

Emergence in School Systems: Lessons from Complexity and Pedagogical Leadership

Gabriela Alonso-Yanez, Sharon Friesen,
Armando Paulino Preciado-Babb, & Barbara Brown
University of Calgary

Abstract

The theoretical framework for this study draws on conceptual advances from two bodies of scholarship: 1) complexity thinking in education, which has recently focused on school system change and, 2) school leadership research, which has recently attended to the effects of leadership interventions to school improvement. Using a complexity-thinking framework, the purpose of this study was to understand how leadership practices contribute to shaping change in school systems and how change occurred across the system. Our study was conducted in an urban centre in Alberta within a public-school jurisdiction and in an area of the city that had a high population of students from culturally and linguistically diverse backgrounds from low-income households compared to other areas across the school jurisdiction. Students in this area typically scored in the lowest quartile on provincial standardized examinations. Our findings are significant because complexity thinking in the context of school leadership has not received sufficient empirical attention. In our study we identified and described pedagogical leadership practices that play a central role in redressing disparities currently found in schools.

Keywords: complexity in education, school change, leadership, equity, organizations

Introduction

The educational applications of complexity science consist of a range of interconnected fields and theories, including complex adaptive systems, complexity, complexity thinking/theory/science, dynamical systems theory, generative science, and systems theory (Davis et al., 2000). A complex system comprises groups of agents that form a unified whole in their interactions, relationships, or dependencies. Learning from a complex system thinking approach has been described as a continuous adaptation of the myriad interactions of diverse elements that give rise to many simultaneous *experiments* as well as *perturbations* in the system, that ultimately produce new knowledge and change (Fenwick & Dahlgren, 2015). Current work in complexity point to the need to examine social organizations with a focus on the emergent circumstances—e.g., the creative experiments and disturbances—arising from the interaction of varied elements within systems, rather than focusing on the agents individually (Lichtenstein & Plowman, 2009; Male & Palaiologou, 2015).

Research on leadership suggests that traditional leadership models have been often shaped by top-down bureaucratic paradigms that had to deal with a very different set of circumstances than the ones we encounter today (Davenport, 2001; Uhl-Bien et al., 2007). Contemporary leadership models require designs that account for diversity and continuous change in complex, interactive dynamic environments from which emergent, unexpected outcomes result. Complexity within leadership theory recognizes the

dynamic interactions that take place within organizations as they change, create innovation, and evolve. The focus is on complex relationships and network interactions rather than controlling, standardizing, and managing the behaviours and actions of single agents (Marion & Uhl-Bien, 2007; Uhl-Bien et al., 2007). Further, complexity leadership theory proposes that adaptability occurs in the everyday interactions among individuals responding to triggers in the work environment caused by a varied set of factors. These interactions connect to produce strong emergent phenomena at various levels of the system (Lichtenstein & Plowman, 2009). Male and Palaiologou's (2015) research on educational organizations describe how levels of complexity produce emergent phenomena.

In this study, we examined school leadership practices through a complexity lens. This offered an opportunity to describe and understand the dynamic, multifaceted character that preceded emergence in ways that traditional linear approaches can often overlook. Using a complexity-thinking framework in this study, we considered school leadership practices as a range of interconnected factors that contribute to shaping change in a zone within a large metro school system that was invested in improving school leader's leadership practices. The purpose of improving leadership practices was to ensure that more students within this system could successfully demonstrate learning outcomes in a school culture with high expectations, caring, respect, and support.

Context of the study

This study utilised data that was part of a larger research study exploring a Design-based Professional Learning Intervention (DBPL) over three years: 2011—2013 (Chu et al., 2020; Friesen & Jacobsen, 2015). Researchers involved in this intervention used a design-based research framework in which school leaders (principals, assistant principals, and school learning leaders) worked together with researchers and professional learning consultants to design and study professional learning for school leaders focused on developing and strengthening leaders' practices in the areas of developing and ensuring quality teaching and raising expectations for student learning. The DBPL involved cycles of knowledge creation/knowledge building and collaborative inquiry for purposes of transforming collective responsibility and offering varied opportunities for learning. The DBPL drew upon Bereiter and Scardamalia's (2014) definition of knowledge creation/knowledge-building as individuals taking collective responsibility for the "the production and continual improvement of ideas" (p. 36). It also drew upon Timperley's (2008) contention that learners "need multiple opportunities to absorb new information and translate it into practice" (p. 15). Considering that learning is iterative rather than linear, the intervention offered participants opportunities to revisit partially understood ideas as they try them out in their everyday school contexts. Researchers analyzed the results from each professional learning session and worked with the professional learning consultants and a team of school leaders to design subsequent learning sessions based on the results emerging from each professional learning session.

The study was conducted in an urban centre in Alberta within a public-school jurisdiction and in an area of the city that had a high population of students from culturally and linguistically diverse backgrounds from low-income households compared to other areas across the school jurisdiction. Students in this area typically scored in the lowest quartile on provincial standardized examinations. In the outset of this larger research study, school leaders participating in the DBPL described in detail a culture of low expectations for student learning, including achievement and pervasive and widely held assumptions about the schools in the SDC zone (pseudonym) of the city. For instance, a number of school leaders hired in schools in the SDC zone viewed their positions as temporary placements with some viewing it as a punishment given the location and reputation for low student achievement.

