

Principal sensemaking and leading school improvement in mathematics

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Preface

This Master's thesis is submitted in partial fulfillment of the requirements for the degree of Master's of Arts in Education at the University of Ottawa. It is an original scholarly work written and based on research conducted solely by David Paul Gautreau. The proposal for this thesis was reviewed and approved by Dr. Stephanie Chitpin, Dr. Richard Barwell and Dr. Michel Laurier. Consent to conduct the research for this thesis was obtained from the University of Ottawa Social Sciences and Humanities Research Ethics Board (REB), which operates in accordance with the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (2nd edition)* and other applicable laws and regulations in Ontario (Ethics file #04-16-24).

Abstract

While research has identified the practices that successful school leaders use, the effectiveness of those practices rests on leaders enacting them with great contextual sensitivity. Research literature suggests that leaders should be thoughtful, discerning, careful and dexterous with regard to how they lead. This thesis presents a qualitative, multi-case study of how five elementary school principals lead the improvement of mathematics achievement in their schools. Taking the perspective that leadership is a sensemaking praxis, principals' perceptions and interpretations of their contexts were explored with the goal of better understanding why they lead the way they do. The evidence revealed that the actions of the principals in this study were the product of their contextually-influenced, idiosyncratic sensemaking. This study demonstrates the value of using the sensemaking praxis perspective as a lens for understanding the enactment of educational leadership. Further, this study has practical implications for principal training, policy implementation, and school improvement.

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List of Acronyms and Abbreviations

EQAO = Education Quality and Accountability Office

OFIP= Ontario Focused Intervention Program

OLF= Ontario Leadership Framework

RMS= Renewed Math Strategy

SIP = School Improvement Plan

ECE = Early Childhood Educator

EA = Educational Assistant

Chapter 1: Introduction

In this opening chapter, a rationale for pursuing this inquiry into the enactment of school leadership will be provided. The rationale will describe some of my past professional experiences that led me to question why school leaders lead the improvement of mathematics education the way they do. This chapter will also describe the context, problem, research question, and significance of this study as well as provide an overview of the organization of this monograph.

1.1 Professional Experiences

My professional experiences have been the source of insight and confusion, both of which have helped to shape my interest in understanding effective school leadership, and the direction that this research has taken.

As an elementary school principal working in Ottawa, Ontario, Canada, with six years of experience in the role, and prior to that as a vice-principal, educational consultant with a school board, and Student Achievement Officer with the Ontario Ministry of Education, I have spent many years trying to bring about change, especially in the area of mathematics education. While I am confident that my leadership has had for the most part a positive impact on the people with whom I have worked, I have never been completely satisfied with the change that I have been able to bring about. I feel like I have been on a perpetual journey, taking small steps forward, never quite arriving at the envisioned destination. This dissatisfaction has been the motivating force behind my desire to better understand effective leadership, or more specifically how school leaders effect change.

Observation, discussion and collaboration with colleagues have been significant avenues of inquiry in my efforts to understand what constitutes effective school leadership. While these

avenues have without a doubt helped to develop my own leadership practice, they have also perplexed me because of the broad range of approaches that I have witnessed school principals using in their leadership. I have, for example, observed how some principals emphasize the importance of provincially mandated assessments, while others minimize the attention given to these assessments. Similarly, I know principals who encourage teachers to teach in traditional ways, and others who encourage teachers to use more progressive approaches. I have listened to principals who have used a confrontational approach with a teacher whose performance is unsatisfactory, and also listened to other principals who describe how they encourage and support teachers who struggle with their practice. Further, I have had the experience of my own views wildly differing from those of a colleague, for example when deciding on the best candidate to hire for a teaching position, or when judging the quality of instruction while observing in a classroom with colleagues. Despite having similar training, and despite working in very similar schools, in these instances, my views, and by extension my approach to leadership was very different than that of my colleagues. These experiences perplex me because there does not appear to be a clear correlation between the characteristics of the school and the approach used or the decision made, nor does there seem to be a correlation between the situation, the approach used or the decision, and the outcome. It seems like principals' approaches to leadership, my own included, are largely idiosyncratic, and that the effectiveness of various approaches can vary considerably. While such anecdotal observations do not satisfy the standard of valid and reliable academic evidence, they have fueled my thinking and influenced my inquiry into better understanding effective school leadership.

I have been similarly perplexed by how often school principals respond to policy mandates and professional learning in ways that differ from the manner intended by the policy

makers and professional learning providers. I think, for example of how career portfolios, which were recently mandated by the Ontario Ministry of Education, became major projects in some schools, while in other schools, the work done on the portfolios was minimal - just enough to satisfy the Ministry's mandate. I also think of how Ontario's Teacher Performance Appraisal process, intended to provide an opportunity for teacher growth, can become little more than an administrative exercise. I think of the "Three Part Math Lesson" (Literacy and Numeracy Secretariat, 2007, p. 6), which initially described for teachers how a 60 minute mathematics lesson should play out was sometimes implemented, sometimes modified, and sometimes not implemented, reflecting perhaps what school principals valued and understood about the lesson structure. Such experiences perplex me. Given similar needs, resources and experiences, school leaders seem to still lead the implementation of new policies in vastly different ways.

Perhaps the strongest influence on my desire to understand what constitutes effective school leadership, and how school leaders can effect change, has been the school in which I currently work. Located in an impoverished inner city neighbourhood in Ottawa, students who attend the school tend to struggle to meet the provincial standard in reading, writing and mathematics. In fact, the school has consistently ranked in the bottom 2% of schools in the province since the first administration of the provincial EQAO assessments in 1997. Since 2004, my school has received significant support from the school district and the Literacy and Numeracy Secretariat, first being designated as a Turnaround school, then as an Ontario Focused Intervention Program (OFIP) school, and most recently as an Intensive Support school. Such support, however, has not resulted in significantly changing achievement outcomes of students. Far from being discouraging, the significant physical, social, mental and academic needs of the

students in my school have been a strong motivator of my interest in understanding how I as school principal can effect change in my school.

My experiences as a school leader and my observations of other school leaders have fuelled my curiosity about the leadership of change in schools. Why is it that principals, given seemingly very similar school contexts, can choose to lead change in seemingly vastly different ways? Is it a matter of the principal's training and experience, skills, talents, beliefs, values, personal circumstances or their confidence as a leader? Is it because of the community, its history, needs, or culture of the school in which the principal leads, or is it because of how the principal perceives or interprets the situations in which they lead? Is it because of their understanding of district directives or their willingness to respond to district initiatives compared to local needs? Is the way principals' leadership actions are influenced by their personal circumstances, their health, or their family situation? Understanding these factors and how they impact the enactment of leadership and thereby impact school improvement is for me, of great professional interest.

There is no shortage of professional literature pertaining to leadership in general, and more specifically to school leadership. As a principal, many books and articles by authors such as Michael Fullan, Andy Hargreaves, Robert Marzano, Richard DuFour and Jennifer Abrams were shared with me. In addition, the Ministry of Education released with fair regularity leadership publications, such as the Ideas into Action Monograph, "Five Core Capacities of Effective Leaders" (Ontario Ministry of Education, 2012) and the Ontario Leadership Framework (OLF) (Ontario Ministry of Education, 2013). While these leadership publications all offered information and ideas about leadership, I found that none of them offered the nuanced deep insights for which I was looking.

1.2 Context of the Study

The study was conducted in the province of Ontario, Canada where the Ministry of Education serves as the highest educational authority. The qualifications and duties of principals are specified in the provincial Education Act and further elaborated by the OLF, a research-based summary of leadership behaviours that serve as the standard of practice to which school and district leaders are held accountable (Leithwood, 2012; Ontario Ministry of Education, 2013). The OLF describes five leadership “domains”, including setting direction, building relationships and developing people, developing the organization to support desired practices, improving the instructional program, and securing accountability (Ontario Ministry of Education, 2013). Looking at the verbs with which the domains are named, that is setting, developing, building, improving and securing, it is clear that bringing about change, as opposed to maintaining the current state, is viewed as an important aspect of a school principal’s role.

