

Thinking Outside the Box: Providing Effective Professional Development for Rural Teachers

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Despite the fact that they are all unique, rural school districts/divisions (in Canada and elsewhere) face similar challenges when it comes to providing effective professional development (PD) for teachers. Issues related to funding, geography, staffing, and contextual differences impact the availability of PD opportunities for educators in rural contexts; however, rural school divisions possess many strengths from which solutions to these challenges might be fashioned. The question of how rural divisions might construct local teacher PD models that draw on local strengths, mitigate local challenges, and support teacher professional growth is critical to the provision of quality education for rural students. Through a single-case study design, this study examined the effectiveness of a rural initiative, the Numeracy Cohort, that was locally constructed to mitigate challenges and improve mathematics instruction and student numeracy outcomes in a school division in Manitoba, Canada. Findings from the study suggest that (a) the Numeracy Cohort model was effective in accommodating contextual differences and mitigating challenges related to funding, geography and staffing through several promising practices; (b) the PD provided to teachers was effective in supporting teacher professional growth in several ways; (c) attention to the multiple nested and dynamic contexts in which teachers worked was an important and effective element of the model; (d) fostering social interaction (among teachers and with more competent others) was important for teacher learning; and (e) finding ways to foster human engagement through mediating tools for learning (e.g., dialogue, reflection, and action research) was critical to the model's success.

Keywords: professional development, teacher professional development, numeracy, rural education

Statistically, the term *rural* in Canada refers to those areas with populations less than 1,000 people, and a density of less than 400 people per square kilometer (Statistics Canada, 2016); however, beyond that it is difficult to describe what is typically rural in Canada (Wallin, 2003, 2005). Rural communities in Canada are more different than similar. Influenced by complex geographic, political, cultural, and economic forces, rural Canadian contexts are as diverse as the DNA that makes up the people within them. Perhaps this is why the saying goes, "If you know one rural community . . . then you know one rural community" (Lauzon, Bollman, & Ashton, 2015, p. 2). Owing to

the diversity that exists in rural contexts, problem solving, ingenuity, and creativity are prized characteristics for those wishing to effect change. In rural education, thinking outside the box is a necessity, and not something that can be entrusted to outsiders who do not have intimate understandings of local people and contexts. Rural educators know this and frequently rise to the challenge of creating local solutions to the problems they face.

The study described in this article sought to look at a narrow, but important, issue in rural education: access to effective and meaningful teacher professional development (PD) within rural

contexts. This issue, while influenced and shaped by the unique and varied rural educational spaces in Canada, is one that nevertheless cuts across many different contexts. Geographically distanced and isolated schools and divisions (which are equivalent to districts in some parts of Canada), despite their unique differences, face similar challenges when it comes to providing effective and meaningful teacher PD. They also possess tremendous strengths from which local solutions to this issue can be fashioned. The question of how rural divisions in Canada might go about constructing local teacher PD models that draw on local strengths, mitigate local challenges, and support teacher professional growth is critical to the provision of quality education for rural students, and to what Reid et al. (2010) refer to as rural-regional sustainability. Through a single-case study design, this research study examined the effectiveness of one rural Canadian school division's attempt to improve mathematics instruction and student numeracy outcomes through the creation of a teacher PD model that drew on local strengths and mitigated local challenges. Recognizing the complexity of rural social space (Reid et al., 2010), the study sought to look deeply at the effectiveness of the locally constructed model, known as the Numeracy Cohort, by answering the following three questions:

1. To what extent (if at all) is the specific locally constructed professional development model used in the rural school division able to mitigate the challenges faced by the rural division and its rural teachers in accessing meaningful professional development?
2. To what extent (if at all) is the model effective in terms of supporting teachers' professional growth in the area of mathematics instruction and student numeracy?
3. How do social constructivist principles contribute to teacher professional growth through the locally constructed rural professional development model?

Relevant Literature

It is important in rural educational research not to treat rural education as problematic or to use a deficit model when referring to rural schooling (Reid et al., 2010). Rural education is not a problem to be overcome so that urban models can be applied; rather, rural education takes place in complex social spaces that include tremendous strengths, unique challenges, and complex and interconnected cultural, economic, geographic, and political factors. Understanding how elements within these complex spaces interact is critical to understanding how learning can be enhanced for rural students. The literature reviewed for this study included articles from a variety of global contexts related to rural teacher PD and effective PD more generally. The literature illuminated several strengths of rural schools and organizations, some of the challenges rural educators and organizations face in accessing and providing effective teacher PD, and several established characteristics of effective teacher PD.

Strengths Related to Relationship and Place

Rural schools are able to provide quality educational programming for their students in many ways. In rural communities, teachers know most (if not all) of the students in their buildings (Canadian Council on Learning [CCL], 2006), and the personal relationships that exist among students, parents, and teachers in rural schools often inspire teachers to be personally invested in the success of their students (Budge, 2006). Strong relationships among teachers can make it easier for them to work together naturally (Howley & Howley, 2005), and similar values and interests often make for a more cohesive school community in rural settings (Chance & Segura, 2009). Within rural social spaces, there is also an implicit understanding of the importance of place and community. Schools are often the heart of rural communities, drawing together students, parents, educators, and other community members to work toward a better life for all who live and work there.

In addition to local relationships, rural educators (often out of necessity) tend to foster the development of diverse professional networks (Wallin, 2008). Because many rural educators do not have colleagues with similar professional

interests, goals, subjects, and/or grade levels available within their own buildings with whom they can collaborate, they often work to find others outside of their immediate contexts with whom to engage in professional learning and dialogue. While such diverse networks can be a tremendous strength for all educators, they are of particular importance to rural educators owing to the professional isolation that they can face. As such, the ability to foster such networks is a critical strength within rural contexts.

Strengths Related to Organizational Structures

The unique structures that exist in rural schools and rural divisions are important to understand and consider. Fewer formal leadership positions in rural contexts allow teachers to have greater voice and input into change initiatives, opportunities to exercise creativity, and the conditions in which true bottom-up change can occur (Anderson, 2008; Forner, Bierlein-Palmer, & Reeves, 2012). Because small rural divisions may have only a superintendent (with few or no assistants), few or no consultants, and few administrators in each building (sometimes only one, who is potentially even part time), there can be more space for teachers to create (or step into) leadership positions in the organization. While a lack of formal leadership positions can cause issues with capacity to carry out initiatives, it can also promote productive dialogue among different levels of an organization and greater involvement across various levels of rural organizations as individuals work toward common and locally relevant goals.

Challenges Related to Funding

Rural school divisions face unique challenges related to funding, due to their contexts, including limited tax bases from which to draw funding (Howley & Howley, 2005); declining enrolments that result in decreased government funding (Chalker, 2002; Suvorova, 2004; Wallin, 2008); higher costs per pupil (Harmon, Gordanier, Henry, & George, 2007); high fixed costs in such areas as transportation/busing and teachers' salaries, which take up large portions of divisional budgets (Wallin, 2008); and inadequate funding for the sustainability of small schools (Manitoba Association of School Superintendents [MASS] & Manitoba Association of

School Trustees [MAST], 2006; Northern Alberta Development Council [NADC], 2010; Wallin, 2008). As a result, they have fewer available resources, forcing them to make difficult decisions about where discretionary money will be spent. Consequently, rural divisions often have to be increasingly creative and resourceful in their operations, finding ways to do more with less. This is particularly true in the area of teacher PD.

Challenges Related to Geography

Geographic isolation and physical distance are significant challenges for rural school divisions in terms of their ability to provide effective PD for teachers (Glover et al., 2016). Many rural divisions are significant distances from the urban centers in which most teacher PD takes place. These distances increase the cost of sending teachers out to PD, as transportation, hotel, and meal costs add up for divisions; moreover, in school divisions where limited PD funds are available, these expenses can sometimes be incurred by teachers, forcing them to consider whether or not they can personally afford the cost of the PD (Tytler, Symington, Darby, Malcolm, & Kirkwood, 2011). In addition to cost, physical distances compel teachers to consider the time required for travel to PD opportunities, including increased time for planning for substitute teachers, increased travel time, and the time that they are away from their family or community (Tytler et al., 2011). The costs of bringing presenters or facilitators into rural divisions are also often impacted by distance from urban centers, as presenters (some of which are already high cost for small divisions) often charge additional fees for transportation (mileage or flights), accommodations, or meals when traveling to rural or remote areas.

