of research on Twitter (e.g. #CommonCore; Cho, 2016; Gao et al., 2012; Krutka and Carpenter, 2016) and Facebook (e.g. Manca and Ranieri, 2013, 2016) has demonstrated the need to study social media, its participants and the effect of their dynamics on education. A case in point is the most recent
#CommonCore Project on Twitter by Supovitz et al. (2015, 2017). These researchers utilized the power of technology to examine a network of 220,000 educators and more than one million tweets regarding a national curriculum reform –Common Core State Standards (CCSS) over time. Researchers found that educational discourse online significantly shapes the landscape of educational policy, influencing policy implementation at the local and state level.

Teachers, as key players in the educational enterprise, both engage in social media to join policy discourse, as well as to access virtual resource pools – those spaces in which teachers may encounter an array of instructional resources and pedagogy (Torphy et al., 2017). In a national survey, RAND corporation found 87 percent of elementary teachers and 62 percent of secondary teachers report using Pinterest for accessing CCSS-aligned resources; similarly, 87 percent of elementary teachers and 52 percent of secondary teachers also report using Teachers Pay Teachers – a sort of educational eBay in which teachers may buy and sell professional resources and materials (Opfer et al., 2016). Though not a social media site itself, as a virtual resource pool, Teachers Pay Teachers is also frequently leveraged by teachers for resource access and sharing as it is often times linked to and from Pinterest. Other text-based platforms, such as Twitter and Facebook, did not make the list of top online sources consulted by teachers in this report, which suggests differentiated purposes in teachers’ professional interactions across platforms.

Our survey results from a large study of ECTs’ mathematics instruction echo RAND’s findings. We surveyed teachers’ uses of various social media (e.g. Pinterest, Facebook, and Twitter) and other virtual resource pools (e.g. Teachers Pay Teachers, Khan’s Academy), and found Pinterest is the most popular social media site for teachers’ mathematics teaching. Specifically, 77 percent of our 90 sampled teachers use Pinterest at least once a month, and 57 percent of them use Pinterest at least once a week for professional purposes. Among these ECTs, the majority reported using Pinterest primarily to acquire and share classroom resources, while only 31 teachers reported the use of Facebook for the same reasons. In comparison, 76.7 percent, or 67 of the sampled teachers reported they never use Twitter for their mathematics teaching. These numbers not only demonstrate the prevalence of Pinterest as a social media source for direct access to instructional resources, they also suggest the different uses of other text-based social media platforms, such as staying informed of local or global news in education and engaging in colloquial conversations with colleagues virtually. Figure 1 shows the comparison of teachers’ purposes for engagement with Pinterest and Facebook. In summary, Pinterest is a unique

![Rationale for Using Pinterest](image1)

![Rationale of Using Facebook](image2)

**Note:** We ask teachers to choose all that apply for this item
social media and virtual resource pool that allows teachers within online communities, to extend their professional networks and directly consume, produce, and preserve social capital.

Despite the prominence and prevalence of teachers’ engagement within Pinterest and other related platforms such as Teachers Pay Teachers, we know little about what teachers acquire and how they leverage social capital within these spaces to direct their teaching and learning. According to Greenhow and Askari (2017), who have conducted a systematic review of a decade of educational research literature from 2004 to 2014 on learning and teaching with social media, most existing studies tend to focus on a single social media platform, such as Twitter and Facebook, but not Pinterest. Furthermore, these authors found only a few studies on social media that focused on teachers’ practices, learning, and/or professional development in the field of teacher education and secondary education. Hence, though many teachers use Pinterest for professional learning and resource curation to supplement their local curriculum, this social media platform is an under-researched field. Within this unique social media space, the ease of network participation lowers costs involved with accessing teaching strategies and other instructional resources. However, in a big data world, those individuals who can cull information and cohesively assemble it are at an advantage (Schwartz, 2004). To better support teachers with research evidence, the research community needs to address the gaps in the literature with regard to Pinterest and K-12 teachers and students.

Theoretical framework
Our conceptualization of teachers’ engagement in Pinterest is situated in the theories of social capital, community of practices, and social networks. We first review how these theoretical lenses have been used in various bodies of literature to study teachers’ professional interactions in physical and virtual spaces, then we introduce SKCs – our niche in these theories, and present our theoretical framework to analyze teachers’ resource curation as participation in communities, through social capital accrual and diffusion.

Lens for studying teachers’ professional interactions as social capital
Teachers’ professional interactions are situated within professional and informal spaces. The people with whom one interacts build a system of information that one may encounter. This notion is conceptualized by Coleman (1990) as social capital. We define social capital to “represent the potential for individuals to access resources through social relationships” (Frank et al., in press). Social capital varies by group and can be influenced by the structure of ties present within a group, the amount of expertise and trust, and the nature of interactions (Coburn and Russell, 2008). Furthermore, the type of district one works within may mediate the social capital present within one’s professional community (Coburn and Russell, 2008). In fact, research shows that social capital within teachers’ communities, schools, or districts may impact professional experiences (Penuel et al., 2009; Coburn and Russell, 2008). In a study on social capital within teachers’ professional communities encountering a district-wide mathematics curriculum reform, Coburn and Russell (2008) found teachers seek out advice and information differentially depending on the topic; in the case of mathematics, teachers sought expertise from their district mathematics coaches. While, Penuel et al. (2009) find homophilic tendencies amongst teachers as they seek out others who share similar values, “people who understand teachers, who have resources to help […] where the teachers are aware of them and open to that [is] where it works” (p. 155). In these cases, social capital may help teachers improve their instruction, collaboration, and integration of new initiatives within a school (Frank et al., in press). Therefore, teachers may increasingly turn to trusted others when making professional decisions.
Teachers’ mobilization within virtual spaces is a bottom-up, emergent phenomenon. Communities stand as spaces for professional collaboration across geography, political context, and time. Reorganizing traditional hierarchies, teachers may produce and diffuse knowledge within their networks and across their field. Thus, social capital may be built within and outside the schoolhouse. Yet, research on social capital accrual and diffusion in virtual spaces is not as prolific as that situated within formal organizational structures. As the boundaries of communities are expanded and enabled by the development of technology, the larger society – including the educational enterprise – faces new opportunities and challenges in navigating expanding communities and new ways of building social capital.

**Lens on studying teachers’ professional interactions in communities/networks**

Research on teachers’ professional interactions, either in physical or in virtual spaces, is often grounded in two types of social learning structures – communities or networks. Wenger et al. (2011) defined networks as “the set of relationships, personal interactions, and connections among participants who have personal reasons to connect.” In other words, participation in a network emphasizes an individual’s active problem-solving process. As a network member, one seeks to leverage a wide range of information flows within and across ties in order to allocate resources, engage in dialogue, and/or find solutions spontaneously, yet sometimes also in incidental and seemingly random modes (Macia and Garcia, 2016).

Many studies use Personal/Professional Learning Networks (PLNs) as a theoretical background to examine the mechanism of educators’ professional interactions online (e.g. Krutka and Carpenter, 2016; Trust et al., 2016). Although the definition of PLNs is not consistently agreed-upon, there is some consensus about their teacher-driven nature (Flanigan, 2011, pp. 10-12) and the scale of connectivity. Still, as there is a dearth of studies on PLNs, there are fewer that examine the quality of those interactions and the effect of PLNs on shaping teaching and learning with empirical evidence.

In the same paper, discussing network as a type of social learning structure, Wenger et al. (2011) defined communities as “the development of a shared identity around a topic or set of challenges,” in comparison to the conceptualization of networks. The main emphasis of this social learning process is that there is sense of trust, a common domain and shared practices within the domain among community members, hence, a shared identity therein (Wenger, 1999). Accordingly, community is often referred to as community of practices (Lave and Wenger, 1990). Many studies on teachers’ professional development in online communities have taken this lens to highlight the social cultural perspective of learning through social participation (e.g. Booth, 2012; Ranieri et al., 2012; Wesely, 2013). Despite this line of work that focus on teachers’ community of practices within their schoolhouse, there is a similar gap in the literature as few studies focus on the quality of practices shared as a result of community participation, and how the knowledge of practices (Cochran-Smith and Lytle, 1999) are internalized by teachers’ cognitive schema. One exception may be Cho’s (2016) study on school administrators in Twitter that critically examines the “quality” of information shared among educators via social media. As Twitter may be more prevalent for educational discourse, particularly policy discourse, the quality of information, knowledge, and practices that classroom teachers construct and diffuse within social media still remains an understudied area.