At the time of the study, mathematics education in Ontario had been experiencing, “a decline in students’ achievement” (Rodrigues, 2014, n.p.) that resulted in considerable media attention (e.g., Hammer & Alphonso, 2014; Casey, 2015; Csanady, 2016). There was also considerable debate among government officials, educators, parents, and academics about how to ‘fix’ the problem (e.g., Stokke, 2016; Bueckert, 2017). Stakeholders on one side were calling for a greater emphasis on developing computational skills and the use of explicit instructional strategies, while stakeholders on the other side were advocating for a focus on developing understanding and the use of more discovery or inquiry-based instructional strategies. The debate around improving mathematics in Ontario at the time of this study was similar to the “Math Wars”, an ongoing disagreement within the mathematics education community, mostly in the

United States, about the goals and methods of mathematics education (Schoenfeld, 2004) and was a significant part of the broader reality facing school leaders.

As a result of the declining mathematics achievement results, and perhaps also due to media attention, the provincial Ministry of Education announced in April, 2016, the Renewed Math Strategy (RMS), directing \$60 million towards improving mathematics achievement (Ontario Ministry of Education, 2016). The RMS initiative included elements such as making training more easily available to teachers and principals, the creation of math-focused coaching positions in schools and at the district-level, and the development and promotion of supports for homework and parents. At the time of the study, the RMS was only few months into its implementation.

Principals of all schools in Ontario are required to have a school improvement plan, or SIP. Such plans require principals, along with school improvement teams, to outline goal and strategies for achieving those goals, usually in the areas of literacy and numeracy. Such plans are shared with school districts and reviewed by district personnel.

1.3 Problem and Research Question

A key role for elementary school principals is to improve the instructional program, and in Ontario, the OLF outlines the practices that successful school leaders use to achieve such improvements (Ontario Ministry of Education, 2013). Yet, according to Leithwood (2012, p. 13),

The OLF is also explicitly “contingent”. While practices included in the OLF are what most successful leaders do in many different contexts, their practical value depends on leaders enacting them in ways that are sensitive to the specific features of the circumstances and settings in which they work and the people with whom they are working.

Schools however are complex places and unravelling the links between context, leadership practices and student achievement is challenging (Bruggencate et al., 2012). Without much guidance from research or professional literature, principals are left on their own to figure out how best to enact leadership practices.

Thus, guided by my past professional experience, rooted in educational leadership literature, and set within the context of a province trying to address increasing mathematics achievement concerns, this study aimed to address the problem of understanding what drives principals to lead the way they do. Framed as a question, this study aimed to answer the following question: Why do elementary school principals lead the improvement of student mathematics achievement in their schools the way they do?

1.4 Significance

The significance of this study is that it weaves together three distinct bodies of research not commonly associated in a manner that makes them very complementary. More specifically, this study combines what is known about effective school leadership practices, what is known about the role of context in the enactment of leadership, and what is known about the socio-cognitive process of sensemaking. Together these three bodies of research provide a unique lens for looking at the enactment of school leadership. Further, this study is significant as it uses a qualitative methodology to examine in a holistic manner, factors that influence the enactment of leadership.

1.5 Organization of the Study

This study has been organized into seven chapters. The current chapter introduces the study. In Chapter 2, literature pertaining to effective school leadership in general, and mathematics education leadership more specifically is reviewed, as is literature pertaining to

sensemaking. In Chapter 3, sensemaking praxis, the conceptual framework used in this study is described. Chapter 4 of this study outlines the methodology and research design used, including descriptions of the rationale, participants, data collection, data analysis, validity and researcher positionality. The findings from each of the five cases are presented Chapter 5, and in Chapter 6, the four themes that emerged from the cross-case analysis are presented. The study is concluded in Chapter 7, which includes closing remarks, as well as descriptions of the implications and limitations of the study.

Chapter 2: Literature Review

Three bodies of empirical and theoretical literature were reviewed for this study. First, because this study is focused on the work of elementary school principal, literature pertaining effective school leadership was examined. More specifically, literature pertaining to the enactment of school leadership practices and the role of context with regard to leadership was examined. Second, given that this study was focused on leading the improvement of student achievement in the area of mathematics, literature pertaining to mathematics education leadership was also reviewed. Finally, literature pertaining to the concept of sensemaking in general, as well as literature pertaining more specifically to principal sensemaking was reviewed. Together, these three bodies of literature, namely effective leadership literature, mathematics education leadership literature, and sensemaking literature provided the research foundation for this study.

2.1 Effective School Leadership

2.1.1 School leadership matters.

For well over a decade, a substantial body of evidence has been accumulating which demonstrates that the actions of school principals can have a significant influence on student learning (Hallinger and Heck, 1998; Witziers, Bosker & Krüger, 2003; Waters, Marzano & McNulty, 2003; Supovitz, Sirinides & May 2010) and school effectiveness (Day, Gu & Sammons, 2016). The evidence is so clear that Leithwood, Harris & Hopkins (2008, p.27) were prompted to claim unequivocally that, “School leadership is second only to classroom teaching as an influence on pupil learning” and Hitt & Tucker (2016, p.531) were confident enough to assert that school leaders were “pivotal in terms of enabling teachers to improve student achievement.” Research has also identified dozens of specific practices that successful school

leaders use and have subsequently collated these practices into organized frameworks, summarizing a vast body of research into succinct, seemingly very practical lists. (Leithwood, 2012; Hitt & Tucker, 2016).

It has been suggested however, that such clear lists oversimplify the complexity of school leadership (Thomson & Hall, 2011; Hopkins, Stringfield, Harris, Stoll, & Mackay, 2014).

“Schools are complex, ambiguous and contradictory organizations” (Salo, Nylund & Stjernstrøm, 2014, p. 5) comprised of a wide array of dynamic, sometimes contradictory internal and external demands (Cordeiro and Cunningham, 2012; Saltrick, 2010). Further, the influence that leaders exert on student learning and school effectiveness is largely indirect, and mediated by innumerable intervening variables. (Hallinger and Heck, 1998; Witziers, et al., 2003; Bruggencate, Luyten, Scheerens, & Slegers, 2012; Dumay, Boonen & Van Damme, 2013). As such, it is not surprising that the evidence pertaining to effective school leadership practices has been described as being a “complex set of generalisations” (Robinson, Hohepa & Lloyd, 2009, p. 71), and “not yet sufficiently fine-grained to inform us about how these practices are enacted” (Leithwood et al., 2008, p. 31). Hallinger (2010) argues that, “no such list could fully account for the contextually contingent nature of successful leadership practice” (p. 129) Given this level of complexity, and the limits of research-recommended practices, enacting leadership successfully can be very challenging for school principals.

2.1.2 Leadership is complex.

A challenge facing the educational researchers is the complex and variable relationship between leadership and learning (Dumay, 2009; Hallinger, 2011; Holmes, Clement & Albright, 2013). For example, in their review of almost three decades of school leadership effects studies, Hendricks and Sheerens (2013), for example found only small direct and indirect leadership

effects. The researchers suggest that this may be due to diverse and evolving conceptions of leadership, and leadership ‘substitutes’. Other researchers have highlighted and attributed the variety of school leadership research results to confounding factors, considering that leadership effects are largely indirect, and mediated by other factors (Louis and Robinson, 2012; Sebastian & Allensworth, 2012; Militello, Fusarelli, Alsbury, & Warren, 2013). Hallinger (2011) implicates context as a complicating factor, while Leithwood et al., (2006) cite personal beliefs as playing a role in leadership effectiveness, and Eacott & Holmes (2010) and Holmes, Clement & Albright (2013) highlight the role played by time. Further complicating matters, researchers also point to multiple sources of leadership in schools, for example shared and distributed leadership (Harris, 2012), the reciprocal effects between leadership practices and the responses to those practices (Spillane, 2006; Hallinger & Heck, 2011), and the synergistic effects between leadership practices themselves (Marks & Printy, 2003). The relationship between school leadership and student learning may be well established, and research may have revealed significant insights about the variables involved, but this does not mean that the ‘recipe’ for effective leadership is simple.