In addition to physical distance, sparsity is an issue in rural educational contexts when it comes to teacher PD. Many rural school divisions span large geographic areas, despite having relatively low populations, something that has been exacerbated through amalgamation of school boards in some provinces (NADC, 2010). As a result, school divisions are forced to find ways to bring divisional personnel together, as well as ways of fostering connections between teachers and administrators

across the spaces that exist even within the local context. Similarly, teachers are forced to look for PD opportunities, whether inside or outside the division, across significant distances between themselves and potential collaborators. While information and communication technologies offer the potential of bringing educators together virtually across distances, it also brings additional challenges. Rural school divisions often also lack such technologies in their schools (CCL, 2006; Mitchem, Wells, & Wells, 2003), making it difficult to rely on technology to bridge the distances that exist in rural contexts.

Challenges Related to Staffing

Rural school divisions face significant staffing challenges that affect both the capacity of rural divisions and their ability to provide effective and meaningful teacher PD. These challenges include recruitment and retention of teachers, availability of substitute teachers, heavy teaching workloads, professional isolation, and internal leadership capacity. While people are perhaps the greatest resource in rural divisions, their numbers in any rural context can be a limiting factor in terms of what is and is not possible.

One of the staffing challenges faced by rural divisions is teacher recruitment and retention (CCL, 2006; Chance & Segura, 2009; Hardré, 2009; Lowe, 2006; MASS & MAST, 2006; NADC, 2010; Seltzer & Himley, 1995; Tytler et al., 2011). Despite the fact that attracting, retaining, preparing, and renewing teachers may be a matter of professional and rural-regional sustainability in rural contexts (Reid et al., 2010), rural and remote school divisions have difficulty attracting and retaining teachers to work in their schools, something that is exacerbated by teacher shortages in specialty areas such as mathematics and science (Wallin, 2008). While high-quality staff development programs may have the potential to improve both recruitment and retention of rural teachers (Lowe, 2006), high staff turnover rates impact the viability of long-term, sustained PD initiatives.

Substitute teacher availability in rural contexts similarly poses a challenge for rural school divisions, particularly in terms of providing teacher PD (Harmon et al., 2007; Manitoba Education, 2009; Seltzer & Himley, 1995; Tytler et al., 2011).

Without access to an adequate pool of substitute teachers, rural educators cannot be away from their classrooms to engage in effective and ongoing teacher PD. The impact of heavy workloads is another thing that potentially makes it difficult for teachers to be away from their classrooms to engage in PD. In spite of a lack of curriculum supports (Harmon et al., 2007; Mitchem et al., 2003), rural educators are often required to work or teach outside of their areas of expertise (Harmon et al., 2007; MASS & MAST, 2006; Tytler et al., 2011). Teachers can find themselves struggling to balance the need for PD in areas for which they had no formal training and the workload involved in teaching new (or less familiar) courses. Planning for a substitute teacher and being away from class to engage in PD in such cases can be an overwhelming task for teachers already burdened by novel and heavy workloads.

One of the greatest barriers to the provision of effective teacher PD in rural contexts is professional isolation (Howley & Howley, 2005; MASS & MAST, 2006; Seltzer & Himley, 1995; Tytler et al., 2011). According to Howley and Howley (2005), "Educators tend to experience professional isolation in rural schools because teaching specialties do not enjoy critical mass in any but the largest of these schools" (p. 3). Without colleagues that teach the same subjects and/or grade levels within their own buildings, rural educators often experience limited capacity in terms of their ability to engage in collaborative projects or collaborative PD models. Moreover, geographic distances between sites within divisions (and between rural divisions and external PD opportunities) potentially compound the isolation faced by educators in rural contexts, as time and cost become significant factors in collaborative initiatives.

A final area of challenge in regard to staffing in rural contexts relates to internal leadership capacity. Rural school divisions often have small numbers of administrative candidates due to heavy and diverse workloads (having "many hats to wear"), isolation, and unrealistic expectations of principals and superintendents (Forner et al., 2012; Newton & Wallin, 2013; Starr & White, 2008; Wallin, 2008; Wieczorek & Manard, 2018). With few mid-level leadership positions, such as consultants and

assistant superintendents, and with overall small faculty and administrative numbers, rural divisions face limited capacity to develop and carry out systemic improvement plans, a part of which includes the provision of effective and meaningful teacher PD (Glover et al., 2016).

Contextual Differences

Rural educational contexts are not homogeneous (Hardré, 2009, p. 2); they all have unique contextual differences that have the potential to be both strengths and challenges with regards to system improvement and the provision of teacher PD. According to Hardré (2009), “Rural teachers need tools and strategies from professional development that are flexibly adaptive to the rural context, feasible with available resources, and locally meaningful” (p. 4). Skyhar (2018) notes that “many PD opportunities provide points of view that originate in urban settings, or that are predicated on conditions that involve much larger schools, or more uniform classes” (p. 38); thus, PD opportunities and initiatives for rural educators need to take into account the contextual differences inherent in the teaching assignments and contexts of rural teachers. By considering such factors as size, makeup, scale, cultural and religious differences, local history, and personalities and norms within classrooms, schools, and communities, the needs of rural educators can be better met through relevant and applicable PD.

Characteristics of Effective PD

While the field of education may not completely agree on what constitutes effective teacher PD, many characteristics do appear to be generally agreed upon. For example, effective PD should focus on student learning and include both content knowledge and pedagogical content knowledge (Campbell, Osmond-Johnson, Faubert, Zeichner, & Hobbs-Johnson, 2017; Hunzicker, 2011; Mundry, 2005; Murray, 2014; Porter, Garet, Desimone, & Birman, 2003; Quick, Holtzman & Chaney, 2009; Timperley, 2008). Moreover, the content of teacher PD should be aligned with school goals, district goals, curricular goals, and the individual goals of teachers (Hunzicker, 2011; Learning Forward, 2011; Murray, 2014; Porter et al., 2003; Quick et al., 2009) and reflect “a balance of teacher voice and

system coherence” (Campbell et al., 2017, p. 8). Effective PD should provide opportunities for active learning, allowing participants to analyze teaching and learning and try out and reflect on new practices (Campbell et al., 2017; Porter et al., 2003). All of this should be done within collegial and collaborative learning environments that are job embedded, relevant, and practical to the work of teachers (Campbell et al., 2017; Murray, 2014; Whitcomb, Borko, & Liston, 2009). Effective teacher PD should be ongoing in duration, sustainable, and scalable (Campbell et al., 2017; Murray, 2014; Porter et al., 2003; Quick et al., 2009; Timperley, 2008). It also requires adequate support in terms of time, resources, and leadership (Bredeson, 2002; Campbell et al., 2017; Goos, Dole, & Geiger, 2011; Learning Forward, 2011; Timperley, 2008; Villegas-Reimers, 2003). Finally, effective PD includes a mechanism for evaluation (Guskey, 2000; Loucks-Horsley, Stiles, Mundry, Love, & Hewson, 2010).

Context of the Research

The research study was conducted in a small, rural school division in Manitoba, Canada. The division, which was the fifth smallest in the province at the time of the study, had only about 1,000 students and 90 teachers. Despite this, the division contained 14 schools, ranging from just over 200 students to single-digit student populations. Of the 14 schools in the division, 2 were public high schools, 5 were public elementary schools, and 7 were Hutterian schools. (The Hutterian schools in the division were located in faith-based communal living settlements, and while the schools were owned by the community, teachers for the schools were provided by the local public school board.) As a result of its size and location, the division faced many of the challenges described in the literature review, including small divisional budgets, significant geographic distances separating the division and urban centers, geographically isolated schools within the division, small numbers of faculty and administrators, very small schools and staffs, small numbers of available substitute teachers, professional isolation, and unique contextual differences such as several Hutterian schools within the division.

The rural division was chosen for the study because it had implemented a PD initiative called the Numeracy Cohort. The initiative was designed specifically to create collaborative PD opportunities for teachers in the division in the area of mathematics instruction and student numeracy, and it used several strategies to mitigate challenges faced by the division in relation to its rural context. As a result, the Numeracy Cohort provided a rich context from which much could be learned about rural strengths and challenges, including strategies for overcoming local challenges.

Elements of the Numeracy Cohort Model

The Numeracy Cohort PD model incorporated several key elements:

- *A 0.25 full-time-equivalent (FTE) numeracy coach:* The primary responsibility of the numeracy coach, a new position created by the school division, was leadership and facilitation of the Numeracy Cohort.
- *Funding and resources from multiple sources:* Funding was drawn from a variety of sources for the initiative. Although the primary source was a provincial numeracy

grant, several other sources of funding and resources were also accessed (e.g., other grants, existing divisional budgets, school budgets, and other nonmonetary resources available).