Members of the leadership team were concerned and held assumptions that school principals and assistant principals did not have a shared, collective understanding of quality teaching. They also speculated that school leaders focused most of their attention on managerial types of tasks focusing on control, rather than leading the work of improving teaching and learning through pedagogical leadership practices. School leaders indicated that in order to address the problem of the culture of low expectations for students, lack of quality teaching, and little to no shared instructional leadership practices, the creation of a distinct professional learning program was required. The central purpose of this novel DBPL intervention was to offer opportunities for leaders to develop shared leadership practices that included high-quality instruction across the area and raised expectations for student learning. The research team used this opportunity to design professional learning that built upon complex leadership practices asso-

ciated with pedagogical leadership. They also saw this as a matter of social justice that required efforts to change underlying deficit assumptions of low expectations for student learning.

The purpose of the DBPL intervention was to work with a team of district and school leaders to bring a research lens to the problem through designing professional learning that required school leaders to build their leadership practices in the areas of developing and ensuring quality teaching and raising expectations for student learning. An overarching question guiding the research was: In what ways do school leaders go about creating shared pedagogical leadership practices focused on the work of improving quality teaching and raising expectations for student learning?

Theoretical Framework: Complexity and Complexity Leadership Theory

The theoretical framework for this study draws on conceptual advances from two bodies of scholarship: 1) complexity thinking in education, which has also focused on school system change and, 2) complexity leadership theory, which suggests framing leadership as a complex interactive dynamic from which adaptive outcomes emerge (Crick, et al., 2017; Uhl-Bien et al., 2007). What is most important for our research is the simultaneous focus on the emergence and observations of novel interactions that occurred during the DBPL intervention rather than on individual agents in schools. We are interested in the pedagogical leadership practices for school improvement and the application of complexity thinking to describe emergent circumstances.

The complexity framework originated in the natural sciences, but education researchers have borrowed it as a powerful paradigm for understanding school systems as large collections of connected elements that influence each other. It is particularly useful for describing flexible structures and emerging processes within school systems and school organizations (Davis & Sumara, 2006; Sawyer, 2005; Uhl-Bien et al., 2017). As a developing paradigm within school leadership literature, the complexity framework has been used as a robust tool to describe leadership practices that affect school change because it accounts for the various relationships school actors encounter and leverage as they modify rules and respond and adjust to diverse and continuous dynamic environments (Clarke, 2016; Morrison, 2010; Uhl-Bien et al., 2007).

Over the past couple of decades, school leadership literature has transitioned from describing traditionally ordered, stable, and top-down management styles to describing systems characterized by diverse school actors, collective decision-making processes, and conditions that interact with one another to bring about change (Edmonds, 1979; Hallinger, 2003; Southworth, 2002; Uhl-Bien et al., 2007). For instance, leadership approaches such as transactional, enabling, transformational, pedagogical, and shared leadership have been used to define these non-traditional and arguably more comprehensive leadership practices (Hallinger, 2003; Robinson et al., 2008). Among these new leadership approaches is pedagogical leadership. Male and Palaiologou (2015) described a pedagogical leadership approach in the following way:

*Pedagogy in the 21st century can thus be seen as the justifiable belief that the process for teaching and learning is cultivated in an environment (i.e., education) where situational and doxastic (common beliefs) justify the construction of knowledge. Pedagogy, therefore, is cultivated by the quest for understanding the being of the learners (the ecology of their community), the experiences of the learners and their community and the meaning making and problem solving required in that context for creating effective educational interactions and relationships. In that sense, pedagogical axes serve as foundation elements of the praxis that is the key activity of educational organisations. In that context, leadership in the 21st century is an aspect of pedagogical axes; thus we call it **pedagogical leadership**. (p. 221)*

Other researchers argue that pedagogical leadership characterizes a sub-set of practices that school leaders perform, aimed at improving school systems (Fonsen, 2013; Sergiovanni, 1998; Webb, 2005). These practices encompass activities, behaviours, and collective processes that foster positive student experiences and student well-being. Sergiovanni (1998) described pedagogical leadership as an investment in various forms of human capital that included social, academic, intellectual, and professional capital. “The episteme of pedagogy is of greater relevance to leaders in education in an age where the

promotion of effective learning involves more than merely ensuring that the relationship between teachers and learners is satisfactory or good” (Male & Palaiologou, 2012, p. 107). Sergiovanni described this leadership approach as “a fabric of reciprocal responsibilities, and support is woven among the faculty that adds value to teachers and students alike” (p. 40).

Despite the growing interest in the construct, it is evident that the construct for pedagogical leadership remains in progress. Ärlestig and Törnsén (2014) conducted a study focused on a pedagogical leadership model that aligns with elements of both transformational and instructional leadership approaches. Their pedagogical leadership model contains three main parts: process-steering, goal-steering, and result-steering. Each of the three elements interact with the others as a collective learning process. The process-steering component focuses on “leading the core process of teaching and learning” (Ärlestig & Törnsén, 2014, p. 858). The process-steering component involves classroom observation with systematic feedback. Goal-steering provides the prerequisites for teaching, including “objectives and visions, high expectations, and organization of the school” (Ärlestig & Törnsén, 2014, p. 859). This component of pedagogical leadership creates the starting points for teacher learning with a clear connection back to process-steering. Result-steering relates to “school results and the qualities to student learning” (Ärlestig & Törnsén, 2014, p. 859). This component involves regular assessment of student learning and analysis of the results to check for alignment with the first two components. Ärlestig and Törnsén’s study concluded that there is no one best pedagogical leadership practice. However, Ärlestig and Törnsén’s model of pedagogical leadership can assist in making pedagogical leadership more concrete without limitations that are inherent with other leadership models.