2.1.3 The importance of enactment.

One assertion that has been expressed by many researchers is that for leadership practices to be effective, they must be enacted appropriately (Hitt & Tucker, 2016). Waters, Marzano & McNulty (2003, p. 2) explain, “effective leadership means more than simply knowing what to do; it means knowing when, how, and why to do it”. Similarly, Day, Hopkins, Harris, & Ahtaridou (2009, p. 2) point out that “a common repertoire [of leadership practices] is necessary but insufficient in itself to secure effectiveness”. Overcoming the complexity of schools requires principals to lead with a “high degree of sensitivity” (Leithwood et al. 2008, p. 31), and

“thoughtful application” of evidence-based practices (Robinson, et al., 2008, p. 269) and “dexterity” (Hitt and & Tucker, 2016, p. 261). Principals must “navigate between prescribed standards and contextual realities” (Militello et al. 2013, p. 76) while “discerning and integrating the relevant factors” (Robinson, et al., 2009, p. 71), and being “sensitive to the specific features of the circumstances and settings in which they work and the people with whom they are working” (Leithwood, 2012, p. 13). They must be “adaptive and responsive to the changing conditions of the school over time” (Hallinger 2010, p. 129). Leithwood, Patten and Jantzi (2010, p. 697) write that,

The task for leaders is to identify, in both a contextually sensitive and research-informed way, the variables on each Path most likely to improve their students’ learning if the status or condition of those variables is improved and then to engage in that improvement work over time.

Further, successful principals must “fine tune their responses to the context and culture in which they lead to optimise school success” (Gurr, 2017, p. 20). It is clear from research that understanding and responding to one’s context is critical to leadership success (Leithwood et al., 2008), yet this important dimension of educational leadership has not received much attention in the research literature. To summarize, educational leadership researchers widely acknowledge that to be effective, leaders must align leadership practices with the context within which they are leading.

2.2 The Role of Context in Leadership

Like the factors that have been implicated as influencing principals’ sensemaking, context seems to be comprised of a virtually endless list of dimensions, aspects, components and

features. Thus, context can refer to any part of a situation in which a leader is leading that has an impact on how leadership is enacted or the effectiveness of the leadership practices used.

In leadership literature, context is described in a wide variety of ways. In a broad sense, context refers to “the circumstance, situations, and events surrounding the phenomenon under study and affecting its occurrence, form, internal dynamics, and meaning” (Shamir, 2012, p. 2). Context has been described as having internal and external dimensions (Avolio, 2007). For example with regard to school leadership, the school, students, staff, the building and resources would be considered components of the internal dimension of context, whereas the district and its policies would be part of the external dimension of context. Avolio (2007) points out that leadership theories also implicate other dimensions of context, including social context, the psychological climate (e.g., do people feel safe to share ideas), and cultural contexts. Avolio (2007) also suggests that there are cognitive, behavioural, historical, proximal and distal aspects to context that should be considered when theorizing about leadership.

More specifically, with regard to school leadership, Hallinger (2010, p. 127) explains that context “consists not only of the community, but also the institutional system and social culture”. Similarly, Braun, Ball, Maguire & Hoskins (2011) conceptualize context as being comprised of four dimensions, including the situated, material, professional and external dimensions. Braun et al. (2011, p. 585) list “aspects such as school intake, history, staffing, school ethos and culture, ‘material’ elements like buildings, resources and budgets, as well as external environments” as examples of contextual factors. Other examples of contexts that have been shown to have relevance include the political context (Pollock et al., 2017), the wider international context (Gurr, 2017), challenging contexts (Moos et al. 2011), school size (Clarke & Wildy, 2004), turbulent times (Clarke, 2015) and the prior academic performance of schools (Sammons, Day &

Ko, 2010). Describing the contexts that shape school practices and leadership with regard to different international educational jurisdictions, O'Donoghue & Clarke (2016, p. 200) vividly suggest that contexts:

are first, multifaceted, unstable amalgams of interdependent material, social, cultural, ideological, political, institutional, historical and geographical factors. Second, these contexts are multilayered, encompassing – for instance, local realities, national policies and practices, and international agreements. Third, contexts are volatile, latent, ambiguous and therefore elusive.

Context has also been considered to have a wide variety of influences on leadership. O'Donoghue & Clarke (2016) suggest that context has a central role to play in the enactment and effectiveness of leadership. Similarly, Dinh et al. (2011, p. 41) highlights the “central importance of context to the emergence and manifestation of leadership processes.” Hallinger (2010, p. 137) suggest that “effective leadership is both shaped by and responds to the constraints and opportunities extant in the school organization and its environment.” Hernandez, Eberly, Avolio and Johnson (2011, p. 1167) argue that “context can act as a direct determinant of the nature of leadership.” May, Huff and Goldring (2012, p. 435) conclude that “contextual factors not only have strong influences on student achievement but also exert strong influences on what actions principals need to take to successfully improve teaching and learning in their schools.” Recently, Leithwood (2017, p. 38) has taken the position that school leadership is “necessarily contingent” and requires “considerable local knowledge.”

While much evidence highlighting the significant role that context can play in educational leadership literature, Belchetz & Leithwood (2007, p. 135) argue that “many claims about the importance of context in the practice of successful school leadership would seem to be

greatly exaggerated.” Similarly, Leithwood, et al. (2008, p. 31) reject the claim that “context is everything.” The point made by these researchers is that while context plays a role in leadership, leaders do not “use qualitatively different practices in every different context” (Leithwood et al., 2008, p. 31). This position reflects a more integrated view of leadership in which “context matters” (Klimoski, 2012, p. 28), but wherein effective leadership practices are neither entirely context-specific, nor one-size-fits-all (Shamir, 2012; Hernandez, 2013).

To summarize, leadership does not occur in vacuum. Leadership takes place in a rich, changing, obvious and subtle, perplexing, interpreted context. Context impacts leadership, and leadership impacts context. Context mediates and moderates the impacts of leadership in a myriad of ways that have only begun to be described by research.

2.4 Mathematics Education Leadership

While ample research focuses on school effectiveness in general (Hopkins et al., 2014), there is far less written specifically about the role of school leaders and the improvement of mathematics. This was a surprise, given that the research that was reviewed drew clear distinctions between the leadership of mathematics improvement and other leadership efforts. Nelson and Sassi (2000), for example, provide evidence showing that a leader’s knowledge of mathematics and mathematics pedagogy constrains their leadership practices. Similarly, Stein and Nelson (2003) highlight leadership content knowledge as being necessary for effective instructional leadership. Eacott & Holmes (2010) also highlight the importance of content knowledge in the implementation of mathematics education reform. Thus apart from the ‘generic’ research recommendations that pertain to the successful enactment of school leadership practices, it seems that content knowledge and pedagogical knowledge play a special role in the way school principals lead the improvement in the area of mathematics.

Confirming the importance of content knowledge in the leadership of efforts to improve mathematics achievement, Steele, Johnson, Otten, Herbel-Eisenmann, & Carver (2015) found that principals' participation in algebra-focused professional development experiences led to meaningful shifts in instructional leadership practices. Similarly, a multi-case study conducted by Stein & Kaufman (2010) revealed that strong instructional leadership with expertise in mathematics had a positive influence on the implementation of mathematics reform curriculum. The researchers suggest that,

Without instructional leadership with such expertise, neither would a common vision for instruction have been articulated clearly or as readily adopted by teachers, nor would have arrangements and supports for so many mathematics-focused teachers been as likely (Stein & Kaufman, 2010, p. 595).

In a related finding Burch and Spillane's (2003) interviews of leaders from eight elementary schools revealed that "views of subject matter both shaped and were shaped by their leadership strategies" (p. 519). In their study, school leaders tended to rely more on external facilitators for improving mathematics instruction than they did for improving literacy instruction, but leaders who interacted regularly with teachers about instruction relied more on teacher expertise regardless of the subject. By contrast, Schoen (2010) found no significant correlation between principals' mathematics knowledge and what they noticed when observing mathematics lessons, and instead found that principals had highly consistent interpretations of mathematics instruction. Apart from this last finding, the relationship between principals' content knowledge and their enactment of leadership practices is reminiscent of the findings of a study by Louis & Robinson (2012) that found that differences in principals' curriculum and

pedagogical knowledge had an impact on the confidence that they had in providing advice, leading data teams, and being partners in professional learning.