**Pinterest as a SKC**

The characteristics of a network and a community often emerge within the same group of teachers (Macia and Garcia, 2016). This is especially true when teachers’ school-based colleagues who share a formally organized professional community extend their collegial relationship into social media. We refer to the nature of these teacher
communities and networks therein within Pinterest and other connected virtual resource pools as SKCs. Distinct from Personal/PLNs, SKCs highlight the uniqueness of teachers’ connections and the kinds of interaction they may have within social media platforms. Teachers in SKCs may develop collegial relationships that reach beyond geography and provide teachers the opportunity to connect to a global social network, yet, they may also maintain relationships with local colleagues beyond the schoolhouse and extend their personal interactions with them into virtual spaces. Accordingly, teachers’ social interactions may build new communities of teacher professionalism, overlaying existing ones and connecting communities through both physical and virtual ties. These persistent and pervasive ties (Hampton, 2016) allow teachers to preserve network connections as they move to new schools, districts, or positions. Moreover, SKCs provide spaces for teachers to develop communities of practice (Lave and Wenger, 1990) at a scope that differs from those developed through traditional professional learning communities. The strength of social network ties and their influence on teachers may shift across physical and virtual spaces, impacting community members’ knowledge and practice construction by way of a completely different mechanism (Liu et al., 2017).

Pinterest, as a unique SKC, is at the center of a network of connected communities due to the fact that it drives a large volume of traffic to and from other platforms. Instructional resources manifest themselves as a form of social and human capital in teachers and, the pursuit of these resources connects teachers to one another and to various virtual resource pools. Behind the phenomenon of resources as currency for information diffusion is the coexistence of teachers’ physical and virtual networks together in social media, and teachers’ further exposure to knowledge and practices beyond direct resources accessed via linked websites outside of Pinterest.

**Pinterest as a lens to analyze teachers curated resources in SKCs**

Teachers within the virtual space may encounter as much as 100,500 words of information that must be navigated daily (Bohn and Short, 2012; Bhaskar, 2016). They may use both their personal and professional connections as they consider what information is important, why, with whom, and where to share it. Professional collaboration may extend from the schoolhouse to the cloud as teachers exchange advice and resources for their classrooms (Friedman, 2005; Hampton, 2016; Liu et al., 2017).

The specific information and instructional resources that teachers choose to access reflects how they conceptualize their curriculum and make sense of the coordination of disparate content into a cohesive whole. This sense-making and construction may be referred to as curation. To curate is to “synthesize existing ideas of materials into a coherent set [and] provide a new and innovative perspective” (Hu and Torphy, 2018). Teachers curating curricula and instruction do so in an effort to preserve ideas for themselves and share these sets of connected ideas with others. Within social media, active socialization through following and being followed across virtual spaces, promotes sharing and facilitates the accrual of social capital, while curated content facilitates the accrual of human capital (Hargreaves and Fullan, 2012). The social and human capital available through virtual networks allows teachers to save time when seeking out help or resources for their classroom. In theory, teachers seeking out resources from their trusted colleagues may identify higher quality content. Yet, it is up to each individual to put together resources in a way that makes most sense for their students, their school, and has relevance to their community.

While curation has historically been undertaken by organizations within the arts, twenty-first century virtual spaces allow individuals to buy, sell, curate, and share ideas and resources across geography and over time. As both consumers and producers, teachers’
professional collaboration binds social and human capital within SKCs. In Figure 2, we illustrate the social process of knowledge diffusion within virtual spaces.

Within a given teacher’s social world, he or she may organize within SKCs to curate instructional content for his or her students. The curated content is situated within teachers’ local and current education policy context. In our theoretical framework, we conceptualize teachers as prosumers in SKCs, that is, consumers and producers of social capital in forms of educational resources (Bhaskar, 2016; Hu and Torphy, 2018). As dual providers, sharing and receiving knowledge and resources within SKCs, teachers leverage both bridging and bonding social capital (Putnam, 2000) as they curate curriculum and share it across the coexisting virtual and physical social network.

Curation stands at the center of teachers’ SKCs (Bhaskar, 2016), as teachers collectively generate and share knowledge with those they trust. Curated curriculum may influence the educational resources and teaching practices utilized within classrooms, while those perceived problems in teaching (Kennedy, 2005; Lampert, 2001) may in turn influence curated curriculum. That is, insufficiency in local district curriculum may motivate teachers to seek out supplemental resources, or, a constructed curriculum focused on a particular content or skill to provide additional resources and social capital. Teachers curating professional resources and curriculum use learning in communities to make sense of materials and how they interweave those materials in their classrooms. As teachers make sense of curricula and collaborate in a social network – within and outside the schoolhouse, they become prosumers who generate and prosume professional knowledge and practices. In other words, teachers’ virtual engagement within SKCs may begin to build toward professional capital (Hargreaves and Fullan, 2012), that is, the teaching wisdom, collaborative capacity, and mastery of content that they develop which may extend from cloud to class.
Method

This study examined teachers’ curation of mathematical resources both in the kinds of mathematics teachers chose and the quality therein. Additionally, we explored through epistemic network analysis (ENA) how teachers made sense of resources through a statistical approach that allowed us to present visualizations of their cognitive organization of mathematics curation.

We focused on one salient virtual resource pool – Pinterest, an image-based social media platform where teachers access and share mathematical resources frequently. Pinterest allows users to pin valuable resources, creating a virtual scrapbook for later reference. Users may organize these pins into boards, often categorized by topic or content. This study used a sample of ECTs from a National Science Foundation funded research grant studying their planning and enactment of elementary mathematics. We identified and analyzed Pinterest accounts for 29 ECTs from three Mid-Western states in the 2014-2015 school year. We confirmed teachers’ Pinterest accounts through cross-referencing demographic information found on Pinterest and other social media websites, including grade level taught, teaching district, and photo recognition. Analysis included all mathematical resources pinned between the origin of their account to November 2016.

When characterizing teachers’ curation of mathematical resources within Pinterest, we took into account the pin’s corresponding description as an indicator of teachers’ conceived use of the pin, i.e. the instructional resource. In some cases, the description was not sufficient to identify the conceived use of the task and we would follow the link to the primary source of the task and analyze how the producer of instruction conceived its use. We chose to follow instructional resources that were not accompanied by sufficient description because we considered teachers as professionals and, therefore, expect that they may also seek additional information on the resources.

Characterization of tasks as grounded in mathematics education reform

There are many different ways to abstract the properties of instructional materials. In order to understand teachers’ curation, we focused on the types of mathematical activity that students engage in. Furthermore, we examined the quality of resources as evidenced in the cognitive process students must perform in order to successfully complete a task.

We characterized mathematical content in these two ways for particular reasons relevant to the educational community and the policy environment. We situated the mathematical typology within the research-based practice and the national curriculum – CCSS. For instance, we draw on the work of Wood et al. (1990) to create our definition of Contextual and Open-ended Mathematics, as this category contains tasks that present students with real-world, authentically “problematic situations” (p. 498) of the type that they called for. This type of mathematical activity is in contrast with those tasks that require students’ immersion in instrumental learning (Skemp, 1978), which we categorized as standard algorithm. Similarly, the work of Núñez et al. (1999) informed our definition of Kinesthetic and Embodied Mathematics, as this category contains, in part, tasks that require students to move with a mathematical purpose. The definitions for some other categories, such as physical resources, are purely descriptive and reflect a retroductive approach (Ragin, 1994) to data analysis in which we situate our conceptualization of mathematics in teachers’ daily professional lives. For the operationalized definitions and examples of each mathematical type (see Table A1).

In tandem to examining mathematical typology, we also identified the cognitive demand inherent within the instructional task. Research has shown that curricula with high cognitive demand tasks contribute to improved student outcomes (Boston and Wolf, 2006). Moreover, curricula with high cognitive demand tasks help students develop the ability to engage in mathematical argumentation and problem solving, resulting in more robust
understanding of important mathematics concepts (Boston and Wolf, 2006). Some researchers argued that the cognitive demand of tasks is better understood by examining the enacted curriculum in the moment of teaching and interacting with students (Stein and Smith, 1998). We acknowledged this dialectic relationship between the potential of tasks in writing vs in action, but our aim is to approximate the cognitive demand of the instructional tasks in teachers’ curation of curriculum in order to characterize their vision of instruction in SKCs. To capture the important characteristics of content, we draw from Bloom’s taxonomy (Bloom et al., 1956) and its revised version (Hess et al., 2009; Krathwohl, 2002) to characterize the cognitive demand of those instructional tasks embedded in the pins. Bloom’s taxonomy offers a hierarchical classification system of cognitive demand ranging from simple to complex and concrete to abstract. The system contains six categories: Remember, Understand, Apply, Analyze, Evaluate, and Create. For the operationalized definitions by cognitive demand levels in mathematics and corresponding examples (see Table AII).

Over time, Bloom’s taxonomy has been widely used to analyze and classify curricular objectives and test items. These analyses tend to show that curricular materials heavily rely on objectives requiring only recall of knowledge. The CCSS call for more rigorous curricula, instruction, and assessments and emphasizes real-world connections in mathematics problem solving. In addition, Porter et al. (2011) find that the CCSS Mathematics place more emphasis on the “demonstrating understanding” cognitive level than the pre-existing state standards. Conversely, the CCSS Mathematics place less of an emphasis than state standards on lower cognitive demand, such as “memorize” and “perform procedures” components. By characterizing instructional materials through mathematical typology and cognitive demand, we may illuminate teachers’ thinking of their instruction, and identify its alignment to a national curriculum.