As we see it, Ärlestig and Törnsén’s (2014) model of pedagogical leadership can be used for the present study with a complexity lens. This perspective will allow us to capture and describe the emergence of activities, behaviours, and collective processes that can provide a foundation for school organizational change aimed at improving student school experience both academically and emotionally.

Our Particular Complexity-Thinking Framework: Conceptual Definitions

We draw mainly on the theoretical frameworks of complexity thinking proposed by Davis and Sumara (2006) and Morrison (2010), which are popular in education research. To support our understanding of leadership practices, we focus on a complexity systems approach that view the school education realm itself as a “system”—a connected set of components that moves along in an interactive and interdependent, and dynamic manner from which adaptive outcomes emerge.

In the context of complex organizations such as schools, recent empirical work has shown that interactions are often highly recurrent and include the formal and informal activities that occur in an organization. These recurrent interactions are conventional and are generally held to be acceptable practices. Some have described these recurring interactional processes as non-predictable, non-manageable, and non-formalizable (Falconer, 2002). However, recurring processes enable mechanisms of change when individuals and collectives are confronted with new events occurring in the system (Morrison, 2010; Rivkin & Siggelkow, 2007) and change conventional behaviours, which in turn leads to drastic system changes and transformational outcomes.

Such mechanisms of change are often enabled by *loops* (Van de Ven & Poole, 1995), which are circular processes of communication, behaviour, or decision making that provide information to the system about what is working and what needs changing. Integral to the feedback course is the constant scanning by actors, like a leader, of the internal and external environment and existing knowledge (Hall et al., 2001). Internal environments refer to actors within the system who continually look for opportunities to create new knowledge or to remove irrelevant information from the knowledge base. External environments refer to the social, political, and cultural demographics that configure the school system. Both internal and external environments are central to understand change in organizations and are not considered isolated dimensions. Feedback loops precede decision-making and provide the organization with updated information about needs, opportunities, or results (Morrison, 2010).

Leaders constantly look for situations and adjustments that change the behaviour and outcomes in school settings (teaching arrangements, administrative decisions) and constantly observe and analyze the school system’s response to the new situations. Drawing on this information, leaders make decisions about appropriate actions to maintain balance or reinforce change. Mechanisms of change in non-linear systems occur at different degrees depending on the level of the system impacted. For instance, closely

connected elements of the system (teachers and leaders working together every day) will enable mechanisms of change at a faster rate than elements of the system that are far apart (district organizational structures, broader community structures).

Here, we are interested in describing the emergent change in an area (Zone SDC) of a school system using a complexity lens. Change in organizations often expand up or spread across the system as a result of specific actions or behaviours of system actors. We also assume that complex systems begin as a collection of individual actions that create relationships in response to events in the system. These resulting relationships are qualitatively different from the sum of individual actions and are described as new behaviours rather than a simple combination of actions. Again, external environmental factors such as social, cultural, and demographic factors are central to understand system change.

Methodology

In this paper, we report on findings from data and draw upon a larger research study exploring a DBPL intervention over three years: 2011—2013. In the study, we applied a convergent mixed method design (Ivankova & Plano Clark, 2018). A convergent design can be described as occurs when the researcher intends to bring together or interface results of the quantitative and the qualitative analysis so they can be compared or combined. The point of interface within quantitative and qualitative datasets occurred during the data analysis. Three types of data were used in the study: interviews, document analysis, and data extracted from a questionnaire. The questionnaire consisted of 23-items assessing participants' responses to five dimensions of effective teaching: teachers as designers, students engaging in worthwhile work, effective assessment, fostering relationships, and continuous teacher learning (Friesen, 2009). Participants (N=26) rated the degree to which teachers in their school engaged in effective teaching practices as a result of the professional learning sessions. For instance, one item sample read as follows: "Designer: Most teachers intentionally design strong inquiry-based tasks that focus on issues, questions or problems central to the discipline." Participants responded using a four-point rating scale, ranging from "I am confident this is true, and I have data to support my claim" to "I am confident that this is not the case, and I have data to support my claim." In-depth interviews followed the questionnaire component.

The main source of information for this paper and the analysis of leadership practices, however, was the data obtained from school administrators' interviews, reports and DBPL session documents, and the researcher's field notes that were maintained throughout the longitudinal study. The participants interviewed were a purposive sample of those who responded to the questionnaire (n=9) and those who did not submit questionnaire responses (n=5). Semi-structured interviews were conducted with principals and assistant principals at their schools. The interviews lasted 1.5 to 2 hours, and the interviewees were presented with short descriptive questions around three topics: 1) Changes in leadership practices over the past three years, 2) Leadership practices that affected the school community (parents, teachers, and students) and 3) Roadblocks to operationalizing pedagogical leadership (aimed at improving student outcomes). All questions were asked in a non-leading, open way, and probing questions were used to encourage interviewees to expand and elaborate on examples and express their views.