In response to the complexity of leading the implementation of mathematics reform in England, Eacott & Holmes (2010, p. 89) propose a framework called “Leading Education Reform in Mathematics.” The framework takes a non-prescriptive approach to the role of leading mathematics reform, in which context is viewed as being “constructed rather than fixed” (p. 89). Eacott & Holmes (2010, p. 89) propose that leaders must have an understanding of “the collective unconscious (or cultural/educational) assumptions of their work, the value placed on their work by a diverse range of societal forces (social) and power relations (political).” Further, principals “must recognise that any given moment represents a point in time, the product of historical and contemporary struggles and developments” (Eacott & Holmes, 2010, p. 90), and finally “know when to abandon a course of action” (Eacott & Holmes, 2010, p. 90). While Eacott & Holmes (2010) do not specifically use the term sensemaking in the description of their framework, it is remarkably similar to descriptions of the process of sensemaking (Weick, 1995), especially with regard to the way in which the construal of context is emphasized in sensemaking literature and in the Leading Education Reform in Mathematics Framework.

2.5 Sensemaking

Sensemaking has been described as a concept, theory, lens, process, heuristic, framework and perspective (Maitlis & Christianson, 2014; Brown, Colville, Pye, 2014; Sandberg & Tsougas, 2014; Holt & Cornelissen, 2010; Weick, 1995). This diverse terminology reflects the sensemaking literature, described by Brown, Colville and Pye (2014) as “burgeoning and increasingly diverse and fragmented literature characterized by tensions, ambiguities and disagreements” (p. 267). Even so, while not fully coherent, there exist central ideas that

constitute sensemaking (Brown, Colville & Pye, 2014; Maitlis & Christianson, 2014; Weick, 1995). In this study, sensemaking is referred to as a process. Viewing sensemaking as a process implies that it involves a series of steps that precede action, which in this study is the enactment of leadership practices.

2.5.1 The process of sensemaking.

So, at its core, what is sensemaking? Karl Weick, author of what is widely considered the foundational text on the concept, was interested in understanding how people, faced with complex and ambiguous events and environments, made sense of what was going on. Weick (1995) explains that central to the study of sensemaking, are questions pertaining to how people “construct what they construct, why, and with what effects” (Weick, 1995, p. 4). In contrast to a purely rational view of cognition, wherein people are seen as information processors (Hoy & Tartar, 2010), Weick (1995, p. 13) took the view that “people generate what they interpret.” Thus, at its core, sensemaking is the interpretivist, social constructionist-rooted idea that people’s understanding and actions are derived from perceptions rather than from objective observations.

More specifically, Weick (1995) describes sensemaking as a process of progressive clarification that involves involving three interrelated steps: noticing, interpreting and acting. Other researchers and theorists use variations on this language to describe what are essentially the same three steps. Webber and Glynn (2006), for example refer to perceptions, interpretations and actions, Sandberg & Tsoukas (2014) use the terms, creation, interpretation, and enactment and similarly, Maitlis & Christianson (2015), refer to noticing or perceiving cues, creating interpretations, and taking action. The use of different terminologies reflects the still evolving thinking that exists around sensemaking.

2.5.1.1 Noticing.

Regardless of terminology used, instances of sensemaking are commonly viewed as being initiated when a person notices, or perceives something that does not fit what is expected (Weick, 1995). The trigger or cue may be any issue, event, thought or situation that violates expectations and causes a sense of confusion, uncertainty or a sense of ambiguity: “Such occurrences, when noticed, interrupt people’s ongoing flow, disrupting their understanding of the world and creating uncertainty about how to act. This happens when there are discrepancies between expectations and reality” (Maitlis & Christianson, 2015, p. 70). Weick, Sutcliffe and Obstfeld (2005, p. 409) explain, “Explicit efforts at sensemaking tend to occur when the current state of the world is perceived to be different from the expected state of the world, or when there is no obvious way to engage the world”, or put more succinctly by the same authors, “sensemaking starts with chaos” (Weick, Sutcliffe, & Obstfeld, 2005, p. 411). When circumstances, whatever they might be, evoke an unsettled feeling in a person, an instance of sensemaking is initiated.

While there was a tendency in early sensemaking research to focus on situations in which the sensemaking cues were obvious, or where there is a clear starting point, such as in crisis situations (Weick, 1995), research describes a broad range of sensemaking cues in a wide variety of contexts. Sensemaking cues range from the subtle to the conspicuous. Weick, Sutcliffe, & Obstfeld (2005, p. 415) classify sensemaking cues into three conditions for the instigation of sensemaking: “situations involving the dramatic loss of sense, situations where the loss of sense is more mundane but no less troublesome, and unfamiliar contexts where sense is elusive.” Similarly, Maitlis & Christianson (2015) identify three types of situations in organizations in which sensemaking might be triggered: situations involving environmental jolts and

organizational crises; situations in which threats to identity are perceived, and situations involving planned change interventions. Thus it can be seen that sensemaking may be triggered by a broad range of experiences, from events that are disruptive, unexpected, novel or exceptional to events that are minor, mundane, fleeting or seemingly insignificant (Helms Mills, Thurlow & Mills, 2010; Maitlis & Christianson, 2014; Weick, Sutcliffe & Obstfeld, 2005).

2.5.1.2 Interpretation.

With the attention focused by some cue or trigger, the sensemaking process moves to an interpretation phase. Weick, Sutcliffe, and Obstfeld (2005, p. 409) explain that “to make sense of the disruption, people look first for reasons that will enable them to resume the interrupted activity and stay in action.” This involves constructing plausible explanations for what the sensemaker has perceived (Weick, 1995). In essence, the sensemaker simply ponders, either consciously or unconsciously, “What’s the story here?” (Weick, Sutcliffe & Obstfeld, 2005, p. 410). Interpretation involves progressively framing and naming perceptions, thus turning amorphous, disconnected circumstances into a clearly defined and articulated situation (Weick, Sutcliffe & Obstfeld, 2005). This is done not by ‘reading’ the circumstances, but rather by actively constructing the situation. While Weick (1995, p. 6) explains that “Sensemaking is about authoring as well as interpretation, creation as well as discovery,” Brown, Colville & Pye (2015, p. 266) emphasize the constructionist view, clarifying “sensemaking is less about discovery than invention.” Initial fleeting thoughts about what is going on are bolstered or dismissed. The sensemaker works through ambiguity and equivocality of circumstances, weighing perceptions against knowledge, values and beliefs, and past experiences as well as the reasoning of others, creating a comprehensive and narratively-organized understanding of the situation (Weick, 1995). With plausibility attained the sensemaker is able to take action.

2.5.1.3 Action.

In turn, interpretations lead to action. Having a plausible explanation of the situation in mind, sensemaking continues with the sensemaker asking and responding to the question, “What do I do next?” (Weick et al., 2005, p. 412). While action might seem to be the concluding point of the sensemaking process, action (or inaction as the case might be), serves as an information feedback loop in the ongoing process. As Weick (1995, p. 6) explains, the process of sensemaking includes not only noticing and interpreting, but also “the revision of those interpretations based on action and its consequences”. The action phase could be considered an experiment, wherein the sensemaker’s actions become another piece of information used for sensemaking. As Sandberg and Tsoukas (2014, p. 14) explain, “the enactment process involves acting on the more complete sense made of the interrupted situation, in order to see to what extent it restores the interrupted activity. As the initial actions already taken by the actors become part of the environment with which they now engage, enactment (i.e., the further actions taken by actors) may lead to further iterations of the three processes, until the interrupted activity is satisfactorily restored—that is, when sense and action are in sync again.” Thus it can be seen that the three steps involved in the sensemaking process are neither linear, nor independent. Rather, the steps are interrelated and iterative (Maitlis & Christianson, 2014).