- *Geographically diverse recruitment as critical friends/partners:* Teachers were recruited as critical friends or partners from across the geographically diverse division both to promote opportunities for collaboration, something that was lacking in the division, and to include the most isolated teachers in the division as much as possible. In the three largest schools in the division, a pair of teachers were nominated as critical friends or partners. In the two very small schools in the division, and the two high schools in the division, one teacher from each was recruited to work together as critical friends, while two teachers from two different Hutterian colonies were recruited to work together as critical friends. In total, a dozen K-12 teachers made up the Numeracy Cohort in the first year of its operation, coming from 9 of the 14 schools in the division (see Table 1). An additional teacher also joined in year 2, for a total of 13 cohort teachers involved

Table 1

Cohort Teacher Makeup

School	Number of cohort teachers	
	2013–2014	2014–2015
Elementary 1	2	3
Elementary 2	2	2
Elementary 3	2	2
Elementary 4 (very small)	1	1
Elementary 5 (very small)	1	1
Hutterian 1	1	1
Hutterian 2	1	1
High School 1	1	1
High School 2	1	1
Total	12	13

- *Face-to-face meetings:* Full-day face-to-face meetings were held with Numeracy Cohort teachers four to five times per year at the division office, located centrally within the division. At these meetings, teachers heard from presenters; discussed divisional, school, and classroom goals; collaboratively designed strategies and materials; and shared their experiences after implementing them.
- *Sessions on divisional or in-school PD days:* In addition to the four to five face-to-face sessions scheduled each year, additional time for cohort meetings was also scheduled on divisional PD days or in-school PD days. These extra meetings meant that cohort teachers saw each other face to face most months of the school year.
- *Mini-action research (MAR) projects:* Numeracy Cohort teachers worked individually and collaboratively on MAR projects, which involved actively designing changes in practice and evaluating the impact of those changes on student learning.
- *Attending external PD as teams:* In addition to having presenters come to face-to-face sessions, small groups of teachers working collaboratively on MAR projects attended external PD (e.g., speakers, workshops, and classroom visits) as teams, sometimes meeting afterward to follow up on their learning. The entire cohort also attended a two-day workshop together during the first year of the initiative.
- *Time and resources available for teacher needs:* Additional money was made available for teachers to buy resources or to get together in small collaborative groups (for planning, or to implement ideas learned at external workshops/PD opportunities).
- *Online component:* An online component was added to the model to foster collaboration, sharing, and reflection. This was done through a group SharePoint site.
- *Interviews and feedback:* Many opportunities for written and oral feedback were included,

such as interviews, written reflections, small group discussions, and reports on MAR projects.

Theoretical Framework

Social constructivist theory informed the research study in two fundamental ways: as a lens through which the effectiveness of the model could be examined, and through the design of the study itself. Teacher PD is often viewed from a social constructivist perspective, which recognizes that teachers are learners who construct understanding in social settings as new ideas rub up against their existing beliefs, attitudes, and understandings (Richardson, 1997, 1999). Social constructivists believe that the social context in which learning occurs cannot be separated from the individual learning that takes place (McCullagh, 2012; Pitsoe & Maila, 2012; Richardson, 1997, 1999). As a result, social constructivist theory lends itself to examining the effectiveness of collaborative teacher PD models like the Numeracy Cohort, in part because they seek to foster interactions among teachers that promote the construction of new understandings, and in part because social constructivist theory recognizes how teachers as learners are situated within complex social contexts.

Methods

A single-case study design, a suitable methodological choice for the in-depth qualitative study of a single unit or bounded system (Creswell, 2007; Flyvbjerg, 2011; Merriam, 1998; Stake, 1995), was chosen for this research study. The Numeracy Cohort model provided a unique case (Yin, 2009) worthy of study due to the nature of the model, and the fact that it was designed specifically to overcome challenges to providing and accessing effective and meaningful PD locally. To examine the extent to which the model was effective in mitigating challenges, multiple units of analysis were considered. Four different perspectives (those of the teachers, the principals, the superintendent, and the facilitator) were examined through a variety of data sources that allowed for thick, rich description to emerge about how well the model mitigated challenges and supported teacher professional growth in the area of mathematics instruction and student numeracy.

Participants

In addition to requesting permission from the school division to conduct the study, participants were invited to participate in the study through letters of invitation. Numeracy Cohort teachers were invited to provide secondary data (e.g., audio recordings and notes from previously conducted interviews, and artifacts they had created throughout the initiative) and to participate in a focus group discussion. The principals of the cohort teachers were also invited to participate in a focus group discussion, and the superintendent of the division was invited to participate in an interview. Of the 14 teachers that were part of the Numeracy Cohort over the 2-year period, 13 chose to participate (one teacher that left the cohort at the end of the first year did not participate, but his replacement did), as well as six out of eight of their principals, the superintendent of the school division, and myself as the facilitator of the PD initiative. My own participation involved adding the facilitator notes and other artifacts I had created in my role as facilitator of the initiative as data sources for the study.

Researcher's Positioning

It is important to describe my own dual roles as both researcher and facilitator of the initiative. During the 2 years that were the subject of the research, I was employed in the school division as a 0.75-FTE high school teacher and as the 0.25-FTE numeracy coach previously mentioned. I came to the numeracy coach position after working with the superintendent of the school division to design a PD model that would provide collaborative PD opportunities for math teachers in the division. Recognizing the potential for researcher bias in the study, I elected to collect and analyze data (take on the role of researcher) at the end of my 2-year appointment as facilitator. This was made easier in part because I left the division to take a university position at the end of the 2014–2015 school year. In addition to bracketing off my dual roles as much as possible, I shared preliminary findings with members of the school division during the analysis phase of the study. This allowed for feedback, clarification, and verification of findings by various members of the school division.

Data Collection

Multiple forms of data were collected over a period of 1 month (June 2015) as the Numeracy Cohort initiative ended its second year of operation. Both primary and secondary data were collected. Secondary data, comprised of data that already existed from the ongoing activities of the Numeracy Cohort, were accessed with permission from the school division and participants and included audio recordings and notes from semi structured interviews conducted with teachers three times over the 2-year period, facilitator notes, and artifacts generated through Numeracy Cohort activities. Primary data, which were generated specifically for the research project, included an interview with the superintendent, a focus group discussion with the Numeracy Cohort teachers, and a focus group discussion with their principals (all of these data sources were transcribed for analysis by me as the sole researcher). Table 2 outlines the multiple sources of data collected for the study. Questions used for the focus group discussions and interviews are included as appendices. Collecting multiple forms of data representing a variety of perspectives allowed for triangulation of data. This added to the trustworthiness of the study, in addition to providing more robust, descriptive, and rich data with which to answer the research questions.

Data Analysis

NVivo, a brand of qualitative data analysis software (Bazeley & Jackson, 2014), was used for organizing, transcribing, coding, and analyzing data. Transcribed data were coded through two distinct cycles of coding by me as the sole researcher. During the first cycle of coding, a priori, theory-generated (Marshall & Rossman, 2011) codes created from the research questions and literature review were used, in addition to emergent codes that were identified from the data. Following reorganization (collapsing and categorizing) of codes from the first cycle, a second cycle of coding took place. Analytic memos were also kept during the coding process to document my own thoughts as a researcher in relation to emerging themes (memos were then also coded at the end of the second cycle of coding).

Table 2

Data Sources

Data type	Description
Primary data	
Interview	<ul style="list-style-type: none"> • Superintendent
Focus groups	<ul style="list-style-type: none"> • Principals • Cohort teachers
Secondary data	
Cohort teacher interviews	<ul style="list-style-type: none"> • Fall 2013 • Spring 2014 • Spring 2015
Facilitator notes	<ul style="list-style-type: none"> • Notes created after each face-to-face session • Notes after meetings with administration • Files used for presentations to administrators and school board
Artifacts created by cohort members	<ul style="list-style-type: none"> • Mini action research forms • Reflections • Small-group discussions • Mini action research oral reports • Presentation files • Teacher activities from face-to-face sessions
Artifacts from cohort operations	<ul style="list-style-type: none"> • Charts of teacher goals • Charts of face-to-face content • Attendance charts • Meeting agendas • Meeting schedules • PowerPoint files from face-to-face sessions • Financial reports

Data analysis was conducted through what Miles, Huberman, and Saldaña (2014) refer to as (1) data condensation, (2) data display, and (3) conclusion drawing/verification. Once codes were organized, they were chunked into themes, thereby condensing the data. Themes were displayed using charts, graphs, matrices, and networks in order to organize and examine connections among them. The findings for the study were constructed through the fleshing out of key ideas (by looking back and forth between thematic displays, codes, and raw data).