We also used data extracted from the Provincial Accountability Pillar Reports from 2011, 2012, and 2013 for the school area under study. This assessment focused on categories that reflect dimensions of education of importance to parents and the public. Given our interest in pedagogical leadership, we extracted data from the survey first marker dimension: "Safe and caring schools." For this section, parents, teachers, and students are asked whether they agree that: students feel safe at school; students feel safe on the way to and from school; students treat each other well at school; teachers care about their students; and students are treated fairly by adults at school. Of note, we use data from this marker dimension which is measured through data collected by the survey of students, teachers, and parents in each school in the area. Data included here does not comprise a larger sample of schools in the province. In contrast to other categories measured in the survey, the Safe and Caring Schools Marker is not measured through annual reports or other provincial data. Data drawn from the Accountability Pillar is used here to show positive trends coupled with interview evidence with principals and staff at participating schools.

Table 1 includes a description of data sources and the number of participants who completed the questionnaire, the number of participants who volunteered to participate in the interviews, the number of DBPL sessions when members of the research team prepared field notes from their observations, as well as the number of accountability pillar reports that were reviewed over the duration of the three-year

 study.

Table 1
Data Sources

Data source	Description	Total
Questionnaire	Principals and assistant principals	26
Interviews	Principals and assistant principals	14
DBPL session documents and reports	Documents reporting final session reflections and planning work across the three years of the project	19
Field Notes	Researcher field notes & observations from DBPL sessions	19
Accountability Pillar Reports	For the years 2011–2013 of the schools in the SDC Zone	3

Overview of the Research Site Under Study

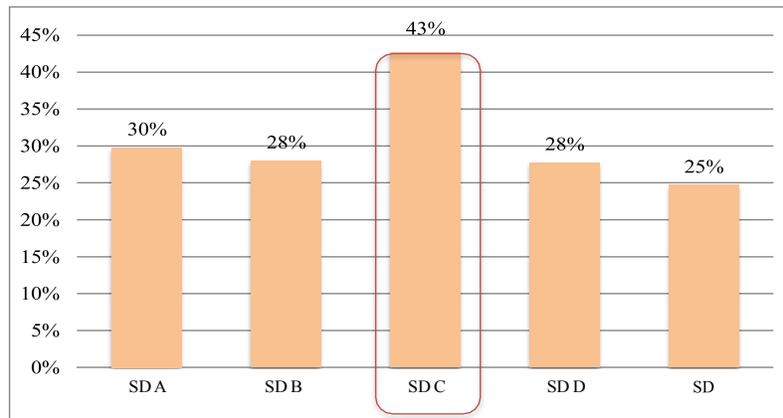
The DBPL was conducted in an urban zone (SDC) comprising 47 schools. This zone of the city, one out of five zones, where the study was conducted and is located in a zone that is described as highly marginalized and socio-spatially polarized (Townshend et al., 2018) with a growing concentration of low- and very-low-income residents in suburban neighborhoods (Meij et al., 2020). The group of schools in the SDC zone has the highest population of identified Aboriginal students with a lower socioeconomic family background (Baker, 2014; Tomaszewski et al., 2020), and higher student mobility than other zones in the city. The SDC zone also has a high percentage of immigrant students and the highest percentage of students with exceptional needs (Miller & Smart, 2011). Here, we use the definition of socioeconomic family background as a measure of one's combined economic and social status which tends to be associated with school performance. Socioeconomic family background does not refer to conventional definitions of socioeconomic status but points to issues of marginalization and strong stratification, mostly related with social stereotypes and deficit assumptions (Bourdieu & Moïshe, 1993). Demographic information of the SDC zone in comparison to the other zones in the city, including average household income, total lone-parent families, and the number of first-generation immigrants, is presented in Figures 1, 2, and 3.

Figure 1*Average Household Income by School District (SD)*

Note. SD C was the focus of this study.

Household income is often used to create a general picture of income across a given geographical area and as a way of indicating the degree to which a family is financially stable (Statistics Canada, 2021). Figure 1 shows a sharp contrast of lower household income in the SDC zone in comparison to other zones in the city. Data related to parents living alone, as represented in Figure 2, is one indicator in attempting to establish a description of the family and home circumstances for the population in this zone of the city (Statistics Canada, 2021). This indicator also shows a higher percentage of lone-parents of the targeted zone compared to other zones. Significant for our study, the location of the schools in the SDC zone include a larger percentage of recent immigrants than other zones (Figure 3). Recent immigrants can face some of the highest poverty rates of any demographic group in the city (Statistics Canada, 2021).

Figure 2*Total Lone Parents by School District (SD)*

Figure 3*First-generation Immigrants*

Combined, the three demographic indicators—average household income, total lone parent families, and a number of first-generation immigrants—can indicate there is a lower socioeconomic possibility for students in the SDC zone examined in this study in comparison to the other zones in the city.

Data Analysis

Qualitative data were analyzed using grounded theory and narrative analysis. Consistent with Grounded Theory analysis methods (Charmaz, 2006; Clarke et al., 2015), we carried out initial open coding and produced over 25 codes for each interview. We compared the codes in order to identify similarities and differences and to develop larger themes. We then created ten categories which, upon review, were merged into two main themes: 1) Emergent sites of leadership that enabled pedagogical practices to foster student success and 2) Emergence of responses to deficit assumptions. We used a narrative analysis which allowed us to give greater importance to the context and circumstances of the narrative, including historical, geographical, cultural, and of course, the background of the author/participant (Lancer & Philips, 2020). We compared and contrasted qualitative data sets to better understand the experience of participants. Descriptive statistics were used to describe the basic features of the data drawn from questionnaires, and we used Excel to analyze and plot the extracted data from the Accountability Pillar Results from 2011, 2012, and 2013 (Alberta Government, 2011, 2012, 2013). In our comprehensive analysis, we aimed to describe what participants identified as emergent pedagogical leadership practices. We did not attempt to reach conclusions that extend beyond the immediate data from this study and its participants.