2.5.2 Core features of sensemaking

In addition to describing sensemaking as a process, Weick (1995), and subsequently others (Weick, Sutcliffe & Obstfeld, 2005; Mills, Thurlow & Mills, 2010) articulate seven core features of sensemaking. These core features “serve as a rough guideline for inquiry into sensemaking in the sense that they suggest what sensemaking is, how it works, and where it can

fail” (Weick, 1995, p. 18). Below, each of the core features of sensemaking highlighted by Weick (1995) will be briefly described.

1. Sensemaking is grounded in identity construction. Identity is the way in which we see ourselves or wish to be seen. Weick (1995, p. 21) explains “The establishment and maintenance of identity is a core preoccupation in sensemaking.”
2. Sensemaking is retrospective. Sensemaking involves looking back and trying to make sense of events that have already occurred. According to Mills, Thurlow & Mills (2010, p. 184), “In order to give meaning to the ‘present’ we compare it to a similar or familiar event from our past and rely on the past event to make sense.”
3. Sensemaking is focused on and by extracted cues. “Extracted cues are simple, familiar structures that are seeds from which people develop a larger sense of what may be occurring” (Weick, 1995, p. 49).
4. Sensemaking is driven by plausibility. Mills, Thurlow and Mills (2010, p. 185) explain that “we do not rely on the accuracy of our perceptions when we make sense of an event. Instead, we look for cues that make our sensemaking seem plausible.” Weick (1995, p. 56) argues that “Accuracy is nice, but not necessary”. He goes on to explain that “Given multiple cues, with multiple meanings for multiple audiences, accurate perception of ‘the’ object seems like a doomed intention. Making sense of that object, however, seems more plausible and more likely.” By using informed plausibility as a threshold for moving forward, sensemaking can be a quick and pragmatic process.
5. Sensemaking is enactive of the environment. Enactment refers to the idea that while circumstances exist independently of cognition, what people notice, and the stories that they construct about their circumstances are the product of their interactions with their

circumstances (Weick, 1995). Weick writes, “there is not some kind of monolithic, singular, fixed environment that exists detached from and external to these people.

Instead, in each case, the people are very much a part of their own environments. They act and in doing so create the materials that become the constraints and opportunities they face.” (Weick, 1995, p. 31).

6. Sensemaking is social. Although the source of some disagreement in the literature (Ganon-Shilon and Schechter, 2016), social contact is often considered an essential aspect of sensemaking. Weick (1995, p. 40) goes so far as to label sensemaking as a “socially conditioned activity.” Similarly, Mills, Thurlow & Mills (2010, p. 185) describe sensemaking as being “contingent on our interactions with others, whether physically present or not” and highlight that social norms and organizational rules influence sensemaking.
7. Sensemaking is ongoing. Finally, while sensemaking is viewed as being a three step process, it never stops. New events and experiences as well as the sensemaker’s own actions become the fuel for subsequent sensemaking. Thus, sensemaking is “a sequential process that never stops because sensemaking flows are constant.” (Mills, Thurlow & Mills, 2010, p. 186).

Sensemaking has been used as a lens for exploring a variety of experiences in a broad range of organizations (Maitlis & Christianson, 2014), including leadership in educational contexts. A review of the body of research literature pertaining specifically to school leadership is presented next.

2.5.3 Principal sensemaking.

For this study, 23 publications pertaining to principal sensemaking were reviewed, including 21 qualitative or mixed methodology papers, one literature review (Ganon-Shilon and Schechter, 2016) and one conceptual paper (Spillane, Reimer & Reiser, 2002). This body of literature reflects a significant contrast to the state of the field less than a decade ago when Starlick (2010) observed that relatively little attention had been paid to sensemaking in K-12 education leadership research literature. Further, this literature review reveals several trends in educational leadership sensemaking literature, including a trend to use sensemaking to understand policy implementation, a trend to use sensemaking to understand how school principals understand their roles, and more recently, a trend to explore how school principals influence the sensemaking of others. Each of these trends is discussed below.

2.5.3.1 Policy Implementation.

The trend to use sensemaking to understand policy implementation by educators seems to have been precipitated by an article by Spillane, Reimer & Reiser (2002). In the article, the authors develop a model of sensemaking that counters conventional accounts of policy implementation. Spillane, Reimer & Reiser (2002, p. 389) assert that,

Viewing failure in [reform policy] implementation as demonstrating lack of capacity or a deliberate attempt to ignore policy overlooks the complexity of the sensemaking process. Sensemaking is not a simple decoding of the policy message; in general, the process of comprehension is an active process of interpretation that draws on the individual's rich knowledge base of understandings, beliefs, and attitudes.

Several researchers have subsequently used sensemaking as a framework for understanding principal's sensemaking about a school sanctioning policy (Anagnostopoulos &

Rutledge, 2007), accountability policies (Saltrick, 2010; Koyama, 2014), a school choice policy (Jenkins, 2010), an inclusion policy (DeMatthews, 2015), a teacher evaluation policy (Rigby, 2015), and district and state hiring policies (Ingle, Rutledge & Bishop, 2011). Following a thorough review of sensemaking literature pertaining to educational reform policy implementation, Ganon-Shilon and Schechter (2016, p. 14) conclude that “individual and collective sense-making processes can assist teachers, school leaders and policymakers in facilitating an effective implementation of reform, thus, promoting a long-term school improvement.” The application of the concept of sensemaking to understand policy implementation is receiving growing attention within the field of educational leadership research. Similarly, the trend to explore principals’ perceptions of their roles has also been a growing trend.

2.5.3.2 Understanding the Principals’ Role.

There is also a trend evident in research to use the concept of sensemaking to understand how school principals come to understand their role. Novice principals are the focus of a study by Spillane and Anderson (2014, p. 2) in which it was found that due to a plurality and diversity of local and organizational expectations, novice principals’ identities “were not unitary and that encompassed inconsistencies and contradictions.” A similar study of novice principals by Spillane and Lee (2014), found that a variety of factors, including sensemaking, socialization, past experiences, emotions, and district policies, influenced principals’ perceptions of their new role. Burch (2007) examined school administrators’ conceptions of instructional leadership and found that professional interactions and local contexts mediated how they perceived their role. Similarly, Carraway and Young (2015, p. 230) found that “content knowledge, preexisting knowledge, structural conditions, social interactions, meaningfulness, identity as an instructional

leader, and positive feelings.” influenced principals’ sensemaking and how they responded to an instructional leadership training program. Abrahamsen, Aas, & Hellekjær (2015) explored how sensemaking contributed to principals’ understanding of their role on reorganized leadership teams and Louis, Mayrowetz, Smiley, & Murphy (2009) explored principal sensemaking pertaining to how leadership was distributed. Together these studies provide complementary evidence that school principals’ conceptions of their roles emerges from their sensemaking.

2.5.3.3 Others’ Sensemaking.

Several research studies also describe the role of principals in influencing the sensemaking of others, a concept referred to as ‘sensegiving’ (Sandberg & Tsoukas, 2014; Maitlis & Christianson, 2014). Brezicha, Bergmark, and Mitra (2015), Coburn (2005), and Krum & Holstrom (2011) authored studies pertaining to how principals influence teacher sensemaking pertaining to the implementation of new policies and Thomson and Hall (2011) explored how principals’ sensemaking contributed to a school staff’s vision of being innovative. These studies highlight that not only do principals engage in sensemaking, but they play an important role in supporting the sensemaking of others within their school communities.

2.5.3.4 Other Factors.

From the aforementioned research literature, a diverse array of factors have been posited or found to play a role in principals’ sensemaking. Abrahamsen et al. (2015), DeMatthews (2015), and Evans (2007) mention efforts to protect or enhance identity as playing a role in sensemaking. Sleegers, Wassink, & van Veen (2009) cite personal biographies as playing a role in sensemaking. Carraway & Young (2015) mention content knowledge, pre-existing knowledge, structural conditions, social interactions, meaningfulness, identity, and feelings. Ingle, Rutledge & Bishop (2011) identify personal beliefs, background, and experiences, school

characteristics and policy mandates. Rigby (2015) identifies principal preparation programs and collegial networks as influencing principal sensemaking of teacher evaluations. Saltrick (2010), Thomson & Hall (2011) and Burch (2007) mention influence of social interactions on sensemaking, meanwhile Spillane et al, (2002), DeMatthews, (2015) and Ganon-Shilon and Schechter (2016) mention the influence of emotion on sensemaking. This account of factors that have been found to influence, and are influenced by principal sensemaking is only a small sampling of those mentioned in the research literature. Suffice it to say, there seems to exist many factors that play a role in the sensemaking of school principals.