After establishing working definitions and decision rules based on preliminarily coding, sampled teachers were randomly assigned to two pairs of raters. Both researchers in each group coded teachers’ pins individually and discrepancies were highlighted for further scrutiny. The coding remained open as the whole rater team came together to discuss the disagreement and flesh out details and rationales in our codebook to guide future coding in similar situations. The most common disagreement in terms of coding mathematical typology was to discern the “primary” purpose of the intended use by our sampled teachers, as a single mathematical task may contain several mathematical problems requiring students to do various mathematical tasks. Our decision rule was to focus on the primary purpose of the task as conceived by the teachers and what kind of mathematics students would do for the majority of the time. We based this decision on our goal to capture the majority of students’ typical learning experiences in the classroom, which is consistent with how we measured the instructional quality through a mathematical observation tool (Frank et al., 2017). Consistent conceptualization of teachers’ behaviors across different data sources provided us the opportunity to triangulate the relationship across different measures of teachers and between intended and enacted curriculum in future studies. Similarly, the most common disagreement in terms of coding cognitive demand was to discern the “highest” cognitive demand in the potential of the task, suggested by intended use. Different parts of the mathematical problem in the task may be inherent to various levels of cognitive demand as a way to build up intellectual challenges for students. As such, the rater teams discussed the meaning of different levels of cognitive demand in an integrated mathematical task and revised the decision rules to explicitly reflect the group’s thought process during those consensus-coding meetings. Lastly, another round of coding was conducted across four researchers with an expert coder who applied a mathematics education background to making the “final call” on any remaining discrepancy cases. This process was completed for 1,937 pins four times with raters agreeing on all codes, resulting in 100 percent
agreement on all the pins coded. Moreover, the way we coded these two attributes frames the interpretation of our network data as to what it means for teachers to pin mathematics resources featuring certain types of activity and certain levels of cognitive demand.

ENA to model structure of teachers’ sense-making of curriculum

After we coded all pins curated by teachers, we applied ENA to map out teachers’ cognitive structure in order to analyze their sense-making of instructional tasks. ENA is a form of network analysis that models how people connect concepts within their discourse to demonstrate their thinking (Shaffer, 2017; Shaffer and Ruis, 2017), and it projects the network structure onto a two-dimensional space for interpretable visualization. In our paper, discourse is teachers’ curation of instructional resources and the concepts presented are those mathematical tasks with different attributes. This analytical approach can quantify, visualize, and interpret those elements characterizing teachers’ complex thinking about their instruction, and enable direct comparison of networks based on meaningful grouping of teachers (such as year of experience). The number of elements in each of our measured attributes in teachers’ conceptualization of mathematics instruction, however, is fixed and relatively small. Many existing network analyses are not constructed to analyze this type of “small” network, while often used summary statistics of networks may leave out important information about the differences in structure when making network comparisons (Shaffer et al., 2016). Accordingly, ENA not only enables us to go beyond analyzing the mere presence and/or absence of each type of mathematical tasks, it also allows us to present for the cognitive network data evidenced. Finally, this analytical approach extends social network analyses which focus on mechanisms behind people-to-people relationships, and more deeply examines the nature of social capital being accrued and diffused.

Built on the work of Lave and Wenger’s (1990) community of practice, we conceptualized teachers’ activities within Pinterest as engagement in SKCs. Thus, teachers’ curation of instructional tasks represents an accumulation of knowledge of practices (Cochran-Smith and Lytle, 1999) and illuminates teachers’ thought process as they seek out mathematical resources for teaching over time. As teachers sort pins of particular typography and quality within boards, we may view a cognitive schematic of how teachers connect mathematical tasks (Newman, 2004; Shaffer and Ruis, 2017). Mapping cognitive structure by teacher and within boards enables us to make sense of what teachers are curating within SKCs. That is, what does it mean to see so many pins within a certain category or cognitive demand level? How do the pins interact with each other in terms of the concept of typography and quality of the task? By examining how teachers make connections among tasks with different mathematics typography and different levels of cognitive demand, we provided a visualization of teachers’ sense-making schema and a rich description of how teachers curate mathematical resources within Pinterest.

Results

What do teachers share within Pinterest?

Mathematical typography pin distribution. Within our sampled teachers and the 1,937 mathematical resources they curate within Pinterest, we found ECTs have a large variance in the types of mathematical tasks they curated, and they predominately pin tasks related to conglomerated Content Resources (22.5 percent), standard algorithm (20.6 percent), and Visual Representations (19.0 percent) (see Figure 3). Examples of coded pins can be found in Table AI.

The largest percentage in the graph – Content Resources – suggest teachers’ tendency to curate a conglomeration of related or unrelated resources that they may wish to use to supplement their instruction (definition as provided in Table AI). These resources often
advertise themselves (on the cover) as Common Core aligned materials. As there is lack of Common Core aligned curricula due to the relatively recent implementation of this educational policy (Polikoff, 2015), teachers' active curation of CCSS materials in our study, as well as in the Opfer et al. (2016), signals their thinking to meet the need of new curricular demands and unsolved problems within their local context.

The second salient type of mathematical tasks teachers curate is standard algorithm – an activity that focuses on a set of well-defined procedures and routine exercises in mathematics. Procedural fluency is an important mathematical proficiency for students to acquire in mathematics learning (National Research Council, 2001; National Governors Association Center for Best Practices, Council of Chief State School Officer, 2010), yet developing procedural fluency does not only mean rote memorization. Moreover, though standard algorithms should have their place in both official and curated curricula, the sharp contrast between this type of mathematical task and the Contextual and Open-ended Mathematical tasks (less than 5 percent) suggests the risk of an imbalance in proficiency development for students. Because developing reasoning within context and an understanding of abstract mathematics through real world tasks is a primary focus in CCSS, the lack of attention to this type of mathematical task in teachers' curation of resources points to a potential insufficiency in curriculum in an area necessary to achieve a principal goal of the national policy reform.

The appearance of Visual Representation, and another related category – Concrete Manipulative (fourth largest percentage in the graph, 11.6 percent) reflects teachers' responsiveness to policy documents' (CCSS, 2010; National Council of Teachers of Mathematics, 2000) and research (Arcavi, 2003; National Research Council, 2001) emphasis on using visual models/diagrams/graphs as well as physical tools in learning and doing mathematics. Districts where these teachers come from have taken actions to encourage uses of visualization and manipulatives through the curriculum as well as the professional development, thus the result of this study shows the convergence of teachers' conceptualization of mathematics instruction with district priorities in these two areas.

Figure 3. The predominance of resources in certain categories
Overall, the variance in the types of mathematical tasks teachers curate within Pinterest shows an emphasis on certain practices and learning experiences and a relative neglect of others.

**Cognitive demand pin distribution.** We examined the cognitive demand of all instructional tasks, excluding all of the content and pedagogical resources and organizational tools which cannot be characterized as they do not feature a primary mathematics task. For the remaining 1,303 pins, we found that the majority of the mathematics tasks (74.0 percent) were at the lower levels of the Revised Bloom’s taxonomy, with the largest proportion of pins representing the Remember Bloom’s taxonomy level (Level 1 thinking order), followed by Understand (Level 2 thinking order) (see Figure 4). Examples of coded pins can be found in Table AII.

Similar to the imbalance argument in terms of the type of mathematical tasks that teachers curate within Pinterest, the even larger variance in the cognitive demand levels inherent in the resources has presented a potential and yet more serious problem with the curated curriculum. As students develop more sophisticated approaches to mathematical thinking and learning, the opportunities for them to engage in mathematical tasks that demand various levels of intellectual challenges are needed. However, given the over-representation of lower levels within Bloom’s thinking order taxonomy and the lack of cognitively demanding tasks we see in this study, the curated curriculum online may have repercussions for teachers’ facilitation of deeper learning.

**How do teachers curate instructional content within Pinterest?**

When we zoomed into how teachers make connections among the different elements in conceptualizing curriculum and mathematics instruction, we found that teachers tend to curate certain types of mathematical tasks even though other categories of tasks may be more salient to their instructional needs, school, or district goals. We also found triadic connections among Remember, Understand, and Apply – the three lower cognitive demand

<table>
<thead>
<tr>
<th>Cognitive Level</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remember</td>
<td>493</td>
</tr>
<tr>
<td>Understand</td>
<td>471</td>
</tr>
<tr>
<td>Apply</td>
<td>207</td>
</tr>
<tr>
<td>Analyze</td>
<td>85</td>
</tr>
<tr>
<td>Evaluate</td>
<td>4</td>
</tr>
<tr>
<td>Create</td>
<td>16</td>
</tr>
<tr>
<td>Not Applicable</td>
<td>651</td>
</tr>
</tbody>
</table>

*Figure 4.* The lower-level skewed distribution of cognitive level required of the activity
levels – as teachers organize their curation and resources. Lastly, among those factors that may influence teachers’ curation, our results suggested that years of experience moderates the cognitive structure with regard to the quality of the resources to some extent, but it does not affect how teachers make sense of different types of mathematical tasks. The sections below describe these results in more detail.