Findings

The analysis and interpretation of the various data led us to identify pedagogical leadership practices that focused on teaching and learning. While asserting that pedagogical leadership based on the accounts of a group of administrators, has any type of effect or mediation on, for example, student success or well-being would be unwarranted, we do conclude that the administrative staff contend that their work has an effect on student success and that they see their actions as connected to the improvement of student outcomes. In what follows, we use a complexity-thinking framework to describe our findings.

Emergent sites of leadership that enabled pedagogical practices to foster student success

We identified relational interactions in the ecology of the school communities as the hallmarks for improvement. Depending on the level of analysis, an agent within the system may represent an individual

leader, a professional learning team, or an entire school district organization. Agents connect to greater or lesser degrees with other agents, sharing knowledge, successful interventions, and resources. Changes promoted by agents at one level have an effect on the larger system and spread across the system. Changes in school systems expanded to other systems within school organizations. For example, we found that effective teaching repertoires affected the school system at distinct levels in distinct ways. Repertoires include a stock of vocabulary, strategies, and shared activities that teachers and leaders in the school system knew and/or were prepared to use or perform in various instances and which were deliberately designed to increase student learning and engagement. These teaching repertoires were originally devised and generated by school leaders in their first stages of professional learning conversations and interactions as a means to solve challenges and obstacles for collaboration. We noted in our field notes that participants consistently referred to a lack of common frameworks and language shared among leaders in the initial stages of their work.

This became an obstacle for reflective and collective practice. As a response to that constraint, leaders described a process of decision-making focused on finding external resources to facilitate a collective learning process across the school. By shifting financial resources, leaders made key pieces of literature on effective teaching available to teachers within their school. They also organized professional development opportunities for teachers, targeted at fostering effective teaching, and encouraged collaborative spaces where they could share successful strategies. These shared reference points created repertoires of activities, vocabulary and strategies focused on student learning and well-being. School leaders played an important role in fostering shared repertoires within their teacher groups. The following quotes are two excerpts from interviews with leaders that illustrate these situations:

*We've taken up some very key pieces of literature with Viviane Robinson's **Student-Centered Leadership**, **The Growth Mindset** work from Carol Dweck, Damian Cooper's *Redefining Fair*, the work from Sharon Friesen and the group on **The Teachers Effectiveness Framework** to deepen our understanding of what those pieces are and how we can put them to work to improve learning environments in our schools. (Interview 7)*

*Our work has focused on ensuring that there is a common understanding around discipline-based inquiry within the school, looking at *The Teacher Effectiveness Framework* and looking at student-centered leadership. That has then permitted me to be able to establish a theory of action for a school development plan and share that with the teachers. This guides our work as a collective. (Interview 3)*

Teaching repertoires were extended *in the process* of collaborating with other leaders and with the teachers. Collaborating with teachers deepened leaders' understanding of effective teaching practices aimed at improving students' experiences within the school. Having a common framework also influenced the emergence of new processes. The following quote from an assistant principal describes the conversations occurring in her school and how those led to a shift in teaching practices from those practices that focused exclusively on following the program of studies, to those that foster student's ability to monitor their learning:

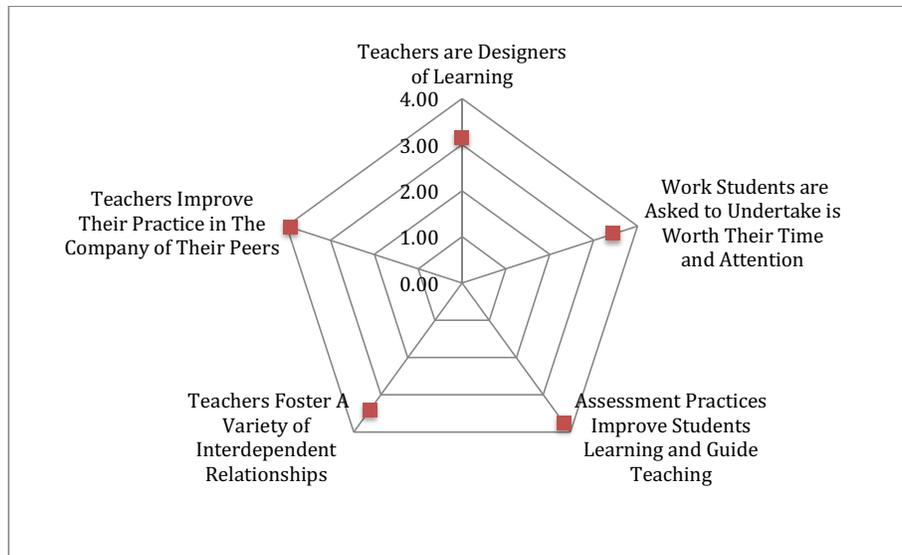
We also had conversations about freeing the teachers up from checking off the knowledge pieces of curriculum and really focusing on the strategies, processes, and attitudes towards learning the program of studies. Our conversations were around how we can make sure students "know how to learn," or "know how to access information," rather than standing up and saying: "In 1975, this happened"... and then testing them. (Interview 5)