2.6 Summary

This literature review presents research findings and scholarly writing pertaining to three areas of academic study, including effective school leadership, mathematics improvement leadership, and sensemaking. From the effective school leadership literature, it is clear that much is known about effective school leadership, including the positive impact that leadership can have on student achievement as well as the specific leadership practices that are associated positively with student achievement. Still, much remains unclear, particularly with regard to the enactment of school leadership, and the role that context plays in the enactment and effectiveness of leadership practices. With regard to the leadership of mathematics improvement, the literature reveals that content knowledge seems to have a role to play in how principals approach their mandates. Finally, the review of literature pertaining to sensemaking revealed that it is a perspective that has been used extensively to understand why people do what they do, and that it is beginning to be used in research to understand the beliefs, understandings and actions of school leaders. Together the three bodies of research reviewed provide a stable scholarly foundation for this study.

Chapter 3: Conceptual Framework

To gain insight into why school principals lead the way they do, leadership was considered to be a sensemaking praxis in this study. To explain this conceptual perspective, the Aristotelian concept of praxis (Barlosky, 2006; Birden, 2009) and the Weickian concept of sensemaking (Weick, 1995), as well as the concept of leadership will be briefly discussed.

3.1 Leadership

For the purpose of this study, leadership is defined as “the exercise of influence on organizational members and diverse stakeholders toward the identification and achievement of the organization’s vision and goals” (Leithwood, 2012, p. 3). While this definition is inclusive of formal, and informal sources of leadership (Hernandez et al., 2011), as well as distributed sources of leadership (Louis et al., 2009), this study has focused primarily on the formal, undistributed enactment of leadership by school principals.

3.2 Praxis

In this study, leadership will be viewed as praxis. Praxis is an Aristotelian idea that simply put, means “thoughtful action” (Birden, 2009, p. 610), or “discerning action” (Barlosky, 2006, p. 544). Through the lens of praxis, human action is seen as neither being driven solely by theoretical knowledge, nor solely by practical knowledge. Rather, when viewed as praxis, human action is seen as being shaped by both theoretical knowledge and practical knowledge. As Bidden (2009) explains a praxis involves “not only intellectual insight, but in-depth acquaintance with the practical considerations needed to intervene skillfully, creatively, and in a timely manner in practical problems” (p. 610). Viewing school leadership as praxis is well aligned with the thinking of leadership scholars who argue that reasoning, discernment, and sensitivity are necessary for leadership practices to be effective (e.g., Waters et al., 2003;

Robinson et al., 2008; Leithwood et al., 2008; Leithwood, 2012; Sammons et al., 2014).

Viewing school leadership as praxis also highlights that enactment is an emergent process, wherein experience leads leaders to action, actions then produce effects, which in turn influence the leaders' thinking, and the actions that they subsequently take. A praxis view of leadership shifts the focus from the practices used by school leaders to the reasoning that underlies the enactment of those practices. This shift in perspective is one that seems to have value both in practical terms for school leaders and in academic terms for advancing educational leadership research.

3.3 Sensemaking

The enactment of school leadership can also be viewed through the lens of sensemaking, a socio-cognitive constructive process that complements and extends the concept of praxis. Simply put, sensemaking, “involves constructing a reality by creating meaning from prior knowledge, experiences, values and beliefs” (Ganon and Schechter, 2016, p. 2). As a socio-cognitive process, sensemaking takes place in the minds of individuals, but it is also influenced by the thinking and actions of others (Weick, 1995). As a constructive process, sensemaking individuals are seen not merely as interpreters of their observations, but as actively generating and enacting their ‘realities’ (Brown, Colville & Pye, 2015). Sensemaking differs from praxis in that praxis is focused mainly on the influence of knowledge and action, whereas sensemaking emphasizes the influence of social and cognitive processes.

3.4 Sensemaking Praxis

When school leadership is framed as a sensemaking praxis, the enactment of leadership practices is seen as a socio-cognitive constructive process that involves giving consideration to both theoretical and practical knowledge. This perspective is well aligned with prior educational

leadership research which posits that the effectiveness of leadership practices does not lie in the practices themselves, but rather it lies in the enactment of those practices (Leithwood et al., 2008). Further, this perspective is also well aligned with prior educational leadership research that acknowledges that while context has a role to play in the effectiveness of leadership practices, the role of context can vary (Warwas, 2015; O'Donoghue & Clarke, 2016). Finally, framing school leadership as a sensemaking praxis emphasizes the constructivist perspective wherein leaders are viewed as authors of their reality (Weick, 1995), in contrast to the more rational, positivist perspective wherein leaders are viewed as objective observers (Spillane, Reimer & Reiser, 2002; Dane & Pratt, 2007; Hoy & Tartar, 2010). Thus, framing leadership as a sensemaking praxis provides a robust foundation this study.

The figure below (Figure 1) provides a visual representation of the sensemaking praxis conceptual framework. Starting at the middle of the figure, the principal's perceptions and interpretations of their situation shown by arrows as being influenced by their knowledge, skills and beliefs (i.e., theoretical knowledge) and the context (i.e., practical knowledge). These perceptions and interpretations in turn lead to actions (or possibly inaction), which may, in turn, have an impact on the principal's theoretical knowledge as well as on the context within which they are leading, thus influencing future perceptions, interpretations and actions.

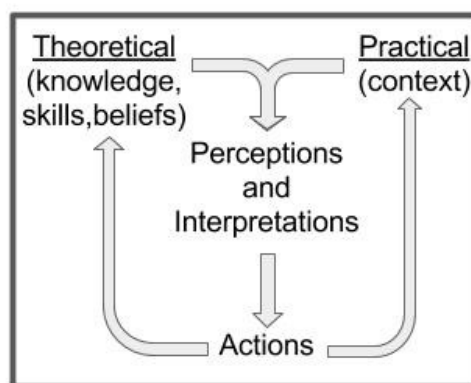


Figure 1: Sensemaking Praxis Conceptual Framework

The data collected for this study, as well as the way in which the data was analyzed, were both influenced by the use of sensemaking praxis as the conceptual framework for this study.

When leadership is viewed as a sensemaking praxis, leadership actions are not considered as being entirely subjective or objective. Rather, actions are seen as being derived from the leaders' perceptions and interpretations of their context. Put another way, all leadership actions are viewed as being the product of sensemaking praxis. Further, leaders' contextual perceptions and interpretations are influenced by social factors and personal factors. As such, using sensemaking praxis as the contextual framework for this study made it necessary to gather the principals' perceptions and interpretations of their school contexts, as opposed to using a more objective strategy for collecting more factual, or generic contextual data (e.g., gathering survey data about the school). The contextual framework also necessitated the gathering of pertinent personal and social information about the principal.

The data analysis was also influenced greatly by using sensemaking praxis as the conceptual framework for this study. First, because perceptions, interpretations and actions are so intertwined with each other and with the principal personally, the conceptual framework necessitated that the cases be analyzed holistically. To have conducted a factor by factor analysis of the data would not have produced a clear understanding of the principals' sensemaking. Further, by viewing leadership as a sensemaking praxis, the data analysis brought the features of sensemaking, such as plausibility, ongoing, retrospective, enactive, and identity building to the focus of the analysis.

In the chapter that follows, the methodology used to explore how elementary principals sensemaking, come to lead the improvement of mathematics in their schools the way they do will be presented.

Chapter 4: Methodology

In this chapter, the research design used in this study is described. The chapter begins with the rationale for using a qualitative, multiple-case study approach. Next the methods of participant selection, data collection and analysis are methods are presented. The chapter concludes with an explanation of how validity, transferability, and the ethical issues were addressed.