How teachers make connections among typology of content. In terms of the types of instructional tasks that teachers curate within Pinterest, the strongest connection in our sampled teachers’ cognitive structure was between Visual Representation and standard algorithm (see Figure 5, representing by the darkest red line). This suggests that when teachers curate instructional resources for mathematics teaching, they often select tasks that require students to visualize mathematical relationships and practice mathematical procedures and routines.

This pattern extends into teachers’ internal consideration of instructional tasks curated within organizing boards of instruction (see Appendix 3 for epistemic networks with the unit of teacher and board). Boards within Pinterest are ways that teachers organize their thinking thematically. For example, a board can be titled “fractions” and may represent a space in which a teacher collects and houses resources on this concept. We found that within smaller coherent collections of instructional tasks, teachers mostly conceptualized tasks that are standard algorithm and Visual Representation together. That is, teachers considering instruction thematically curate standard algorithm resources within the same boards in which they pin Visual Representation and Content Resources. The strong connections shown through ENA across these three particular mathematics typologies persist across sampled teacher subgroups given years of experience (one and two years of experience vs three and four years of experience) with $p$-values 0.154 and 0.772 along X- and Y-axis, suggesting no significant moderation effect by this factor.

How teachers make connections among the quality of content. Within the group of sampled teachers, the strongest connection made was between the lowest two levels of

![Figure 5. Epistemic network of sampled teachers representing the structure of cognitive connections in terms of mathematical typology of the instructional resources](image-url)
cognitive process – Remember and Understand. Second, we found a salient relationship between teachers’ curation of content that aligns with Bloom’s Remember, Apply, and Understand levels (see Figure 6). These connections are largely consistent when we examined teachers’ organization of the mathematical tasks within boards (see Appendix 3 for the epistemic network structure with the unit of Board). Connections across other levels of cognitive demand are relatively weak. In other words, when teachers accessed instructional materials online, making efforts to organize them in ways that make sense to their conceptualization of mathematics instruction, they tend to make relatively fewer connections across low to high cognitive demand. Thus, teachers’ curation of instructional quality was relatively consistent and of low quality tasks within and across boards.

In contrast to how teachers with different experience made sense of pins in terms of mathematical typology, more experienced teachers (two to four years of teaching) have exhibited different patterns of thinking in the curation of resources with regard to quality (see Figure 7, where blue represents experienced teachers and red represents first year teachers). The two networks are marginally significant along the Y-axis (p-value = 0.081).

To create the structure of the network above, the weight of each connection in teachers with just one year’s experience was subtracted by the weight of each corresponding connection for teachers with two to four years of experience. The subtraction highlights the difference in the two groups of teachers’ cognitive networks. As shown in the subtracted networks of these two teacher subgroups, we found that teachers with more experience make stronger connections between Remember and Understand, and Understand and Create, while teachers with minimal experience made stronger connections between Understand and Apply, and Understand and Analyze. Therefore, there is evidence that teachers’ experience may translate into differences amongst the cognitive structure of their conceptualization of curriculum and mathematic instruction. In summary, more experienced teachers tend to focus more on developing their students’ foundational skills (Remember and Understand) and the highest thinking order (Create). In comparison, less experienced teachers tend to focus more on developing students’ thinking levels, understanding the meaning of concepts and procedures, and the ability to use these concepts and procedures to solve problems.

**Figure 6.**
Epistemic networks of sampled teachers representing the structure of cognitive connections in terms of cognitive demand of the instructional tasks

**Note:** Unit: Teacher
Limitations
One assumption in our theoretical framework of situating teachers’ curation in SKCs is that participation in communities and leverage of social networks influence teachers’ conceptualization of mathematics instruction. It is beyond the scope of this study, however, to incorporate social network analysis to examine differentiated network influence and distinct resource flow paths. Some of our other works show emerging evidence on how teachers forming connections with one another within the schoolhouse and across SKCs relates to their knowledge uptake and curation of curriculum (Liu et al., 2017; Torphy et al., 2017). As this study focuses on the curated product as a result of teachers’ active engagement in SKCs, we did not make the linkage in this paper.

Another limitation of this study is that our sampled teachers are ECTs from several Mid-Western states. The results and inferences we made regarding imbalance in categories of mathematical typology, and cognitive demand, may be partially attributable to the fact that these teachers are still in the early stage of their teaching. As the larger sample of the project features experienced teachers at different career stages, we may begin to see in future studies whether the patterns as found here are consistent across a more diverse population of teachers. Moreover, we may examine the existence of other moderating factors that are more influential for teachers’ curated curriculum online.

Discussion and implications
Social networks and communities within physical and virtual spaces provide the potential for teachers to connect to one another and generate knowledge (Zhao et al., 2015). Within SKCs, teachers may expand both their human and social capital as they collaborate and learn from one another across geographic boundaries and time. Teachers’ curation of instructional resources provides a concrete example of this knowledge construction and diffusion in professional communities online. Though some attention has been paid to educators’ engagement in other social media such as Twitter and Facebook, there is little research on how teachers as prosumers conceptualize their curricular landscape in a digital era. Yet, twenty-first century classrooms and teachers engage frequently in curation of instructional resources online, bridging, and bonding social capital from the cloud to their students. Characterizing this space is a first step to study teachers’ professional interactions and social capital accrual and diffusion in SKCs. Our work contributes to this body of literature on

Figure 7.
The subtracted cognitive network of two groups of teachers with different experience in teaching, in which the connections made by teachers with two to four years’ experience are subtracted from the connections made by teachers in their first year of teaching.
social media and education by providing accounts of content and quality as part of professional interactions in online communities. As this space continues to evolve, researchers and education policy makers should begin to develop a greater understanding of social media in education, and their potential to increase equitable distribution of knowledge and high quality instructional resources through this venue.

Despite the prominence of capitalizing on social media for high quality resources and access, our results suggest that teachers may not have curated sufficient high quality resources to promote and maintain higher cognitive demand in engaging students with mathematics. Hence, teachers, despite the motivation in taking up instructional leadership in directing their profession, may still need to be supported to both examine worthwhile content within their SKCs as well as embody the wisdom to enact it within their local context. This seems to be a particularly clear need for ECTs, as they navigate the challenges of teaching at different levels. The years of experience as a moderating factor that sets inexperienced teachers apart from their counterparts in the cognitive demand of their curated resources suggests the need to support new teachers to think beyond the form of activity that students do, and to be more attentive to the kind of student thinking enabled by the task. Building on teachers’ daily routines in social media and the incentive to empower teacher leadership, we would advocate for teacher preparation and professional development programs to incorporate “social media literacy” for teaching, and help teachers develop habits of mind in curriculum curation. Our future work will start this process by creating a reflection guide for teachers’ resource requisition online. Working with pre-service teachers in a university teacher preparation program, we hope to support progress for teachers in this field.

Social media data change iteratively and provide a record of teachers’ lived experiences over time. This space affords researchers rich data to investigate teachers’ professional interactions in a larger social world in Web 2.0. The development of machine learning techniques makes accessible those living archives of teachers, including artifacts and discourses, while new methodology such as the ENA used in this study helps reduce the high dimensional data into visually interpretable information. We argue that ENA can be used in conjunction with social network analysis to provide us a more comprehensive picture of what social capital is built, how it is diffused, and what impact it has on community members. Besides the common survey approach found in many existing studies on social media (Greenhow and Askari, 2017), future research may connect multiple analytical approaches to examine social media educational data, linking content to network, and cloud to class. Our study contributes to this future research agenda by leveraging both extensive human coding of mathematical resources online and a new statistical approach to unfold the nature of the content in those virtual spaces. Our next steps will leverage ENA to expand our exploration of teachers’ professional interactions within Pinterest. Specifically, we plan to examine how teachers consider sources as they curate curriculum within SKCs. Additionally, we will examine teachers’ alignment of curriculum to CCSS standards to identify perceived curriculum needs across teachers’ physical and virtual social networks. Through these two lines of work, we seek to portray a more comprehensive story of teachers’ engagement in this new and growing community of practice.

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Further reading


Appendix 1

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art and fine motor skills</td>
<td>Mathematical tasks within this category primarily focus on creativity in art or on finer motor skills rather than the mathematical demand of a given task, this can be identified by the proportion of time expected a student, as the doer of the task, will spend on the mathematics of a task vs the art within the task.</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>Visual mathematical representation</td>
<td>These mathematical pins depict mathematical representations showing relationships between numbers through visual images including words, pictures, symbols, and graphs. These visual images can be created by the teacher or the student. Pins within this category do not provide students explicit opportunity to manipulate the mathematics by students.</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Concrete and manipulative</td>
<td>Pins within this category facilitate students doing mathematics with a concrete tool they can manipulate. This includes visual and physical tools, such as a 100 charts or base ten pieces, which allow students to solve mathematical problems.</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Table AI. Definition of mathematical typology and examples (continued)
Kinesthetic and Embodied Mathematics

Kinesthetic mathematical pins are categorized as those mathematical activities which require students to move with a mathematical purpose (Núñez et al., 1999). These pins may not only relate to kinesthetic movement, we include mathematics musical videos and other interactive mathematics media within this category.