Findings

The presentation of findings from this study is organized by the research questions. Despite the fact that the three questions look through distinct lenses at the Numeracy Cohort model, together they paint a coherent picture of one division's local

solution to the problems faced. In his interview, the superintendent of the school division said the following:

I think that's a strength of rural divisions. . . . Because rural divisions have challenges, and they have limited funds, they have to really figure out, they have to really problem solve, they have to really [have] that twenty-first century ingenuity that comes into thinking outside the box and changing something to make it better. Because really the bottom line is there's not going to be a lot more money. There could be a little bit more money. We can increase this and do that. We can refocus, but you really have to think differently. Rural school divisions have a great history of doing that.

The hopefulness and place-based appreciation shown by the superintendent in this statement

echoes the statements of many others regarding the need for innovative solutions to the problems faced in rural contexts (O'Malley, Wendt, & Pate, 2018); the ability of rural teachers, schools, and school divisions to value local knowledge in word and in practice (Avery, 2013); and the possibility of engaging in a sense-making process that allows for local strengths to be leveraged to develop school-community partnerships (Zuckerman, 2019). Likewise, the findings from this study illustrate what such a view of rural ingenuity looks like within the context of rural teacher PD, as the division in this study, through the Numeracy Cohort initiative, attempted to "think outside the box" to find a local solution to the challenges faced.

Mitigating Local Challenges

Several challenges were identified across data sources in this study, many of which occurred in multiple data sets (see Table 3). These challenges fell within the four categories: funding, geography, staffing, and contextual differences. So, too, did the strategies that the division employed locally to mitigate these challenges.

In terms of funding, the school division (which was funded through a combination of provincial government funding and locally levied property taxes) faced significant challenges. Declining enrollment in the division resulted in decreases in provincial government funding (allocated primarily on a per-student basis) while costs per pupil continued to rise. In addition, the superintendent of the school division described issues in the provincial funding formula in relation to distance and sparsity. In his interview he noted the following: "There's a huge gap between rural and urban school divisions and southern and northern school divisions in terms of the dollars that are received and how far those dollars will go in a particular environment because of distances." To mitigate the funding challenges faced by the division in relation to developing the Numeracy Cohort initiative, a creative financial model was constructed to draw on resources from a variety of areas, including grants, new funding from the budget/local levy, reallocation of existing financial resources, and reallocation of existing nonmonetary resources. A provincial numeracy grant was accessed each of the 2 years

(\$10,320/\$11,450), as was a reflective practice grant from the local teachers' union (\$1,000/\$800). This money covered the cost of bringing cohort teachers together four to five times per year for face-to-face sessions, as well as materials, registrations, and other expenses. Teachers also drew on local school budgets to attend external workshops, and the central PD funding in the division paid for all of the cohort teachers to attend a two-day workshop together. Through a new budget line, the 0.25-FTE numeracy coach position was funded at a cost of about \$20,000 per year, and a variety of nonmonetary resources were leveraged, including using existing division/school PD days to meet, drawing on local expertise, and finding external expertise that could be accessed at little to no cost (e.g., swapping services with another division's coach/consultant, and bringing in a professor from a relatively nearby university).

Just as Glover et al. (2016) suggested in their work, geographic isolation and physical distance were also significant challenges for the division in the study. Distances between schools in the division, and the distance of the division from the two large urban centers where most of the PD in the province took place, posed challenges in terms of cost, time, and safety. The Numeracy Cohort initiative, however, was able to mitigate several of these challenges by providing PD locally within the division. Having face-to-face meetings centrally within the division drastically reduced travel costs and the time required for travel. Paying teachers mileage and having PD within the division also ensured that teachers did not have to incur personal costs for the PD and that their personal lives were not impacted by excessive travel. Finally, including an online component for teachers to collaborate and communicate virtually within the division provided a platform that bridged the geographic distances that existed in the division. Unfortunately, however, issues related to the late introduction of the platform and poor teacher uptake led to the platform being abandoned as a communication tool during the second year of the initiative (although it was still used for sharing resources).

Table 3
Local Challenges and Promising Mitigation Strategies

Divisional challenges identified	Promising local mitigation strategies
Funding	
<ul style="list-style-type: none"> • Declining enrollment (−3.51% over 3 years) • Provincial funding provided on a per-student basis (−0.99% over 3 years) that did not keep pace with increasing costs (+5.44% per pupil over 3 years) • Decreases in PD funding (−3.42% over 3 years) from the province, forcing the division to fund an increasing amount of PD from discretionary budget areas 	<ul style="list-style-type: none"> • Using a creative funding model to access sufficient funding (including grants, local levy, reallocation of existing financial resources, and reallocation of existing nonmonetary resources) • Drawing on resources available at little to no cost (e.g., accessing resources available through other organizations, accessing existing divisional PD days to meet, having cohort teachers lead a PD day for other teachers in the division)
Geography	
<ul style="list-style-type: none"> • Large geographic area (~3,400 km²/1,300 mi²) • Distanced from urban centers where PD typically was offered (245- to 404-km or 152- to 251-mile round trip to the largest urban center, at a mileage cost of \$100–170) • Significant distances between divisional schools (the farthest schools were 186-km or 116-mi round-trip travel) • Distances increasing PD costs for the division and/or teachers (for meals, hotels, travel, additional childcare, etc.), and the time required for travel • Inclement weather (snowstorms, icy roads, etc.) 	<ul style="list-style-type: none"> • Locating PD within the division (and bringing presenters in) • Holding meetings centrally in the division to minimize travel costs and time required for travel (a maximum mileage cost of \$288.12 for each session for 13 teachers, with no teacher traveling more than 1 hour round trip) • Paying mileage to teachers (to eliminate personal costs for teachers attending face-to-face meetings) • Incorporating an online component
Staffing	
<ul style="list-style-type: none"> • Challenges to teacher recruitment and retention in the smallest schools in the division • Professional isolation, with most teachers in the division having few (if any) colleagues teaching the same subjects/courses/grades with whom they could collaborate • Many teachers with multigrade and/or heavy teaching loads, as well as many hats to wear within the school and/or community • Limited substitute teacher availability and quality (particularly in very small schools and in specialized areas) • Few formal leadership positions (no consultants) 	<ul style="list-style-type: none"> • Recruiting teachers from diverse geographical areas and substitute teacher pools • Holding meetings midweek when demand for substitute teachers is low • Increasing collaborative opportunities (face-to-face meetings, critical friends, small-team PD attendance with follow-up, etc.) • Bringing new ideas in (other teachers, presenters, facilitator) • Creating a 0.25-FTE position for facilitation (the numeracy coach)

Contextual differences

- Two unique contexts in the division:
 1. Seven Hutterian schools—located in faith-based communities known as colonies. These schools were extremely small, having only one to two teachers (responsible for teaching multiple grades and subjects). Teachers in the schools were very isolated and had heavy teaching loads. The schools also observed additional religious holidays (not observed in the public schools).
 2. Two very small schools—these geographically distanced schools had only three to four teachers in each (responsible for teaching multiple grades and subjects). Like the Hutterian schools, taking teachers out for PD had the potential of interrupting normal school functioning.
 - Recruiting one teacher from each of the very small and two of the Hutterian schools, and pairing them up with another teacher with a similar teaching context
 - Flexibility to deal with issues or conflicts (religious holidays, hollowing out small staffs, conflicts with other PD or leadership roles)
 - Built-in feedback and reflection mechanisms (interviews, oral, written, discussion, etc.) to gather information about teacher needs and experiences
 - Mini-action research projects—autonomy to focus on areas relevant to teaching contexts (specific grade levels, culturally relevant, multigrade, etc.)
-

In terms of staffing, the school division in the study experienced many of the challenges previously identified in the literature reviewed for this study. As indicated in Table 3, recruitment and retention of teachers was a minor problem in some of the smallest schools in the division, as was substitute teacher availability. In addition, the quality of substitute teachers in the division was also an issue, particularly in specialty areas (e.g., high school math). One high school math teacher noted the following in an interview:

There is also nobody that actually substitutes at our school that is a math teacher, so I have to be very well prepared to leave the kids with something that they can do with a guest teacher that is not qualified. And so, I'm losing classroom time, and we all know that we don't have a lot of classroom time to get the jobs done.

Teacher isolation was a significant problem, as most teachers did not have access to colleagues in their buildings who taught the same grade levels and subject areas as they did, making collaboration difficult. Cohort teachers noted that, in addition to isolation from collaborative partners, they also felt somewhat isolated from the broader educational community in the province. Teacher workload, including new or changing workloads, multigrade

classrooms, and having many hats to wear, was cited as a challenge by several teachers in the Numeracy Cohort, as well as by principals. In the focus group discussion with cohort teachers, the impact of these heavy loads on teachers' capacity to engage in PD was explained the following way:

The same people that are on the school, the local school PAC [Parent Advisory Council] committee, which are on the local rink board, which are on the town whatever, it seems to be the same people. That happens in small schools too. The same teachers end up being on several committees, which can be—[it can] make PD difficult in that those teachers are extremely busy, [they have a busy] workload, and then [an] extremely busy PD load.