4.1 Rationale

This study was conducted to gain insight into why five elementary school principals lead the improvement of mathematics their schools the way they do. A qualitative, multi-case study design was used (Yin, 2009; Creswell, 2013). Such a design was used as it has been found to be well suited to delving into social complexities of lived experiences (O’Leary, 2013), enabled a holistic view of the principals’ sensemaking to be taken (Weick 1995; Ganon-Shilon and Schechter, 2016), and provided the opportunity for emerging themes and insights to be confirmed through replication and the triangulation of data, thus enhancing the study’s validity (Santos & Eisenhardt, 2004).

Cases were built primarily using interview data. Through the interviews, participants were able to articulate the reasons for which they led the improvement of mathematics achievement the way they did. Using interviews as a data collection method is consistent with other sensemaking research (e.g., Starlick, 2010; DeMatthews, 2012; Rigby, 2015).

4.2 Participants

Participants were purposefully selected for this study using the following criteria. First, given the focus of the study, and the desire for some consistency between the cases, all participants had to be elementary school principals who were currently working in Ontario

English language schools. Second, to maintain a degree of objectivity, all participants had to be principals with whom I did not work directly, nor with whom I had a close personal or professional relationship. Third, to capture a diversity of cases, consideration was given to participant gender, years of experience, school district, school size and the community served by the school. Finally, an effort was made to recruit participants who were ‘typical’ rather than exceptional or unique (Creswell, 2013). With these criteria in mind, I contacted six principals, one at a time, between September and December, 2016. Five of the six principals contacted agreed to participate. One principal declined to participate, explaining that he did not have the time to participate in the study. The number of participants involved in this study was well aligned with the recommendation using between three and five cases (Schram, 2006). Further, as Creswell (2013) points out, the number of cases is sufficient to yield a diversity of perspectives, and yet not so large as to ‘dilute’ the details of each individual case.

The table below (Table 1) summarizes the background information about the participants.

Principal	Age	Experience as a Principal	District	Approximate Student Population	Community	Approximate Grade Three E.Q.A.O. Math Results**	Approximate Grade Six EQAO Math Results**
Charlotte	50-60	2 1/2 months	A	200-250	Suburban	85-90	75-80
Jackie	40-50	6 years	A	150-200	Suburban	45-50	25-30
James	50-60	18 years	A	450-500	Suburban	60-65	35-40
Peter	40-50	6 years	B	350-400	Rural	40-45	50-55
Mallory	40-50	4 years	C	250-300	Urban	15-20	10-15

Table 1 - Participants. EQAO Math Results (**) represent the percentage of students achieving the provincial standard in mathematics on the May, 2015 provincial E.Q.A.O. assessment.

4.3 Data Collection

Interviews with the five principals took place between October and December 2016 and ranged in length from 11 minutes to 64 minutes. Four of the five principals were interviewed in their school offices, and one interview took place at an alternate site. Interviews were completed at a time the principals felt was convenient. Interview data was supplemented with observations made at four of the principals' schools, and reviews of the schools' websites and publicly available mathematics assessment data.

The interviews followed a semi-structured interview protocol (Appendix 1). A semi-structured format was used to allow the principals being interviewed to share what they wanted to share and to elaborate on whatever they felt was pertinent to the interview, and so would better capture unpredicted factors that may be playing a role in principals' sensemaking. The interview protocol had four broad groups of questions. First, principals were asked about their professional background. Principals were then asked to describe their school community. Next, principals were asked more specifically about mathematics teaching and learning in their schools, and finally they were asked to describe any other factors that they felt may have influenced how they led. The intent of the first and last groups of questions was to gain insights into personal factors that may have influenced the principal's sensemaking and enactment of leadership. The intent of the second and third groups of questions was to reveal the principals' perceptions and interpretations of their school context. Together all four groups of questions were intended to reveal the breadth of factors that might be influencing the principals' sensemaking and leadership. Each of the five interviews was audio recorded in situ and transcribed.

Finally, publicly available, digital documents pertaining to leadership and/or mathematics education from the Ontario Ministry of Education and school districts were reviewed. By the

end of the fifth interview, the experiences and ideas principals shared began to repeat, leading to the decision that saturation had been reached. Saturation is the point at which, when collecting data, new ideas ceased to be revealed (Creswell, 2013).

4.4 Data Analysis

Data analysis followed the process outlined by O’Leary (2014). First overall impressions were noted during the interviews and as the interview data was being transcribed. The interview data was subsequently coded, organized, and reorganized as patterns, interconnections and themes emerged. The process of summarizing and comparing the cases led to the refinement of four emergent themes. Throughout the data analysis process, data and emergent themes were discussed with a trusted colleague to verify interpretations and conclusions. Ongoing efforts were made to remain aware of my own sensemaking, to “bracket” (Creswell, 2013) my personal and professional biases, and as much as possible, to understand each case from the principal’s perspective rather than from my own.

Within five days of each interview, I began the transcription of each interview from the audio recording to a typed Google Document. This process involved listening to the recordings several times. First, I would play the audio recording, pausing and rewinding frequently. Once the initial transcription was complete, I listened to each audio recording a second time, adding omissions, correcting inaccuracies, fixing typographical errors, and adding punctuation. I listened to each audio recording a third time with few pauses, making only minor corrections, and checking that the written transcript was accurate. The final stage of transcription involved reading through the transcripts and changing names and identifying information to ensure the anonymity of the participant, the school, and the school district. Also, ‘ums’, ‘ahs’ and other

nonsensical utterances were removed from the written transcript. Together, 35 pages of single-spaced transcripts were produced from the five interviews.

Following the transcription of the interviews, transcripts were read and re-read several times for the purpose of summarizing each case individually, and also for the purpose of identifying similarities and differences between the cases. Quotations of statements, anecdotes and examples were highlighted, cut and pasted into other documents, and analytical insights were noted alongside the quotations. This process went through several iterations and resulted in the data being organized and reorganized in several different ways and themes emerging, changing, being discarded, and re-emerging. By reading, re-reading, and comparing the transcripts, patterns and connections between what principals said, or did not say also began to emerge. For example, for all principals there seemed to be considerable alignment between principals' beliefs and their actions. Further, it also became very evident that there was considerable alignment between principals' beliefs and their past experiences.

The conceptual framework for this study, that is the view of leadership as a sensemaking praxis, was used to guide the analysis of interview data. More specifically, analysis involved examining interviews for statements that reflected the processes or the core features of sensemaking (Weick, 1995). For example, during the data analysis transcripts were examined for instances where actions that were based on plausible assumptions rather than certainty, or where actions were influenced by beliefs or past experiences. Transcripts were also examined for instances where sensemaking was retrospective, where principals labelled what they noticed, and bracket out certain observations, or where their observations, interpretations or actions served to construct or maintain their identity. Viewing principals as sensemakers, and leadership

as a sensemaking praxis provided guidance for the way in which data was interpreted in this study.

4.5 Validity

Two potential threats to the validity of this qualitative research were reactivity and researcher bias (Maxwell, 2005). Reactivity involves the influence that the researcher has on the study, for example by making the participant behave or feel more or less comfortable to share openly during an interview. Researcher bias, by contrast involves the influence that the researcher's ideas or beliefs have on the way in which the data collected, analysed and interpreted.

To address the threat of reactivity, participants in this study were reassured that their anonymity would be protected. Further, the interview protocols included questions that provided an opportunity for participants to share what they wanted, and statements designed to build trust and comfort. Finally, during the interview, an effort was made to keep statements non-judgemental and emotionally positive.

To address bias, before conducting any interviews, I responded to the interview questions myself, as if I was a participant in this study. This made me more aware of my own assumptions, preconceptions and sensemaking, and helped me to bracket out my own beliefs and ideas (Creswell, 2013). I also wrote a statement of positionality, included below, to alert readers of this study to potential biases in this study, particularly with regard to data collection and analysis.