Contextual and Open Ended Mathematics

This category uses a constructivist vantage of mathematics to identify mathematical tasks situated in a context that facilitate students’ construction of mathematical concepts (Wood et al., 1990). The pins reflect an expectation the student will do mathematical tasks and provide opportunity for multiple strategies to find a solution.

Socialized Knowledge Communities

Table AI.

(continued)
### Table AI.

<p>| Standard algorithm mathematics | Mathematical tasks or posters are categorized as standard algorithm if they focus on procedures or memorized routine exercises |
| Pedagogical processes | Mathematical pins that reflect teaching strategies teachers may use such as journaling, whole brain teaching, or growth mindsets |</p>
<table>
<thead>
<tr>
<th>Physical resources</th>
<th>Pins within this category relate to physical resources such as organizational materials, blank mathematics graphic organizers (such as a blank dice), and manipulatives with no accompanying mathematical task within the pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content resources</td>
<td>Content resources are defined as a conglomeration of related or unrelated resources that teachers may wish to use to supplement their instruction. These resources are varied and may not be mutually exclusive within one mathematical category</td>
</tr>
</tbody>
</table>

Table AI.
## Appendix 2

<table>
<thead>
<tr>
<th>Cognitive Demand Level</th>
<th>Rationale</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1: Remember</td>
<td>Represent a math relationship with pictures and symbols.</td>
<td><img src="image" alt="Example Picture" /></td>
</tr>
<tr>
<td></td>
<td>Ask students to remember the conversion among units</td>
<td>Teacher comment: I wish someone would have taught me this a long time ago so I would remember gallons, quarts, pints, and cups! This is pure GENIUS!!!</td>
</tr>
<tr>
<td>Level 2: Understand</td>
<td>Ask students to compose and decompose numbers with blocks in order to understand the numbers and operations in another representational form</td>
<td><img src="image" alt="Example Picture" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Teacher comment: TGIF! - Thank God It's First Grade!: More Math Stations and an Addition Freebie!</td>
</tr>
<tr>
<td>Level 3: Apply</td>
<td>Ask students to solve one-step problems by applying regrouping skills in addition</td>
<td><img src="image" alt="Example Picture" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Teacher comment: Double Digit Addition with no regrouping!</td>
</tr>
</tbody>
</table>

Table AII. Example of tasks at different cognitive levels and rationale of coding. (continued)
<table>
<thead>
<tr>
<th>Level 4: Analyze</th>
<th>Ask students to retrieve information from a graph to analyze the data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher comment: Free - Addition and subtraction with regrouping</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 5: Evaluate</th>
<th>Students are asked to read a book, use graph to represent the information in the book, and evaluate the graph to discuss which show the data better</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher comment: Here is a GREAT lesson on making a circle graph inspired by a great piece of math literature. Very motivating for students!</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 6: Create</th>
<th>Students are asked to formulate an original problem given the answer using what they have learned. The problem needs to make sense in terms of the scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher comment: Think Math: Answer is on the board, students make question on sticky note and put it on their class number</td>
<td></td>
</tr>
</tbody>
</table>

Table AII.
Appendix 3. Epistemic networks of sampled teachers

Figure A1. Epistemic network of sampled teachers representing the structure of cognitive connections in terms of mathematical typology of the instructional task

Note: Unit: teacher and board

Figure A2. Epistemic networks of sampled teachers representing the structure of cognitive connections in terms of cognitive demand of the instructional tasks

Note: Unit: teacher and board

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Flourishing in adaptive community: balancing structures and flexibilities

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Faculty of Education, University of British Columbia, Kelowna, Canada, and
Keith Walker
Department of Educational Administration, University of Saskatchewan, Saskatoon, Canada

Abstract

Purpose – This paper documents findings from a qualitative research project on flourishing in schools using a positive organizational research approach. The purpose of this paper is to uncover and bring to description educators’ experiences of the conditions, forces and influencing factors for flourishing in their context. The main objectives were to inform research and practice in school improvement from a positive perspective, provide knowledge and practice about noticing and growing well-being for educators and to encourage an attention on individual and collective well-being as an organizational imperative.

Design/methodology/approach – To gain a rich description of what it means for educators to feel a sense of flourishing in their work, the researchers used qualitative, case study methods and appreciative research activities. For the case study reported on in this paper, data were collected through open-ended, appreciative, focus group conversations and researcher observations in the participants’ classrooms. Conversations were recorded and transcribed. The researchers analyzed the transcripts using an iterative process of coding, categorizing and abstracting data.

Findings – Participants grew their adaptive communities through balancing structures (collaboration, purpose, administrator support) with flexibilities (synergy, creativity, tinkering, friendships) for adaptation and co-creation. Well-being was connected with feeling collegial support, care, shared meaning and engagement and where positive relationships were central in their work. These relational conditions seemed to contribute to building a social container that promoted flourishing. This led to innovation as teachers worked together in ways that promoted their learning and growth as a group, and increased their sense of vitality in their work. The researchers found that the principal plays a vital role in fostering, encouraging and sustaining conditions for teachers to cultivate adaptive community.

Research limitations/implications – While small in scale and not generalizable across contexts, this research offers particular examples of what is working well for these teachers. Insights from these examples are intended to be generative, potentially resonating with and inspiring others to examine the possible benefits and potentials that may come from a positive approach to research and practice in school improvement in their own contexts. Engaging in positive organizational research in schools led to new insights on the work of teaching, learning and leading in schools. The researchers suggest that this positive, appreciative and generative perspective offers potentials and benefits for new understandings on school improvement.

Practical implications – The findings from this case study indicate that more attention is needed to supporting educators to cultivate the conditions necessary to experience rich and meaningful relationships within which they will thrive, grow and innovate in their teaching. At a system level, the authors argue for a re-orientation of schools toward well-being and a more holistic and human-development perspective on schooling.

Social implications – Currently and internationally, schooling is under re-design as the authors learn more about the need to organize the schools in ways that encourage the kinds of teaching and learning necessary to prepare young people for an increasingly unpredictable future. The findings from this study highlight the importance of attending to teacher well-being as a fundamental aspect of encouraging the kind of teaching needed for the kinds of learning desired in schools across all contexts.

Originality/value – This case study provides the findings that illustrate the potential and benefits of research on school organizations from a positive organizational perspective. Additionally, this study is a reminder of the systemic nature of all living systems, such as schools, and the associated need to ensure well-being for all members of the learning community.

Keywords School improvement, Innovation and community, Positive organizational research, Teacher well-being

Paper type Research paper
We have been researching school organizations from a positive perspective to determine and describe what it means for educators to flourish in their work (Cherkowski and Walker, 2014, 2016; Cherkowski et al., 2018), guided by the growing field of positive scholarship in business, psychology, health and education. Research findings reinforce the assertion that there are benefits and payoffs in all areas of our work and life when we pay attention to what works well, as opposed to focusing on how to remedy deficiencies and deficits (cf. Achor, 2011; Fredrickson, 2008; Cameron, 2008; Seligman, 2011). For example, encouraging and promoting compassion, kindness and forgiveness improves and grows relationships, learning, health and other human qualities and experiences (Worline and Dutton, 2017). While positive scholarship does not deny the existence of negative experiences, suffering and trauma that inevitably afflict all humans and human systems, there is a deliberate attention to focus on the positive with the aim of magnifying and amplifying these traits, capacities and experiences (Cameron and Dutton, 2003). Paying attention to positive relationships is an essential aspect of experiencing well-being (Fredrickson, 2008; Seligman, 2011).

Flourishing in schools is an ecological metaphor for imagining growth, interconnection and well-being. The metaphor encourages us to think about the heliotropic nature of plant life, turning and stretching toward the sun to grow, shifting our attention toward the capacities that promote vitality, generativity, well-being in schools, prompting us to see the system from the perspective of what is working well, what makes us feel whole, connected, engaged and alive.

Living systems are constantly in a state of change, dynamically responding to the environment. Wheatley (2006) described how a system heals and grows by “connecting it more to itself […] [that] to make a system stronger, we need to create strong relationships” (p. 145). When we think about schools as living systems, we see how connecting the system more to itself through promoting and supporting strong relationships among teachers becomes a necessary priority. From a thriving living systems view, we conceptualize adaptive communities as groups of educators who are working together toward constant improvement in their teaching and learning (Stoll et al., 2006), aware of the changing nature of human systems (Capra, 2004; Wheatley, 2006), responding with resilience, inquiry and appreciation to unknown and uncertainty, growing relationships to collaboratively learn toward creating a future they desire (Senge et al., 2008), knowing this future is constantly in a state of change. In short, adaptive communities are groups of educators working together, growing relationships and well-being to collaboratively learn their way forward in ongoing improvement, responding to their dynamic environments with inquiry, creativity and appreciation.