Leaders consistently described leadership practices that foster student success, including the following: constantly seeking evidence of student learning; constantly clarifying learning goals; and using various formative assessment strategies. This was consistent with questionnaire responses. We analysed the questionnaire responses using descriptive statistics and plotted the data in a radar chart (Figure 4) to summarize the results. Figure 4 shows the value of each dimension depicted by the node (anchor) on the spoke (axis). While the five dimensions each had a significant presence in the schools, teachers improve

their practice in the company of their peers, and assessment practices appeared to visible dimensions for effective teaching according to the perspectives of the questionnaire respondents.

Figure 4

Appraisal of Leaders: Dimensions of Effective Teaching in Schools



Implicit in participants' responses and their perceptions of change that occurred was the idea that leadership practices designed in the DBPL over the three years had positively affected teaching by supporting and actively encouraging actors within the system to focus on providing conditions for improved student outcomes. The analysis of the interview data and field notes over three years provided more detail regarding the leadership practices that emerged in the schools and actions, behaviours, and decisions that engendered perceived changes.

Leadership in these schools went beyond sharing decisions and guiding teachers to focus on student learning. In fact, leaders reported spending time in classrooms, where they not only supervised or observed but also taught classes and developed a relationship with students. Leaders noted that spending time in the classroom positively contributed to improving the use of a shared repertoire within the school. Further, forming personal connections with students and their struggles seemed to be very useful when leaders attempted to re-culture the school system for shared distributed leadership practices. Having a well-rounded knowledge of the school, the teachers, and the students allowed leaders to collaborate and interact more authentically with others in the system, including parents.

Leaders reported further that the use of a shared repertoire affected other levels of the system, such as actors outside the school setting. For instance, interview data revealed that parents also adopted the use of "effective teaching jargon" particular to the formal school settings. One assistant principal recalled student-parent meetings being a celebration of student work and learning. Another principal would refer to the positive change in conversation with parents when there was a clear distinction between behavior issues and student learning performance:

For instance, parents' questions about student work were targeted at processes of learning and not only at the product. Questions were not only if the kids enjoy doing the task. Now, when we showcase student work, parents ask questions about the work, the content, and students feel proud describing their work. (Interview 3)

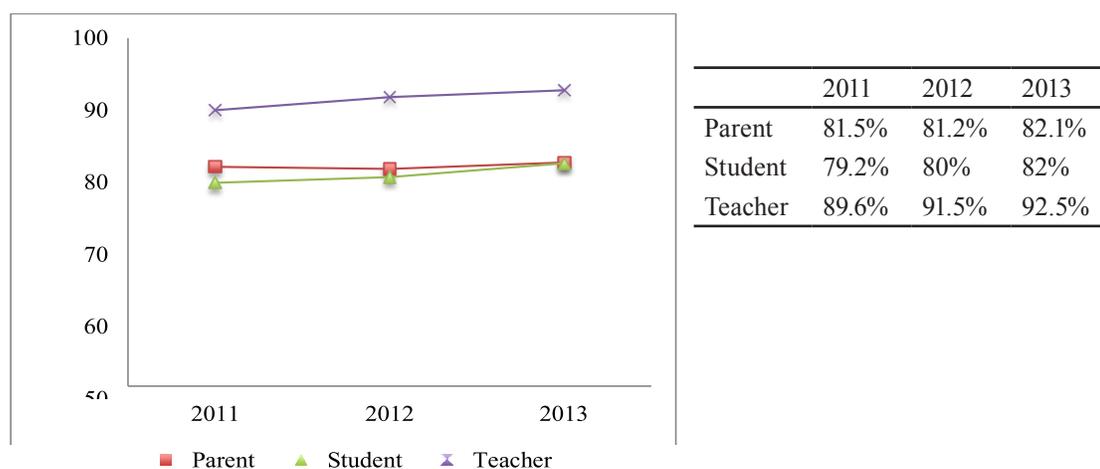
Probably the most exciting for us this year is the parent engagement. I think we are at 87% attendance this last time that to me has been huge. This is based on our conversations with parents. And our aboriginal parents as well, they're making contact, they're attending con-

ferences, they are starting to engage a little bit more with school. Because again, it was that focus on the positive. It wasn't about a report card mark that showed that your kid was working below grade level or about negative behaviour. It was all of the great things that have happened and the growth that's been made. (Interview 9)

Based on our analysis of data, we were able to trace how the use of a shared repertoire expanded up to other levels of the system. For instance, our field notes and records of the planning and organization within the DBPL intervention include examples of change that extended beyond the SDC zone and at a school district-level, such as several new projects and activities leaders initiated across the district to foster collaboration and strengthen the district network outside the district schools (science parent nights and math fairs organized in coordination with other school districts). During the DBPL, leaders worked in groups and described and discussed the activities they were engaging in as a district collective. Our analysis of the results from the Provincial Accountability Pillar Reports (for the three years) also revealed some evidence of changes that were occurring across the district related to fostering well-being (shown in Figure 5).