Finally, internal capacity in terms of divisional expertise and leadership capacity was also cited as a challenge within the division, largely due to the small numbers of faculty and administrators on staff. In his interview, the superintendent of the division said the following:

We have 90 professional staff. We are not going to have all the strengths that a staff of two or three thousand would have, or two or three hundred teachers would have. We have to scale it and find where are our strengths, and we have to play [to] our strengths.

As indicated in Table 3, staffing challenges were mitigated in several ways. Leadership capacity was established through the creation of the 0.25-FTE numeracy coach position, and collaborative opportunities were fostered through a division-wide cohort. Teachers were able to work with others (critical friends and/or small collaborative groups) who taught similar grade levels and subjects/courses, and new ideas were shared at face-to-face sessions, bringing ideas from the broader field to previously isolated teachers in the division. One of the Hutterian teachers in the cohort noted that the initiative had “lifted the gates of that isolation” for him, allowing him access to content and collaborative opportunities that were previously not available. Finally, issues related to substitute teacher availability were mitigated in two ways: through recruiting teachers from geographically diverse areas of the division (and therefore from different substitute teacher pools) and by holding meetings midweek when the demand for substitute teachers was lowest. Attendance data from the study (which cited reasons for absences) indicated that in the 2 years of Numeracy Cohort operation (including dozens of release days), only one teacher cited unavailable substitute teachers as a reason for not attending face-to-face sessions, two times.

While the division in the study had many unique contextual characteristics, the two differences that required significant consideration in relation to PD were the two very small schools and the seven Hutterian schools in the division. As indicated in Table 3, these schools had very few teachers, and taking (too many) teachers out for PD had the potential of disrupting school function by hollowing out the staff; as one teacher noted in the focus group discussion, someone had to remain in the building to “mind the store.” In addition, the teachers in these very small and Hutterian schools worked under unique circumstances, including significant isolation from colleagues (especially teaching the same grade levels), and heavy workloads (including part-time administrative duties, multiple responsibilities in relation to committees and volunteer work, and teaching in multigrade classrooms). Finally, the Hutterian schools in the division were located in faith-based communities that had unique religious and economic structures,

eliciting a need for culturally/locally relevant curricula for students and cultural sensitivity in relation to religious holidays in particular. As previously described (see Table 1), the cohort structure was in part designed to ensure that teachers in the most isolated schools in the division were able to participate, that they had a critical friend or partner to collaborate with, and that not too many teachers from any one of the smallest schools would be away. Flexibility was also employed to avoid religious holidays and multiple commitments, to avoid having too many teachers away from very small schools, and to allow teachers to design and utilize multigrade and culturally/locally relevant resources in their practice. One of the Hutterian teachers described the benefits of the Numeracy Cohort initiative in the following way:

I think being part of the cohort has lifted the gates of that isolation that we had. Like we now had a chance to discuss with other teachers, and being able to collaborate with them. And another thing is that the group that I was working with was real[ly] good about doing the multigrade—we set up those projects for grade 7, for grade 6, for grade 5, and even below if we needed to. I think [cohort teacher name removed] did a good job in addressing all of those areas because he is also in a small school.

The MAR projects that teachers engaged in (with critical friends or small groups) allowed all teachers to focus on their own areas of need. This was particularly important for the Hutterian and very small school teachers, whose contexts were significantly different from both other teachers in the division, and potentially the assumptions on which many resources and PD opportunities were based.

In addition to drawing on local knowledge as a pedagogical strategy (Avery, 2013), contextually relevant approaches to teacher PD are important in rural communities to meet the needs of teachers within the constraints of rural school divisions. As outlined in Table 3, the division in this study was able to employ several promising local mitigation strategies for overcoming challenges to the provision of teacher PD. These strategies, while unique to the division in the study, shed light on not

only the types of challenges faced by rural school divisions and teachers but also potential ways of overcoming such challenges. These may be of interest to those teaching, researching, or leading change initiatives in other rural contexts where similar challenges are faced—those attempting to “think outside the box.”

Providing Effective PD for Teachers

The second research question in the study focused on the extent to which the model was effective in supporting teachers’ professional growth in the area of mathematics instruction and student numeracy. To answer this question, I employed Guskey’s (2000) five levels of critical evaluation to look at the effectiveness of the Numeracy Cohort, both as a model and as a supportive mechanism for teacher learning.

Level 1: Participants’ Reactions. In terms of teacher reactions, there was surprising coherence in what teachers cited as valuable, despite the diversity of contexts they worked within. Teachers noted they appreciated the community and collaboration built into the model’s design, content in terms of exposure to new ideas, time and resources available to individuals and collaborative groups, autonomy to focus on areas of their own choosing (relevant to their own contexts), and the focus and accountability fostered through ongoing contact and the MAR projects they engaged in. Table 4 provides examples of teacher comments/reactions when asked about their experiences and the effective aspects of the model.

In terms of less effective aspects of their experience, there was less coherence, except in relation to the online element. Teachers in general found the online communication delayed, and less useful. This, in part, was the reason the online communication tool was abandoned in the second year (although the online platform was still used for posting resources).

Level 2: Participants’ Learning. Teachers noted several things they felt they had learned through their participation, from specific strategies and content (e.g., rotations, workstations, mental math strategies, Guided Math, Math Recovery, and national/international test results) to changes in

their beliefs and attitudes (e.g., what counts as PD, depth vs. breadth in teaching, effective assessment strategies, how to help struggling students, and newfound interests in engagement and problem-based learning). They also noted they learned who other people in the division were, how culturally relevant and multigrade projects could be generated, how to increase student engagement, what wasn’t working in their classrooms, and the value of collaboration and action research.

Level 3: Organizational Support and Change. One of the strongest pieces of evidence for organizational change, aside from the actual creation of the Numeracy Cohort, was the impact of its creation on PD in the school division, as reported by the superintendent:

I also think it’s had a huge effect because once we did this, the teachers who were involved in trying to improve our French, the teachers who were involved in trying to improve physical literacy, they saw the model and said, “Hey, can we do that?” And then we started using some central and some school PD funds to support those groups in getting together and having a collaborative model. It was already happening to some degree in literacy. . . . It’s really helped promote it. . . . I would say it’s our flagship of collaborative PD. . . . Now we have more teachers asking to be part of groups than we have groups available . . . and that’s a good problem to have.

In addition to affecting the way PD was conceptualized and carried out in the division, organizational support was also evident through the funding of the numeracy coach position, the overall funding provided to the cohort, and a variety of new communication pathways opened through the initiative. For example, the numeracy coach and cohort teachers shared their successes with the administration council and with other teachers in the division (they hosted a divisional PD day for other teachers in the second year). Principals, teachers, and the superintendent also reported dialogue about the Numeracy Cohort among cohort teachers and others in the division in a variety of contexts, including formal presentations at staff meetings and informal conversations in hallways, classrooms, and

Table 4

Evidence of Teacher Perceptions of Effectiveness

Category/ theme	Sample teacher comments
Community/ collaboration	<p>"I valued time to collaborate with colleagues. This enabled me to stretch my thinking on several topics."</p> <p>"I felt part of their school, kind of . . . I felt like a professional learning community. I did from the cohort, and I wouldn't probably have experienced that otherwise. . . . I wouldn't have known [Carol] and [Ellen] at all, really. Like you would have seen them, 'Hey, how's it going,' but I felt comfortable to say, 'I need help with this. Can you help me?' Whereas in my school, it's not that no one's willing to help, it's just we're all working at different areas and different grades. It's hard to have that professional learning community which I felt the Numeracy Cohort brought to me."</p>
Content	"It was good to have somebody bring in some ideas and some of the PD topics that are out there, and some of the new things that are happening because I'm not likely to see it any other way."
Time and resources	<p>"Time. Um, getting the time to sit . . . and work, not necessarily have things thrown at you. . . . We've had people come in and speak to us, but it's time to take what you've learned and implement it—find ways to actually implement it with another person in the same area"</p> <p>"I was getting PD paid for by the division that was relevant to my teaching assignment and useful, and not coming out of the school budget."</p>
Autonomy	"I never really thought about any of these things that I wanted to do as professional development. . . . Like I have been teaching a long time and that's quite an eye-opener that working on my math, bringing in new things, isn't just something that I want to do and have to support totally on my own. . . . I've never really seen that as professional development and I really like trying to kind of hone my craft. That's a wonderful thing for a math teacher."
Focus/ accountability	<p>"I think the mini-action research projects kept us focused and on track so that we knew what we had to do and what we were going to do."</p> <p>"There was accountability. We need to post them. We need to present. . . . You have to have accountability. I mean when is your house the cleanest? When you have company coming. . . . There has to be accountability. There is when we teach, so there has to be when we're learning as well."</p>

staffrooms. One area that also emerged in terms of organizational support, however, was a lack of consistency in administrative support among schools. Some teachers felt less supported in their work (emotionally and financially), which was something that they felt negatively affected their learning opportunities during the initiative.