In this paper, we profile two groups of teachers from our research that we describe as adaptive communities. We offer these stories as a provocation for others to think about their schools as living systems and how they might grow adaptive communities as they attend to positive relationships and well-being. In the following sections, we provide a brief description of literature that frames our thinking about interconnection, interdependence and well-being in adaptive community – relational knowing and presence as awakening to relationality. We then describe our research and offer stories from the teachers who are engaged in co-creating their own experiences of adaptive community.

Community as relational knowing
Cultivating a culture of community in schools is an important aspect of school improvement research (Fullan, 2017; Hargreaves and Fullan, 2012; Mitchell and Sackney, 2009). Research findings highlight the importance of positive social relationships for well-being at work and in our personal lives (Seligman, 2011; Stephens et al., 2011), and so we frame adaptive community as involving the co-creation of group processes that support and value relational knowing and well-being for the self and others. Block (2014) argued, “making community the point is a major undertaking. It means we need to make the common good a priority again. It calls for cooperation and collaboration. It asks that we place the well-being of all of
us higher than the well-being of any single one of us” (p. xii). The work of making community happens long before the need for community arises (Born, 2014). Building the necessary relationships for community takes time, energy and ongoing inquiry and investment. These relationships contribute to our well-being, as “the key interaction that builds a sense of belonging. When we belong and enjoy strong relationships with one another, we can rely on one another in both good and difficult times. This makes us more resilient, and it makes us healthier” (p. 5). Being known and cared for, caring and knowing others are key to our health and ability to adapt as needed to the constantly changing dynamics of life (Seligman, 2011).

Nurturing and sustaining these social relationships for building community requires placing community making at the heart of our work. Supporting an ecological metaphor of community as a living system of interconnections and relations, Palmer (2007) suggested that all learning and teaching happens through coming to know reality within the living system, the community. Within this understanding of community relational knowing becomes a strength as members satisfy their need for communal ties, for meaningful work together, for knowing and being known through relationship (pp. 99-100).

**Presence as an awaking to relationality**
The essence of adaptability in an ecological sense is the seamless way that the whole learns together (activated collective intelligence) in the context of constant change. For adapting to occur each person must be present and contributing from their own unique place; each able to see their impact and influence on the system (Scharmer, 2009). In adaptive systems, collective thinking means learning together with ease, not necessarily thinking the same (Scharmer, 2009). There is a commitment to lean into each other’s strengths, seeking an understanding of each other and moving forward together in learning. One way to describe this mutual attunement is captured with the word “presence,” described by Rodgers and Raider-Roth (2006) as “a state of alert awareness, receptivity, and connectedness to the mental, emotional and physical workings of both the individual and the group in context of their learning environment” (p. 265). Teachers who feel a deep presence to themselves, to their colleagues and to their students may be described as being pedagogically present, aware of the purposes and pathways to effective learning, heightened adaptability and an awareness of responsibility (Fels, 2010). When a teacher is present to her responsibility to the other and is wide-awake (Greene, 1978) to her situation including social, political and cultural considerations, she moves with a clearer sense of ethical awareness. Arendt (1958) called this “natality,” which is explained as the moments in life when we are in active relation to the world and when we take full responsibility for ourselves in relation to others.

As living systems, adaptive communities are fostered and sustained through processes of relational knowing and presence, where teachers are aware of their human interconnection, express a reliance on their interdependence, appreciate and value each other’s diversity, build positive relationships and welcome the creativity and emergence that comes from learning with each other. In the next section, we provide a brief description of the larger research project on flourishing in schools and details about the narrative methods used to collect data from the participants in the adaptive communities profiled in this paper.

**Our positive research in schools**
We have been engaged in a multi-year, qualitative research project to understand what it means for educators to feel a sense of flourishing in schools. From a positive organizational perspective, we deliberately sought out examples of and stories about learning communities where teachers were already thriving to gain insights about what it means for teachers to flourish in their work. Our main objectives were to inform research and practice in school improvement from a positive perspective, provide knowledge and practice about noticing
and growing well-being for educators and to encourage an attention on individual and collective well-being as an organizational imperative.

We used research literature and early experiences with participants to conceptualize flourishing in schools as three domains of attention: subjective well-being, leaderful mindsets and adaptive community. Throughout each of these domains are three professional virtues that we think support, animate and enliven flourishing, namely trust, compassion and hope (Figure 1).

The conceptual model has been helpful both for guiding conversations with participants and as an analytical frame to help us make sense of our narrative data.

To gain the rich descriptions of what it means to flourish we used case study methods and appreciative inquiry processes with educators in British Columbia (BC) and Saskatchewan (SK). We met with school district leaders for permission to carry out our research and they suggested schools they thought would be interested. Over the course of three years, the research team spent time in five schools in BC and five schools in SK. We got to know staff through informally talking with them during breaks and attending staff meetings, observing them in their classrooms and during whole-school activities and connecting with them through various research activities. With the principals we co-developed activities as appropriate for each school’s context and culture. All teachers in the school were invited to participate, and participation varied at all the sites. Examples include a month-long e-mail activity where teachers in one middle school were encouraged to notice and then e-mail to us moments of flourishing (23 participants). Another example was engaging interested participants in appreciative letter writing, a strategy shared with us by a principal, where they were invited to write a letter about the best of what they had experienced that year or to write a letter to their future self about what it feels like to flourish in schools (11 participants). A few schools took on the challenge of noticing and sharing with us evidence of flourishing across the whole school. Focus group conversations were held in most of the schools (varied from three to seven participants), where they talked about what it means to them to flourish in their work. In general, participants described how they benefited from the practice of paying attention to what works well, sharing their stories with others and reflecting together on how to

![Figure 1. A conceptual model of flourishing in schools](image)
promote more of what makes them flourish at work. The teams of teachers profiled in this paper participated in focus group conversations and invited us to observe them in their classrooms.

**Our narrative methods**

These teacher teams were participants from schools in BC. They had developed collaborative teaching arrangements to offer interdisciplinary teaching and learning, to combine and teach from common interests such as outdoor education and to build a new way of engaging students in meaningful learning. The “Lynwood” group (Steve, Robert, Melanie) shared students in intermediate elementary grades in a small elementary school (N= 350 students). Both Steve and Robert had been teachers for over 15 years, and created a team approach to teaching five years ago to find new ways to engage students in their learning and to share their passion of outdoor education with their students. Melanie joined them as a teacher in this group for two years, but was moved to another school at the end of the second year at the time of layoffs due to her low seniority within the union. While they each had a designated classroom of up to 30 students, they collaboratively planned all of the educational activities for all of the students that included large and small group learning opportunities.

The “Bayview” group evolved from one of the teacher’s graduate school project. Gordon worked with his administrator in this medium-sized secondary school (N= 600) to create an in-school academy where all the grade eight students would be platooned with four teachers to offer the core subject areas as a collaborative teaching team. Gordon was a science teacher. He recruited interested teachers from the math (Bill), English (Tracy) and Special Education (Sarah) departments. These teachers planned and co-delivered the instruction and assessment for all of their grade eight students who stayed together as a large group for their first semester. Their vision was to create opportunities for their students to engage as learners in ways that promoted their sense of agency and enthusiasm for learning across all parts of school and life.

Both of these teams were described by their principals as thriving, engaged and innovative teachers who cared deeply for the development of the whole student, and who demonstrated a substantial level of engagement and enthusiasm in their work. We observed these teachers at work with their students on two occasions for two hours, recording our observations as field notes. We also carried out two appreciative focus group conversations at each site that lasted an hour each time. These conversations were open-ended, with a series of prompts designed to evoke participants’ stories about their experiences of flourishing at work, such as: “Think to a time in your teaching when you felt really well in your work. Maybe you felt alive, engaged, connected, valued, appreciated, and energized. Bring that experience to life for us and describe it in as much detail as you can.” The conversations were recorded, transcribed and then provided to the participants to ensure we aptly captured their stories and statements.

We engaged in several rounds of coding of the transcripts guided by the ideas from the theoretical framework underpinning the adaptive community domain in our model (Figure 1). Early themes included: choice, collaboration, risk taking, resilience, tinkering, hope, feedback, teams, social time, friendships and purpose. We then collapsed these into seven themes: purpose, collaboration, administrative support, synergy, creativity, tinkering and friendship, and noted that these themes resonated with what we observed of these teachers during classroom and school visits. Drawing on Wheatley’s (2006) ideas about how stability in a system comes from a deep and clear awareness of who it is and what it needs that then leads to a growing adeptness to work with its environment (p. 83), we interpreted that adaptive community was understood by these teachers as an ongoing process encouraged through balancing structures for adaptation and co-creation (collaboration, purpose, administrator support) with flexibilities for adaptation and co-creation (synergy, creativity, tinkering, friendships).
Structures for adaptivity: collaboration, purpose and administrator support

These teachers attended to relational knowing through presence, intentional processes and structures for sustaining and growing their positive identity as individual teachers and as a group, and this seemed key to their ongoing health and vitality. As they grew their community, they grew their practice, and as they reflected on and celebrated their improving practice together, they deepened their community. In this section, we describe the themes of community, shared purpose and administrator support.