Figure 5

Percentage Agreement that Schools in the District Under Study are Safe and Caring



According to our analysis of the accountability reports during the three-year study, there was a relatively moderate increase in percentage regarding agreement among parents, teachers and students that students were safe at school, were learning the importance of caring for others, and were treated fairly in school from year 2011 to year 2013 (Alberta Government, 2011, 2012, 2013). These data provided responses from students, parents, and teachers who completed provincial surveys at a larger scale in the school system (district level) for the three-year period.

As we see it, the leadership practices identified across our data correspond with features of effective pedagogical leadership that expanded up and had a streamlined impact in the school system (that is, within and beyond the school). Pedagogical leaders within the school developed structures, made decisions, mobilized financial resources, and enabled spaces to foster the learning and well-being of students.

Emergence of responses to deficit assumptions

We found the leaders in our study experienced a number of challenges when changing their leadership practices at an individual level. They consistently described a shift in their individual, preconceived ideas about leading for effective teaching and in their ideas about what was expected from them in their role as principals and assistant principals. For instance, they assumed that others expected them to spend a significant portion of their time addressing school discipline rather than building relationships with students and understanding their interests. The following quote from a participant serves as an example of

a consistent idea of principals within our sample: The kids saw me as someone who sits in an office, who disciplined them when they've done something wrong, a head disciplinarian (Interview 7).

However, we noted through their ongoing continuous interactions and conversations with other leaders during the DBPL sessions, their ideas and concerns underwent changes, which helped them navigate these beliefs about conventional leadership roles. They were thus able to choose leadership practices that better suited their goals, such as shifting their focus from managing behaviour to building relationships and providing engaging learning opportunities for students. This change was especially important for the welfare of students in this zone of the city, since many belong to groups more vulnerable to negative experiences in schools. The following excerpts from interviews with participants illustrate leaders' descriptions of these realizations:

So for me, a significant shift—when working in those meetings (DBPL) was really focusing on what does it mean to be a leader? What does it look like? Is that different from perhaps our traditional views of what an assistant principal does [which is] related to discipline, related to scheduling, related to coaching others? (Interview 1)

So, yeah, I think that for me, that was probably my most significant challenge in terms of my own leadership—viewing myself as on the ground, in the classroom, with many alongside teachers and getting to know the students. (Interview 1)

Yes. In our building, discipline is a larger piece to the equation at certain times of the year than we'd like and there's a lot of student problem solving that goes on. I also think that maybe here more than other places, I do a bit of a student advocate in my role as principal. I think that it is important that kids in this school, no matter what they have done, need to feel like there is somebody standing in their corner. (Interview 9)

During the interviews, leaders also described barriers at a district and provincial level, including heavy administrative loads, inconsistent district policies, and lack of coordination with programs and services that support students. Leaders referred to the way decision-making authorities—usually disconnected from the realities in the school—designed institutional policies that were incompatible with school needs. Change at the district level was, however, difficult to control given the gap that existed between leaders' own practices and decisions made at a system level. In the following quotes, we present examples of leaders' accounts regarding barriers faced at a system level:

Well, yeah, I can think of a lot of roadblocks, and unfortunately, it mostly comes from Central Office downtown. I think that I have learned—in terms of my leadership—to protect my teachers sometimes from all the stuff that comes from downtown, from Central Office. We continue to have a significant number of bureaucratic administrative tasks that we are responsible for. I like to believe that, at least for the most part, we put the pedagogical pieces before the administrative pieces. But then that means that we're here [at] five or six o'clock at night doing paperwork. (Interview 5)

We noted a gradual change in assumptions about the SDC zone. Schools included in our study were often described with deficit assumptions about the marginalized or minority populations in the schools.

Because of the demographics ... we're probably in the top five in terms of the poorest neighborhoods in the city. So, we feed our kids breakfast, we feed them lunch, we have snacks in the office throughout the day, we clothe our students. So I need to look for outside agencies, social services. I have a bulletin board covered with business cards from various social service agencies, job and family services. (Interview 7)

In the interviews, participants discussed how these assumptions and social perceptions tended

to influence how leaders, teachers, students, and parents experienced school and envisioned goals for the school's future. We found that leaders discussed how they played an important role in moderating the impact of these subjective and often negative social perceptions on their students when they adopted leadership practices that interrogated the deficit perceptions about the marginalized populations and their capabilities. The following quotes illustrate how leaders perceived changes in the ways the school zone was noticed:

For so many years, our schools have been seen as the disadvantaged ones. I think that a big part of our role and responsibility has been to become advocates for our students, and recognizing and having the conversation that our kiddos are just as capable in our school as they are in any school area in this city or in this province. Also, sharing our successes with people in our area, with people outside of our area. (Interview 9)

We talked about how there are shifting or changing narratives related to our district and our learners here... A long time ago, maybe even five, six years ago, just because of the demographics of the area, where new immigrants came, the low-cost housing and all of those pieces. And at one time our zone was thought of as all we do is we just deal with the behaviour and the social, emotional, and we don't really get the kids to engage in any high-level thinking because we're just dealing with poverty. And I think that the narrative has certainly shifted, and I see that certainly when [at] our conversations at our professional learning sessions we stop asking: how does poverty impact learning? It's just about learning and I think that we've taken poverty out of the equation and I think it's been a significant change in mindset. (Interview 1)

To navigate the complex landscape of the school system at a zone level, leaders had to constantly challenge deficit assumptions about their area. Again, leaders were able to exert limited control over these deficit assumptions at a system level, but they constantly challenged the negative perceptions at the school level with some evidence of their success. The change in perceptions of the area was possibly reflected in results from the Accountability Pillar Reports over the three years. Although, it is difficult to show a direct relationship to the results in our study, we noted the reports showed an increasing trend in parent, teacher and student perceptions that schools in the area were safe and caring.