Level 4: Participants' Use of New Knowledge and Skills. Participants' use of new knowledge and skills was evident in the MAR projects and reports provided by Numeracy Cohort teachers and included changes in practice, such as incorporation of project-based learning and culturally relevant projects, implementation of new assessment

techniques, use of rotation and workstation strategies in classrooms, incorporation of mathematics games, organization of Hundred Day celebrations that used many math strategies, and development and implementation of strategies for helping struggling students. While it is not possible to describe all of the cycles of MAR projects for 12–13 teachers over a 2-year period, Figures 1 and 2 provide examples of the type of collaborative work cohort teachers engaged in. These figures are two artifacts collected from a group of four early-years teachers who attended a Bureau of Education and Research workshop together on implementing workstations in the initiative's second year and met within days afterward to create resources and prepare to implement workstations in their classrooms (focused on addition strategies).

In addition to the outlined process evident on the MAR forms, oral presentations at face-to-face meetings and interviews with participants illuminated and clarified how teachers used the workstations with students and several of their thoughts about their experiences. The early-years teachers described how the workstations helped them teach specific addition strategies to students (e.g., doubles, doubles plus one), helped them assess student understanding of such strategies, and were helpful for targeting instruction with students who had not yet demonstrated mastery. Moreover, the teachers noted that they had begun to use common vocabulary so that students moving from grade to grade would hear similar terminology across grades, and that they got their classes together in one school to host a Hundred Day celebration where students used several of the strategies developed in a carnival-like atmosphere celebrating the 100th day of school.

Level 5: Student Learning Outcomes. Student learning outcomes, while not directly studied in the research study, were self-reported by teachers. Some important outcomes identified by Numeracy Cohort teachers included increased engagement, demonstrated ability to answer provincial exam questions correctly, student successes with project-based learning, improvements in student independence, improvements in specific problem-solving strategies, and other student successes based on specific learning outcomes such as

identifying patterns. In the case of the early-years examples (Figures 1 and 2), the teachers who worked together collaboratively described increased engagement and confidence in learning, stronger command of addition strategies, less “down time” in the classroom (more efficient use of time), and use of common vocabulary as improvements in student learning outcomes. Although student data was not collected for the study, teachers cited both anecdotal observations and student assessment results when describing these improvements.

Fostering the Social Construction of Knowledge Through PD Design

The third research question in the study looked at how social constructivist principles contributed to teacher professional growth through the design and enactment of the Numeracy Cohort model. This question can be used both to bridge theory and practice in the study and to provide discussion about the lessons learned. Drawing together social constructivist conceptions of learning, findings from the first two research questions, and literature reviewed for the study, several key takeaways and contributions can be identified.

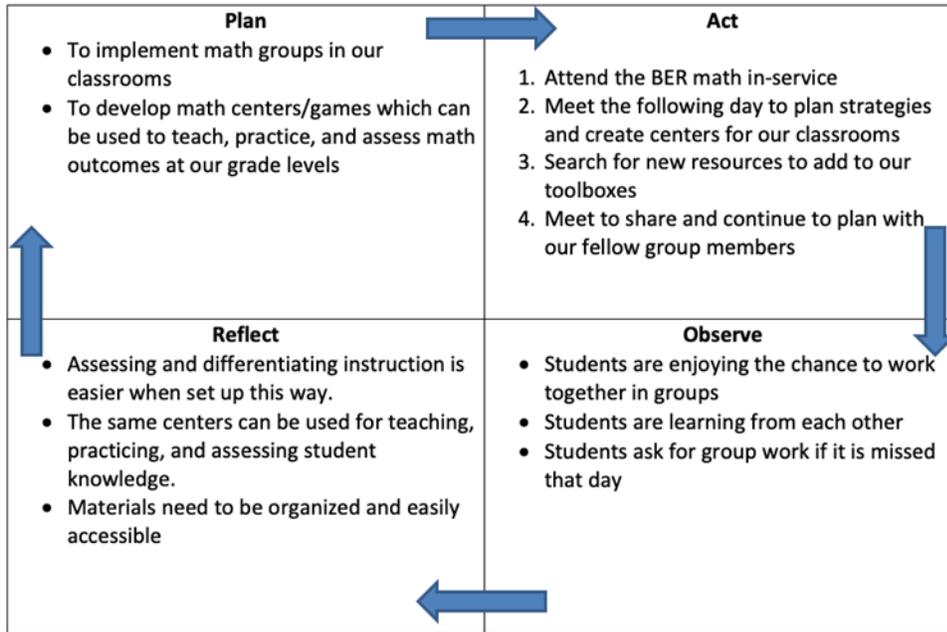
Social Context. From a social constructivist perspective, the construction of knowledge is not something that takes place solely within the individual; rather, it occurs simultaneously within a social context that influences and is influenced by the learner (Palincsar, 1998). Because of this, individual learning is inseparable from the social context in which it takes place (McCullagh, 2012; Pitsoe & Maila, 2012; Richardson, 1997, 1999). In terms of the Numeracy Cohort, the context in which the model was designed and the multiple contexts in which it was enacted were critically important. Challenges faced by the division in relation to teacher PD had to be considered, as did the unique contexts in which teachers worked. Findings from the first two research questions suggest that consideration of multiple levels of nested contexts (including classrooms, schools, community, divisional, and even provincial levels) led to a contextually relevant and locally constructed PD model that was effective for teachers.

(Continued on page after figures)

Figure 1

Early-Years Group Mini Action Research Form

Name: _____ Mini Action Research Form Date: _____



Form adapted from the work of Cathryn A. Smith (2014)

Figure 2

Workstation Resources Created by Early-Years Teachers



What these findings offer the field is an example of both how and why consideration of specific and unique rural contexts (at all levels) is critical to the effectiveness of rural teacher PD. Without consideration of specific (and dynamic) contextual details, such as the very small and Hutterian schools, multigrade classrooms, geographic sparsity, funding structures, and small number of substitute teachers, it is unlikely that the division would have been able to create a viable model or provide teachers with PD that met their needs. While literature on effective PD often cites alignment of teacher, curricular, school, and divisional goals as a critical element of effective PD (Hunzicker, 2011; Learning Forward, 2011; Porter et al., 2003; Quick et al., 2009), what that looks like, particularly in rural contexts, is rarely discussed. This study, through its description of the Numeracy Cohort in relation to local challenges, provides such a description—one that may help other rural divisions/districts to create their own contextually relevant PD models.

Social Interaction. Adopting a social constructivist view of learning requires one to acknowledge (and perhaps even privilege) the role of social interaction in the learning process. According to Richardson (1997), “The development of an individual relies on social interactions. It is within this social interaction that cultural meanings are shared within the group and then internalized by the individual” (p. 8). Within the context of the Numeracy Cohort, the importance of social interaction was clearly evident. Because geographic distances and teacher isolation (from other colleagues and from the field more generally) were significant challenges that had to be mitigated in the division in relation to PD, significant features of the model were developed to allow for social interaction and professional collaboration, including the development of a cohort of 12–13 teachers, the incorporation of critical friends pairings, face-to-face meetings four to five times per year, providing time for teachers to meet in smaller groups after attending workshops together, and the incorporation of collaborative MAR projects. What emerged in the findings was that cohort teachers felt less isolated, appreciated the safe and trusting community, and valued the opportunities for social

interaction and collaboration that were provided. Together, teachers engaged in individual and collective meaning making in relation to such topics as what counts as PD for math teachers and how to create effective strategies for use in multigrade contexts. As a result, new ideas and understandings emerged from the collective, illustrating that the whole is greater than the sum of its parts when it comes to social interaction and learning. Without the social interaction provided through the Numeracy Cohort model, the teacher learning that took place would not have been possible. One of the cohort teachers described the impact of her interactions with other cohort teachers (on her learning) in the following way:

I think that a really big deal is that we are working with other people so you're getting to—that whole way you're learning, you're discovering what somebody else is doing and you're being able to take that, you reflect on it, um, sometimes it is quite different than what you're doing, or [where] you're going, “I don't know if I can make that work,” and you're thinking about it, reflecting on it. And then you're basically, you're learning, you're changing, you're evolving, and you're upping the quality of your practice.