Collaboration as lived experience

Our participants highlighted the focus on community as an important structure for innovating in their teaching and one of the reasons why they enjoyed their work so much more than they had in the past. Their enjoyment was often expressed through having noticed students’ improved learning as a result of their collaborative teaching arrangements. Both groups of teachers explained that they had noticed that the students were better able to make sense of their learning when the various parts of the program were integrated, rather than studied as separate subjects. Sarah’s description of how community is part of the learning reflects ideas expressed by both groups. When asked why they were so engaged in their teaching, she reflected, “There’s a whole layer underneath everything you guys are talking about and it’s about community. And it’s having kids that feel like they are a part of something, they have good relationships with adults in the building that they trust. And, that also enables them to be risk takers, to break out of that mould that they’ve come to us in.” Robert’s descriptions of what he loved most about teaching at Lynwood resonate with ideas of community:

And I love seeing all the kids together. They are comfortable going from one class to another. And, last night, it was kind of neat because we were doing “meet the teacher night” and the kids would come in and we would meet their parents and the kids would say, “okay come on, let’s go meet my other two teachers.”

He also noted that the positive impact for their students went beyond their classroom, that from talking with teachers at the middle school, students from the Lynwood collaborative group seemed to be able to cope well with the transition to the next level, had a strong sense of support and belonging with a larger group of students, and seemed to enjoy smoother transitions.

The experience of collaborative teaching as the lived experience of growing and deepening community gave the teachers a confidence to adapt in the moment. For example, Steve shared, “we realized that we didn’t have the time to set the game up at lunch. And we were like, okay, what can we do? And we thought okay, I have a prep, why don’t you send your kids over and I can take them for PE and you know, it works because all of us are going to benefit from it.” The teachers had many examples of evolving support and the flow of responding to the moment; this was often described as a benefit of working in community.

Shared purpose

A second structure that enabled these teachers to work in responsive ways was through their shared sense of vision and purpose for their teaching, a common anchor around which they gathered and that kept them grounded as they set their sights on re-imagining learning for their students. For example, Tracy described how a shared vision had been helpful in moving away from patterns of the past:

Some of these kids have been programmed to work [in only one way]. It kind of scares me that, in the world we are going into, we have kids who are not meeting their potential because of limitations that [school has] created for them. And so for me, [working in these collaborative ways,) it’s truly an opportunity for kids to have an expansive approach to learning.
Sarah described how having this shared purpose, or common ideal, had been an essential element for working as well together. She explained how a shared purpose made the work more effortless, and that over time the group seemed to function seamlessly together without much formalized attention. She also noted that when there were disagreements they usually went back to their common purpose to understand each other better, and that this attention to their relationships translated to offering better teaching for their students.

**Administrator support**

A common story we heard through all of our conversations was the importance of the principal who ensured that the collaborative groups had the time and space to work together, that they had the resources necessary to carry out their joint teaching and that they encouraged them to take risks and try out new practices. Sarah said that their group needed innovative leadership to encourage and support the teachers’ creativity. Similarly, Robert shared, “[Administrator] was a huge encouragement to us, helping us understand that, you know the walls that we perceive around us are not necessarily there. We take those walls down [now] any chance we get to take the kids outside to learn. Yeah, they encouraged us in a huge way.”

Other specific supports appreciated from the school leadership were the hiring choices that ensured that the group could sustain itself when members had to leave, due in most cases to end of contracts or maternity leaves. Each of the teacher groups described the importance of having people on the team who were willing to work together, to take risks and try new things, and to engage in the kind of generosity needed to make these teams work. Steve described the importance of hiring someone “[who would want to] know [everyone] and link up and create community within a school.” Each group of teachers had welcomed others into their dynamic units each year, and they were aware of the impact of administrator support to hire, and then assign, teachers who were willing to share in this collaboration. Steve and Robert admitted that if they did not have this careful hiring, that they would likely decide to make their group smaller to ensure they could continue with their purpose and vision of student engagement.

While we have described the importance of structures to adaptive communities, these were not understood as barriers, but rather as adaptive containers, or nests, to hold and cradle the important work of teaching and learning and that allowed for fluidity and integration. We found that these kinds of adaptive structures seemed to evoke and assist further flexibilities that supported the ongoing co-creation of the community.

**Flexibilities: support and care, synergy and creativity**

The communities that these teachers crafted emerged from a set of structures that enabled them to carry out their work together, and also from a set of flexibilities that had added a sense of play, joy and love to their work that contributed to their ongoing learning and innovation in their teaching. The themes of support and care for each other, a sense of synergy and creativity emerged as central for how these teachers described how risk taking to improve and provide even better experiences and activities for their students had been a driving force behind their work together.

**Support and care to improve practice**

Bill had been teaching for 20 years when he agreed to join the Bayview group and try something he had never done in his career, collaboration. He described the enjoyment he had reaped from this experience of teaching with other adults in the room, and his surprise that he had been willing to try out as many new practices and experiences as he had. He shared:

> Well it’s like I never would have done that [on my own] right? I would still not be doing it right? Now if I go back to my room I still may not do it, but when you are with a group, it’s like safety, if everybody is willing to gamble and go, “let’s go.” Right? If it doesn’t work, it doesn’t work, we all come back and say, “yeah.”
The idea shared by both groups was that working closely entwined with others was empowering because it relieved the fear of getting things wrong. Beyond that, the teachers expressed that greater insight from multiple perspectives increased their confidence in their own understandings. Sarah said, “you get authentic evidence of those connections because I think sometimes as a teacher you can trick yourself into thinking that kids get things when they don’t because you have probed in a certain way.” This way of using the group to see beyond their own subjectivity helped the teachers respond more effectively. Tracy described her appreciation of the various perspectives and noted the importance of feeling safe for this to occur:

I need to work with my colleagues and I need to feel inspired and have that opportunity for us to grow together and re-look at, because all these different subjects and trying to look at them holistically and through an interdisciplinary approach, but it’s scary too, like exactly what you said, it’s scary to teachers because it’s unknown and I get it because it was unknown [to me].

Steve shared a similar appreciation for getting feedback from each other, saying “that’s the other really great thing about this is when we do things we always get to come back and say ‘how did this go? How can we improve it?’” Robert explained how he enjoys the sharing aspect of working together, saying “[it often] seems easy for teachers to think, ‘this is my world, these are my kids right?’ But when the focus shifts to our world, our kids and our projects, a powerful change in ethics occurs and a sense of joy takes over.”

The Bayview group left the school on Wednesdays to have lunch out so that they remembered to be social and have fun together. Similarly, Melanie shared that part of their magic was, “We have fun, it’s engaging for us, it’s engaging for the kids and it’s great. I don’t know how we fit together so well, but we do […] it just shows how much we need each other to be around. We find it really strange when one of us isn’t there […]. It’s really powerful to have the three of us together.”

For these groups of teachers, humor, care, attention to relationships and supporting each other through constructive feedback that helped them grow and improve in their practice had been essential supporting elements that had fostered a desire to take risks and innovate in their work.

Teacher synergy for adaptive work
The teachers described their abilities to adapt, shift and grow their ideas almost effortlessly through this collaborative teaching. They credited this dynamic movement of teaching and learning to the synergy that happened when they combined their talents, energies and passions toward one common purpose. One of the Bayview administrators briefly joined one of our conversations and described how she had noticed that “with this group, one plus one plus one plus one does not equal four, it equals infinity. There is so much potential in this group together.” Melanie shared about how this synergy had been happening in her Lynwood group:

And the kids get more out of it because they are learning from three different minds, right? […] we got to enjoy it because we got to dive deeper into one subject area instead of having to cover all three in such a short amount of time, so it makes it so we can get more into what we want the kids to learn about and take with them.

Robert then chimed in, reflecting:

[…] when I think of all the things that we have planned together, I really think that three minds are better than one. I just think that you can come up with so many creative things. You have the courage to take on many more things with the kids when you know that it’s not just up to you to be supportive. Not just three teachers, but also the CEAs that work with us, it’s huge.