Discussion and Conclusion

In this paper, we investigated leadership practices through a complexity thinking lens. Educational researchers are employing a complexity lens for their research into school leadership, even as critiques of this approach persist. The criticisms pivot on the lack of transparency in the theoretical grounding and methodological applications that underpin this orientation (Morrison, 2010, 2012). In our study, we addressed these theoretical and methodological critiques by describing early in the study the conceptual underpinnings of our research design. Using metaphors drawn upon complexity-thinking frameworks, such as organizations as systems integrated as wholes within larger systems; recurring processes (formal and informal activities consistent over time); loops (mechanisms of change and adaptation), we described how pedagogical leadership practices changed school systems dynamics and caused these systems to change. We also identified how changes expanded up to other levels within school systems. For instance, leadership practices (individual) had an effect on the collective action level (school communities and schools or zones within districts). The changes described include an organized set of repertoires or collective actions, strategies, activities, and ongoing processes that changed over time and that were designed and aimed towards improving student learning and well-being. In turn, this focus on student learning and well-being also fostered an environment of trust and fairness in schools. We described what we noted as a useful, practical application of complexity thinking, one that addresses a particular problem specific to pedagogical leadership research. In our study, we considered school systems as complex situations shaped by several interconnected factors. We described the processes that underpin the emergence of outcomes that support student well-being and learning. Unlike other complexity frameworks employed in education that offer predictable, generalizable theories of educational change (Mason,

2008), our study offers new provisional, grounded descriptions about school system dynamics based on a variety of data and evidence. What is more relevant as a contribution for current research on leadership and complexity is that here we identified processes and actions that reveal or make explicit how change can expand or spread across a school system from day-to-day activities to changes in perceptions about schools as spaces that support learning, well-being and safety.

In the leadership research literature, pedagogical leadership has been described as a complex multifactor construct that does not lend itself to reductionist methods of exploration and analysis. The interrelated and interacting components of Årlestig and Törnsén (2014) approach to pedagogical leadership captures the varied notions and central tenets that we have attempted to capture. In our study, we have identified emergent sites and responses that could complement previous descriptions of pedagogical leadership, and we have provided a nuanced account of how multiple factors interrelate to generate spaces for school administrators to perform pedagogical leadership. Previous research suggests that pedagogical leadership practices impact positively a range of student outcomes, including data related to achievement, student safety, and the ability of students to relate to each other in positive ways (Harris, 2006; Louis et al., 2012; Robinson et al., 2009). However, pedagogical practices are not merely characterised by the relationship between outcomes and learning. Data from Male and Palaiologou (2015) “suggest that positions on how an educational organisation should be led has a number of levels of complexity and it needs to be acknowledged that it should be understood that educational process ought to be characterised with what Osberg and Biesta (2007) described as ‘sites of emergence’, which should be the central quest of leadership in educational organisations” (p. 228).

Accordingly, we found that pedagogical leaders in this study identified these sites of emergence as those that shaped their work around the belief that all students were capable of success in learning. They provided a space where students’ abilities were not underestimated and where the school system functioned in the best interest of students. Effective teaching repertoires promoted by leaders within the school system facilitated change in processes through new knowledge and a shared focus on situating the student at the core of practices, decisions, and planning. Leaders began by establishing a common repertoire among actors within the system (teachers and staff). This enabled conversations and processes that fostered effective ways to personalize learning for individual students’ needs and to better support student learning overall. Small-scale changes prompted ongoing modifications that, in turn, spread to other school system actors, specifically parents.

One particularly interesting finding from our research is our report on the activities and practices that pedagogical leaders carried out in their schools and how these activities and practices can possibly affect the larger school systems. Previous research suggests how school leaders spend their time in school relates to student outcomes; specifically supporting financial and administrative decisions that are deliberately targeted at improving learning and development of teachers and students (Lichstein & Plowman, 2009; Louis et al., 2012). Consistent with this research, in our study, leaders reported that teaching classes and spending more time in the classroom contributed to a shared repertoire within the school that helped foster a positive learning environment.

A large body of research reports a strong link between socioeconomic status and student achievement and a recognition that mainstream policies and school culture reproduce and often exacerbate existing inequalities, especially for families and students from non-dominant groups who have historically had limited access to resources and decision-making power in the educational systems in Canada and elsewhere (Entwisle, 2018; Galloway & Ishimaru, 2017; Theoharis, 2007). Moreover, previous research suggests that educational leaders are more likely to uphold rather than challenge existing inequities (Blackmore, 2002; Byrne-Jimenez & Orr, 2013; Cambron-McCabe & McCarthy, 2005; Tillman & Scheurich, 2013). In our study, we identified and described pedagogical leadership practices and emergent circumstances that can play a role in redressing disparities currently found in schools. Our findings report how a group of leaders challenged deficit assumptions about their schools and population and devised strategies that enabled them to lead, create and maintain educational environments that addressed inequalities in their schools by emphasizing a culture of learning and success.

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