The findings from the Numeracy Cohort study align with existing literature on the characteristics of effective PD by highlighting the importance of collaborative learning experiences (Campbell et al., 2017) for teachers. From a social constructivist perspective, these collaborative experiences foster social interaction and both individual and collective meaning making, thereby promoting teacher learning. This is why teacher PD models like the Numeracy Cohort are both effective and desperately needed in rural contexts. Given the geographic and professional isolation faced by rural teachers, finding ways to mitigate such challenges (to provide contexts in which teachers can socially interact and collaborate) is of critical importance.

In addition to the importance of social interaction in the learning process, most social constructivists would likely identify the people with which interaction occurs as equally important in the learning process. Underpinning such a view is the

belief that learners can be assisted by more competent others within their zones of proximal development (Postholm, 2012; Vygotsky, 1978) to attain more than what they would otherwise be able to learn on their own. More competent others in terms of teacher PD could be colleagues, facilitators of workshops, presenters, curriculum coordinators, instructional coaches, or even authors of books, teaching materials, research, websites, blogs, and so forth. Whether face to face, online, or vicariously through writing, interaction with more competent others who have knowledge or expertise relevant to the learner creates opportunities for growth and learning. In the case of the Numeracy Cohort, more competent others included the numeracy coach, a university professor who was an expert in math instruction, numerous workshop facilitators, presenters, a curriculum consultant from another division, teachers inside and outside the division with experience using particular strategies, and authors of webpages, blogs, and books on mathematics pedagogy. Findings from the study suggest that teachers appreciated access to content, information, and strategies provided by these valuable resources, which mirrors existing literature on the characteristics of effective PD (i.e., contains content and pedagogical content knowledge, is aligned with curricular outcomes, focuses on student learning, and is supported with resources and leadership). What can be learned from this alignment is that, like opportunities for social interaction and collaboration, relevant content (in the form of interaction with more competent others) is valuable in rural contexts and an important consideration in the design of rural teacher PD models.

Human Engagement. From a social constructivist perspective, for significant learning to occur an individual must be actively engaged rather than passively compliant (Palincsar, 1998; Postholm, 2012). This means that the learner must have the “will to learn” (Postholm, 2012, p. 424) and to actively work toward new knowledge. Within the context of teacher PD, one of the ways that engagement can be fostered is through what Palincsar (1998) refers to as “tools that facilitate the co-construction of knowledge” (p. 353), such as dialogue and reflection. From a social constructivist

point of view, reflection and action are interconnected, as are thoughts, emotions, the will of a person, and action (Postholm, 2012). As a result, finding ways to foster dialogue and reflection are of critical importance in the design of teacher PD.

In terms of the Numeracy Cohort, opportunities for dialogue and reflection were built into the model in many ways. Dialogue was fostered through activities at face-to-face (and small group) sessions focused on goal setting, community building, sharing MAR experiences, and engaging with new ideas for improving teaching practice. Reflection was fostered through the conducting of teacher interviews; the incorporation of written, online, and oral reflections; the use of MAR forms; and the reporting of MAR project results/findings to the cohort and the division’s administration council. Together, these opportunities for dialogue and reflection permitted new ideas to rub up against existing ones, allowing cohort teachers to construct individual and collective understandings that previously did not exist.

One of the things that becomes apparent when looking at the engagement of the teachers involved in the Numeracy Cohort is the critical role the MAR projects played in the learning process. In addition to fostering dialogue and reflection, these projects required teachers to remain engaged in cycles of planning, acting, observing, and reflecting over a 2-year period. Just as McCullagh (2012) describes the use of video as a mediating tool for teacher learning through the cyclical processes of “observation, interpretation, and modification of practice” (p. 145), the MAR projects in this study promoted teacher learning by enriching social interactions, supporting dialogue and reflection, and promoting teacher engagement and action. In looking at cohort teachers’ perceptions of the effectiveness of the model (see Table 4), many of the valued aspects of the model are linked to the MAR projects, including having the time, focus, and accountability to follow through on planned changes in practice; having the autonomy to choose contextually relevant topics and strategies to engage with; and being able to work collaboratively on the projects with colleagues. These valued aspects of the model also align with the literature on effective PD, which suggests

teacher PD should be active, collaborative, ongoing, job embedded, and focused on student learning. The MAR projects used in the Numeracy Cohort initiative provide an example of what teacher engagement in professional learning can look like. Their use and effectiveness also suggest that those wishing to construct local models of teacher PD need to think about what teacher engagement will look like and how it will be fostered in their own contexts.

Conclusion

The Numeracy Cohort initiative examined in this study provides an example of a locally constructed teacher PD model designed to be responsive to the local context, local challenges, and the specific needs of teachers in the division. It links literature on rural challenges and effective teacher PD with practice in a rural context and, in doing so, offers one image of theory and practice working together in rural education. Those interested in designing rural teacher PD models may find promising practices that help them mitigate rural challenges to the provision of teacher PD in their own contexts. They may also find theoretically grounded elements of effective PD that will meet their own contextual needs and the needs of their teachers. Findings from this study suggest that paying attention to the multiple nested and dynamic contexts in which teachers work is both effective and prudent. Only through deep consideration of local strengths and challenges can effective local models be formed. Findings from the study also suggest that attention should be paid to fostering social interaction (among teachers and with more competent others) and human engagement (through mediating tools for learning such as dialogue, reflection, and action research). By paying attention to how new knowledge and understandings can be socially and collaboratively constructed, those in rural contexts can engage in what the division's superintendent described as "thinking outside the box," in order to draw on local strengths, mitigate local challenges, and support teacher professional growth.

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About the Author

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Appendix A

Semistructured Interview Questions Used for Teachers

The following questions were used for semistructured interviews conducted in Fall 2013, Spring 2014, and Spring 2015. The goals of the interviews were to obtain information in order to plan PD experiences that would meet the needs of teachers and to assess the initiative's effectiveness in meeting its goals. Permission was requested for their use in this research project through letters of informed consent and consent forms (signed by the superintendent and the cohort teachers).

Fall Interview Questions (Fall 2013)

1. What is your teaching background? How long and where have you taught? What subjects and grades have you taught?
2. Describe your professional development experiences over the past 2 years. What was the most effective professional development you have attended? What made it effective for you?
3. Have you experienced any barriers to accessing professional development? [e.g., issues related to funding (available money, cost to you personally), geography (distance and time required for travel, not having staff nearby), staffing (changes in staffing that breaks up collaboration, lack of availability of subs, teacher isolation, lack of curriculum coordinators/resources), or context (attitudes toward attending PD, lack of available PD in your interest area, lack of appropriate PD formats)] Please explain.
4. If you could design your own professional development experience, what would it include as key elements (e.g., working with a colleague to plan teaching strategies together, participating in a Professional Learning Community (PLC), learning about theory and applying it to your own classroom practice, etc.)
5. Describe your school and divisional numeracy goals. What is happening in your school currently regarding working toward those goals?
6. Describe your own goals regarding numeracy, mathematics teaching, and student learning in mathematics.
7. Describe the collegial environment in your school. Do teachers work together on collaborative tasks? Are you part of any of these collaborations?
8. You are what I refer to as "critical friends" or partners. You have volunteered/been nominated to participate in this project or cohort together. Tell me about your background with each other. How long have you worked together? What (if anything) have you collaborated on in the past? Why did you choose to work together on this project? What goals/perspectives do you share?
9. You indicated that you are interested in working toward _____ as an individual goal. How do you think you will know if you have achieved that goal? What will your practice look like? What will you see from students if that goal has been met?
10. What information, resources, and activities do you think you will need to meet your goals? What role do you envision this cohort taking in helping you meet your goals? How might members of the cohort support you in achieving your goals?