The teachers acknowledged the benefit of having had many minds and hearts engaged in planning, delivering and assessing the best learning they possibly could for their students.
They talked about how they had started to become “seamless” in their routines and that they had begun to “finish each other’s thoughts.” Steve described how he was not sure how they were “able to pull off the kinds of things we do,” but that he thrived in this climate of shared vision, shared planning, shared enthusiasm for challenging and supporting their students and the companionship in their work. During one of the conversations a student teacher who had been with the Lynwood group sat in and expressed his views of what he had observed and experienced as part of working with these teachers:

> They have something special and I don’t use that word lightly. I’ve had the opportunity now to be immersed in [many] school communities, many different school communities throughout my university so far, and what they have going on in terms of the collaboration and in terms of commitment, they are so committed and dedicated, forward thinking. The foresight among them is amazing. Everything they do is for the betterment of education and with the kids in mind, and it’s only possible because they work as a team. They feed off each other.

**Creativity and risk taking**

These groups of teachers shared the impact of an open, trusting and enthusiastic administrator to support their creativity and to challenge them to grow their ideas and reach for new heights. For example, Robert said:

> I think the creative ideas [have pushed us] and this is something that [our administrator] encouraged us with a few years ago. She could kind of opened the door for us and said, “you know if you could do anything, like ignore the walls of the school for a minute, if you could just think completely outside the walls of the school what would you do?”

He went on to discuss how they had noticed that this freedom to innovate to improve student engagement resulted in them becoming more engaged themselves as teachers. He explained his reflections on how his mindset about teaching had shifted, “I think a lot of people might sometimes feel confined, or that this is the exact lesson you have to teach, and this is how you teach it. But if you can start thinking outside of that you are actually a lot freer. You don’t need to be stuck in that situation, and that can sometimes happen.” Steve jumped in to explain how he had enjoyed the creative processes of building new ideas together:

> Yeah, it was amazing [creating that lesson together for them], and the comprehension of every single kid in the class was just, like they had it, they knew, they experienced it right? And that’s the thing that’s kind of fun about it. Like, this is kind of a crazy idea […] sometimes if you have people who are willing to be crazy with you, you can actually do it.

He explained how their thinking and their processes were an act of creativity that had become the fuel for their work together saying, “But it’s just creatively [asking] ‘how are we going to teach this, how are we going to make this interesting for us and how are we going to show kids learning, right?’”

An interesting idea that emerged as part of the creative process for these groups was the freedom to try out new ideas, along with the freedom to discard ideas and routines that were not serving them well. Sarah described that, “when we talk about the dynamics and the composition of the group, I think it’s something that needs to be addressed is the intention and the culture of the group that fits right? And so as we start to make traditions we need to be flexible to leave those traditions as well.” Robert shared his appreciation for the group influencing him being able to shift and leave behind teaching ways that no longer served his students:

> […] when I think of my teaching style, I [now] use a textbook very rarely. There are just so many other creative things, creative ways to engage the kids. And, I look at the kids’ math book now and we don’t use it very much. The kids use their whiteboards to show their knowledge, we use so many manipulatives, and different types of games, and part of that is just my own development over the years, but part of it is seeing what my colleagues are doing and the influence of their ideas.
Growing adaptive community: the power of positive relationships

These teachers’ ongoing attention to relationships and presence connected to how they experienced a sense of community, trust and a freedom to innovate in their teaching, a dynamic response to their desire to positively harness the constant changes they see as part of the learning in their community. This resonates with findings in positive organizational research where experiencing positive relationships and connections at work has been linked to improving performance and commitment (Stephens et al., 2011). Carmeli and Spreitzer (2009) found that trust and a sense of connectivity were key ingredients that contribute to innovation at work, and that “thriving at work not only enables employees to get their job done well but also increases their capacity to display innovative work behaviors” (p. 184). Aligning with, and also extending, these findings, we see that thriving is also a relational capacity, where developing relationships of trust, care, connection and belonging builds a supportive climate for strong teaching and learning, and that these relational conditions seemed to contribute to building a social container that promoted flourishing. This led to innovation, as teachers worked together in ways that promoted their learning and growth as a group and increased their sense of vitality in their work. Spontaneously helping each other, learning to respectfully disagree with each other, valuing each others’ ways of teaching, enjoying and appreciating each other were a few of the examples of how these teachers attended to relational conditions to nurture the community, and that this contributed to them feeling a greater sense of well-being.

Collaboration and inquiry learning are increasingly encouraged to engage students in deeper learning and this requires that teachers and administrators develop in themselves the habits of mind and heart necessary for adaptive, responsive and innovative teaching and learning (Bridgeland et al., 2013; Erickson, 2008; Erikson and Lanning, 2013; Kools and Stoll, 2016). We argue that focusing on positive relationships in a living system provides

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Table I. Adaptive community embodies relational knowing and presence.
opportunities for teachers to collaboratively inquire into who they are (identity) and what they need to thrive (adaptivity). From these relational learning teachers can make decisions that contribute to growing well-being – working well together in relationships that provide a sense of care, belonging, enjoyment, meaning and achievement. We see this as a complementary perspective to the research on collaboration, where we know the importance of building climates of trust for the risk taking that is necessary for innovation to happen (Stoll and Temperley, 2009). However, we do now wonder how we can encourage and support, at the individual and collective levels, ways for teachers to engage in this relational learning that requires them to show up as contributing members of a flourishing system. What we know from our participants, and from systems learning, is that the opportunity to learn from the mistakes and failures, as well as from successes and positive growth, is imperative and that this learning is magnified if it can happen in a collaborative way (Goleman and Senge, 2014; Stoll and Louis, 2007). We would add that attending to teachers’ sense of engagement, connection, meaning, wholeness, aliveness and other aspects of well-being also contributes to growing conditions where they seek out ways to collaboratively inquire into their work, to take risks (trying new ways and letting go of old ways of teaching and learning), to reflect on the outcomes and tinker as necessary. The focus on well-being provides a catalyzing, or igniting, role where teachers feel a sense of flourishing as they engage in their collaborative endeavors and that this has an effect of promoting more of those positive experiences in the future; what Cameron (2008) called a virtuous cycle.

These educators demonstrated that they had personal dispositions and capacities for engaging themselves and others in an ongoing pursuit of thriving in their work. They were capable of supporting and guiding each other to develop the emotional and social intelligences needed for building and maintaining positive relationships at work. For example, Goleman and Senge (2014) argued that there is an important synergy between social emotional learning and systems thinking, that when harnessed produces a sense of thriving. As a social emotional competence, Goleman (2006) argued that adaptivity, which he described as the capacity to have flexibility in handling change, being able to juggle multiple demands, and adapting to new situations with new ideas or innovative approaches, can be learned. In our work with teachers and administrators in the flourishing research, participants found the conceptual model (Figure 1) to be a helpful tool for reflecting on personal and systemic capacities for well-being. Wheatley (2006) argued, “If we are seeking resilient organizations, a prized priority of living systems, information is a key ally” (p. 99). Models, organizational stories and learning mentors (such as the principal and other teachers) can serve as anchoring points for the information needed by and for the system to learn how to thrive. We suggest more research is needed to determine and develop strategies and tools for educators to learn how to appropriately and generatively gather, hold and distribute information for systems- and social-emotional learning. One of the recurring themes in our data was the critical importance of the school principal in fostering and supporting a school climate where teachers and their students could flourish. Focusing on and growing positive leadership, wherever this may be found in the system, can be an important catalyst for growing and sustaining conditions where others may thrive (Cameron, 2008; Quinn, 2015).

Conclusions
While small in scale and not generalizable across contexts, our research offers particular examples of what is working well for these teachers. The findings describe the structures and flexibilities contributing to their adaptive learning communities. We hope that insights from these examples are generative, that they resonate with, and even inspire others to examine the possible benefits and potentials that may come from a positive approach to research and practice in school improvement in their own contexts. As such, we have offered
our descriptions and examples for readers to draw their own conclusions from their experiences and observations in their schools. We know that our participants expressed appreciation at the opportunity to engage with their colleagues to explore the best of what they do and who they are as they co-constructed positive images of their desired futures together through the appreciative case study experiences. They described how well-being was connected with feeling collegial support, care, shared meaning and engagement and where positive relationships were the anchor, or core, of their community. Their adaptive community was an ongoing process that supported them in taking risks and having fun as they worked together closely, often, and over time, to continually refine their teacher to offer meaningful, engaging and responsive learning opportunities for all their students.

Developing relationships and growing well-being at work requires attention to empowering teachers to co-create the structures and flexibilities necessary for them to feel a sense of flourishing in their work. We see this as a new ethic in education, an ethic of appreciation that focuses on flourishing to support and encourage the more traditional ethics of justice, care, community and professionalism (Furman, 2004; Shapiro and Stefkovich, 2011; Sturratt, 2004). This ethic might provide new opportunities for the shifts in mind and heart that are needed to encourage and sustain well-being for adaptive professional learning communities. This ethic of appreciation aligns with a humanistic approach to school organization, where the purpose of education is assumed to be a focus on sustaining and enhancing the dignity, capacity and welfare of the human person, in relation to others and to nature (The United Nations Educational, Scientific and Cultural Organization, 2015), with a focus and attention on inclusion, equity and excellence for all.

References


Further reading


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