11. If you could design your own professional development experience, what would it include as key elements

Spring Interview Questions (Spring 2014)

1. Can you describe some of the things you have learned as a result of participating in this cohort?
2. Do you feel that your attitudes and beliefs about teaching mathematics have changed as a result of your participation? How have they changed?
3. Do you feel that your teaching practice has changed as a result of participation in this cohort? How has it changed?
4. Can you describe to what extent (if at all) you were able to collaborate with your critical friend/partner? Alternatively, did you have the chance to collaborate with other cohort members? What did this collaboration look like? How did it help you?
5. What types of student data (if any) did you utilize during this past year as part of your participation in the cohort? How did you use the data? Do you intend to continue collecting this sort of data? What role do you see student data playing in your teaching in the future?
6. What (if any) improvements in student learning outcomes have you noticed in your classroom? Describe what changes you made that resulted in these improvements?
7. At the beginning of the process, you identified your goals to be _____. To what extent do you feel that your professional needs have been met as a result of participating in the cohort? To what extent do you feel your goals were achieved?
8. Describe which parts of the cohort professional development structure were most beneficial to you (e.g., working with a critical friend/partner, observing classes, receiving feedback, online reflections, face-to-face sessions on particular topics, reading and reflecting on articles, conducting mini-action research projects). In what ways were they beneficial? Which parts do you feel were the least beneficial? What made them less effective for you?
9. At the beginning of this process, you identified the following barriers that you had experienced in accessing meaningful professional development: _____. Which, if any, of these barriers has the cohort addressed for you? In what ways were they addressed?
10. What suggestions do you have for making this process more effective in meeting your needs, improving teaching practice, and improving student learning outcomes in the second year of operation?

Second-Year Interview Questions (Spring 2015)

1. Can you describe some of the things you have learned as a result of participating in this cohort?
2. Do you feel that your attitudes and beliefs about teaching mathematics have changed as a result of your participation? How have they changed?
3. Do you feel that your teaching practice has changed as a result of participation in this cohort? How has it changed?

4. Can you describe to what extent (if at all) you were able to collaborate with your critical friend/partner? Alternatively, did you have the chance to collaborate with other cohort members? What did this collaboration look like? How did it help you?
5. What types of student data (if any) did you utilize during this past year as part of your participation in the cohort? How did you use the data? Do you intend to continue collecting this sort of data? What role do you see student data playing in your teaching in the future?
6. What (if any) improvements in student learning outcomes have you noticed in your classroom? Describe what changes you made that resulted in these improvements.
7. At the beginning of the process, you identified your goals to be _____. To what extent do you feel that your professional needs have been met as a result of participating in the cohort? To what extent do you feel your goals were achieved?
8. Describe which parts of the cohort professional development structure were most beneficial to you (e.g., working with a critical friend/partner, observing classes, receiving feedback, online reflections, face-to-face sessions on particular topics, reading and reflecting on articles, conducting mini-action research projects). In what ways were they beneficial? Which parts do you feel were the least beneficial? What made them less effective for you?
9. At the beginning of this process, you identified the following barriers that you had experienced in accessing meaningful professional development: _____. Which, if any, of these barriers has the cohort addressed for you? In what ways were they addressed?
10. Would you like to see the Numeracy Cohort continue in the future? What suggestions do you have for making it more effective in meeting your needs, improving teaching practice, and improving student learning outcomes?

Appendix B

Semistructured Interview Questions for Superintendent

1. Your background experiences may help shed light on your perspectives as a rural superintendent. Could you give me a brief description of your background (positions held etc.) so that I can better understand what experiences you draw from in answering my questions?
2. What challenges does the division face in providing effective PD for teachers?
3. What challenges do you think divisional teachers face in accessing effective PD?
4. What were the division's goals in creating the Numeracy Cohort (the PD model)? How does it fit within the broader PD context within the division?
5. What funding/financial considerations have been made in developing this model?
 - a. How has PD been financed in the past? What changes in financing PD took place to implement this model?
 - b. What funding barriers has the division faced in providing effective teacher PD in the past? Was the PD model designed to mitigate any of these funding barriers? If so, how? Were they effective?
 - c. What has been the impact on the financial cost of PD for the division as a result of implementing this model? (What were the PD costs before and after implementation?) What is your opinion about the cost versus benefits of the PD model in terms of funding?
6. What geographical/logistical matters did you have to consider in creating the model? Can you describe how the PD model tried to mitigate any geographical barriers? To what extent do you feel the model has been successful?
7. Can you describe the decisions around staffing that you made to implement the PD model? Were any of these changes in staffing designed to mitigate challenges faced by the division with regards to the provision of PD for teachers? If so, to what extent do you think they were successful?
8. What do you feel is unique about this school division? How is the context of the division both different than other rural divisions and similar? How do you feel contextual differences in this division contributed to the creation of the PD model? Can you comment on any challenges posed by the local context and whether or not any of the challenges were addressed through the Numeracy Cohort initiative?
9. From what you know about Numeracy Cohort activities over the past two school years, how do you feel the PD model has supported teachers' professional growth in the area of mathematics instruction and student numeracy?
10. What social constructivist elements do you see within the Numeracy Cohort/PD model, and how do you feel they contribute to teacher professional growth within the local context?

Appendix C

Focus Group Discussion Questions for Principals

Opening script to be read:

I would like to thank each of you for contributing to this very important discussion. Your feedback is extremely valuable and important. Before we begin, I would like to set some ground rules for the discussion. It is important that you do not talk about specific teachers in your responses. Feel free to discuss your own experiences as much as you would like, but please refrain from making statements about particular teachers in your responses. Do you have any questions? Thank you again. We will spend approximately 6–7 minutes on each question. Let's begin.

1. Your background experiences may help shed light on your perspectives as a rural administrator. Could we just go around the table and, in about a minute, could you give me a brief description of your background (positions held, places worked, years in current position, etc.) so that I can better understand what experiences you bring to this conversation?
2. What challenges do you feel a small rural division like this one faces in providing effective PD for teachers (financially, geographically, in terms of staffing, or even in terms of the local context)?
3. As principals, you are at times responsible for the provision of PD for your staff? What challenges do you face in providing PD opportunities for your teachers?
4. What challenges do you think rural teachers face in accessing effective or meaningful PD?
5. Over the past two years, the school division has implemented a Numeracy Cohort, which is a PD initiative in the specific area of numeracy. How does the initiative fit within the broader PD structure of the division? What do you see as the strengths and challenges of this initiative from an administrator's perspective?
6. How do you think the Numeracy Cohort initiative has addressed some (if any) of the challenges facing rural divisions, administrators, schools, or teachers, through its design?
7. From what you know about Numeracy Cohort activities over the past two school years, how do you feel the PD model has supported teachers' professional growth in the area of mathematics instruction and student numeracy?
8. A social constructivist view of teacher PD recognizes
 - teaching as a complex activity
 - teacher PD as a fluid, emerging construct
 - the interrelatedness between the individual and his/her environment
 - the interrelatedness between existing beliefs and future actions
 - learning as constructed as opposed to transmitted
 - the importance of context on the learning process
 - the importance of discovery and inquiry-based active participation
 - the art and importance of leadership/facilitation
 - the importance of teacher-directed learning

- teacher PD as a lifelong, inquiry-based, collegial activity
 - the importance of language and dialogue on the learning process
 - the importance of reflection and dissonance/disequilibrium on the learning process
 - the establishment of a collaborative, safe learning environment
9. What social constructivist elements do you see within the Numeracy Cohort/PD model, and how do you feel they contribute to teacher professional growth within the local context?
 10. What do you think should be changed about the PD structure or Numeracy Cohort generally moving forward? What do you hope to see in the future? What constructive thoughts do you have about ways the cohort could be improved? What would you like to see continue? Do you have any thoughts about how this model could look long term?

Appendix D

Focus Group Discussion Questions for Cohort Teachers

1. What challenges do you feel a small rural division like this one faces in providing effective PD for teachers (financially, geographically, in terms of staffing, or even in terms of the local context)?
2. What challenges do you think rural teachers face in accessing effective or meaningful PD? What challenges have you faced personally?
3. How do you think the Numeracy Cohort initiative has addressed some (if any) of the challenges facing rural divisions, administrators, schools, or teachers, through its design?
4. To what extent do you feel the Numeracy Cohort has been effective in meeting teachers' needs in the area of mathematics instruction and student numeracy? What has it done well and where has it fallen short?
5. A social constructivist view of teacher PD recognizes
 - teaching as a complex activity
 - teacher PD as a fluid, emerging construct
 - the interrelatedness between the individual and his/her environment
 - the interrelatedness between existing beliefs and future actions
 - learning as constructed as opposed to transmitted
 - the importance of context on the learning process
 - the importance of discovery and inquiry-based active participation
 - the art and importance of leadership/facilitation
 - the importance of teacher-directed learning
 - teacher PD as a lifelong, inquiry-based, collegial activity
 - the importance of language and dialogue on the learning process
 - the importance of reflection and dissonance/disequilibrium on the learning process
 - the establishment of a collaborative, safe learning environment

What social constructivist elements do you see within the Numeracy Cohort/PD model, and how do you feel they contribute to teacher professional growth within the local context?