Potential bias was also addressed in many other ways. During the interviews, I continuously reflected on the questions that I was asking, and the 'direction' that the interviews were taking. I felt that my role during the interviews was to guide, but not to steer. During data

analysis, whenever I had an insight, or whenever a theme or pattern emerged, I made an effort to consider alternate interpretations for my findings. These alternate explanations were noted alongside other findings. Finally, to address bias, I also shared the transcripts and analysis with a trusted, but critical colleague to verify that the conclusions drawn from the data were plausible.

The following statement of researcher positionality summarizes my own beliefs, ideas and sensemaking about the leadership of mathematics education in my school.

4.6 Researcher Positionality

In addition to conducting this research, I work in the province of Ontario, Canada as an elementary school principal with six years of experience. Prior to becoming a principal, I worked in the area of mathematics education at the district level for six years and with the Ontario Ministry of Education for one year. Like the participants in this study, I am engaged in leading the improvement of mathematics achievement in my school. Over the course of my career, my thinking about what is needed to improve mathematics achievement has evolved. I currently believe that improving mathematics achievement involves helping students to develop knowledge recall and procedural fluency, as well as conceptual understanding and reasoning skills. With regard to the math wars debate, I feel my beliefs reflect a middle ground position. In terms of leadership, I believe that most if not all teachers are well intentioned and hard working, and they do what they do based on what they believe, understand and are comfortable doing. As such, I believe that improving mathematics achievement requires a two sided approach, developing understanding pedagogical content knowledge for teaching mathematics (Hill, Ball & Schilling, 2008), and providing a balance of pressure and support for teachers to try new practices.

My work in education has provided me an ‘insider’s view’ of school leadership and the improvement of mathematics achievement and gives me understandings and insights that might not be evident to a researcher who has not had such experiences. On the other hand, my professional background also makes me susceptible to “confirmation bias” (Kats & Dack, 2012). Taking advantage of my ‘insider’s view’ while at the same time minimizing confirmation bias was a challenge. Writing this statement of researcher positionality and vetting the study’s research design with my thesis advisor served as checks against confirmation bias, but I also recognize that these checks did not entirely eliminate it.

Chapter 5: Findings

The findings of this study will be presented case by case. The decision to present the cases individually as opposed to presenting them according to emergent themes was purposeful. Sensemaking involves creating a holistic picture of events (Weick, 1995). In order to gain insight into why each principal led mathematics improvement in their schools the way they did, it was felt that presenting complete cases, one at a time would be helpful. This approach reflects that of Ganon-Shilon and Schechter (2016, p. 1), who highlighted the importance of using a “holistic approach” to explore sensemaking in school leadership pertaining to policy reform.

Each case will begin by briefly providing some basic information about the principal and school that are the subject of the case. Following this, for each case, a description of what the principal perceived as the improvement needs of their school, of how the principal believed those needs should be addressed, and of the factors principals that said influenced their leadership will be provided. Each case will conclude with a brief summary of the case.

5.1 Charlotte and Citadel School

Citadel School is located in a well-established, middle class suburban neighbourhood in a city in the province of Ontario. The school has a stable student population of about 250 students, and a staff of 28 teachers, Early Childhood Educators, and Educational Assistants. On provincial EQAO Assessments, the school had consistently performed above the provincial and district average in the reading, writing and mathematics for more than the past ten years.

At the time of the interview, Charlotte, the principal of Citadel School, was a brand new principal. She had only been in the role for two and a half months. Prior to that, Charlotte’s long, 27 year career involved teaching Grades three to eight at a variety of schools. Before being

appointed principal of Citadel School, Charlotte had been a part-time vice-principal and part-time special education teacher in a large, suburban elementary school.

5.1.1 School improvement needs.

Although Charlotte had only been the principal of her school for a short time, she had already made several observations and had had several experiences that led her to form strong opinions about areas needing to be improved in her school. Charlotte had examined her school's EQAO mathematics results and determined that, "math is consistently lower, we're talking almost a 7-8 point spread between Math and Language" and that she "would like to see the standards, the standards of Math go up." Charlotte also shared that she had been observing "a lot [classroom practices] that would have been used 10 or 15 years ago" and was "seeing a lot of textbook use" in mathematics classrooms. She went on to explain, that "textbooks can be great, it's just that [teachers] are relying heavily on textbooks." Charlotte felt that she would "like to see some new ways of doing things, a lot more of inquiry and things like that."

Beyond mathematics instruction and achievement, Charlotte shared many other observations and anecdotes about Citadel School that had had significant impressions on her. For example, she shared how dismayed she was by the many rooms in her school that were "filled with junk, complete junk." She shared her belief that the school's financial accounting practices were inadequate. She shared how she had been receiving many serious parent complaints about one teacher's assessment practices, and how a "stubborn" Kindergarten teacher was using outdated teaching practices. While mathematics was the focus of the interview with Charlotte, and while she had clearly noticed several needs in the area of mathematics, it was also clear that she had noticed issues in other areas that warranted her attention and action.

5.1.2 Approach to improvement.

While Charlotte recognized the need to take action in the area of Mathematics, she admitted that she had yet to take any significant actions in this area. Charlotte explained, “I haven’t gotten there yet, because if I go in, they don’t know me just yet. To go in and to discuss curriculum would be challenging. I want to wait for that.” Charlotte felt that she needed to develop trusting relationships with her teachers before she was able to address sensitive instructional issues with them. Not feeling that she was able to take action to improve mathematics seemed to weigh heavily on Charlotte.

Although reluctant to take action with regard to improving mathematics, Charlotte felt more comfortable making improvements in other areas where she had perceived needs. For example she had already begun cleaning out, re-organizing and decorating what she described as “junk-filled” rooms. Charlotte explained that although she recognized that making cleaning up junk a leadership priority “sounds really weird”, she saw it as a good place to start. She explained, “I just see a new beginning for some [staff members]. It seems very simple, but I feel that’s where we have to go first before we move to the next [step].” Charlotte had also already taken action to improve her school’s financial accounting practices. This, it seems, was not by choice but by necessity. She explained that “when you come in you don’t want to feel like you’re imposing things that are unreasonable,” and yet she felt she had to make changes. Similarly, Charlotte shared how she “had to deal” with the aforementioned parent complaint. These examples show that as a new principal, Charlotte willingly took some actions, avoided taking some actions, and reluctantly took other actions.

5.1.3 Influences on leadership.

Having only been a principal for a very short time, Charlotte's extensive teaching experience seemed to be a significant part of her professional identity. It was such a significant part of her that during the interview, Charlotte mentioned on three separate occasions that she "really enjoyed" teaching. She also explained how she wanted her staff to see her not only as a principal but as a teacher, too: "I'm a teacher, too, just like you, and I really believe that, I'm still a teacher. That will never stop. I'm always going to be the teacher."

As a teacher, Charlotte described herself as "a very involved staff member", and now as a principal she encouraged her staff to do the same, explaining "My idea of leading is encouraging the staff to become part of the place [...] I'd like to empower them as much as possible." She valued her experience as a special education teacher and having had the opportunity to work in schools "on the needier side", as well as in schools that were "quite affluent". Charlotte felt that these experiences helped her to "understand when you have people that are needy, how to deal with them" and gave her "insight into this work that I'm doing now." Similarly, as a teacher, Charlotte shared that she always gravitated towards "the social side of things". Now as a principal, Charlotte maintained this inclination, stating that, "I want people to know that I care and that I am really encouraging them in what they are doing because I believe in it." Charlotte's responses suggest strongly that what was important to her as a teacher was still important to her as a principal.

As a novice principal, Charlotte found many aspects of her new role stressful and challenging. She described feeling pressure to fulfil regular leadership duties, explaining, "Now I'm hearing it as a principal, 'This is your responsibility Charlotte.' I find I'm under time

constraints. It is very difficult.” She described the stress of needing to learn about school improvement planning:

The whole forming of a SIP plan is something new for me. I have the vision, but putting it down and really making it happen and implementing it will be the challenge for me.

And that’s what I’m working on now.

Similarly Charlotte described feeling pressured by district staff to be an instructional leader, explaining:

They talk about instructional leadership, right, so you’re going into classrooms. I find myself, you know, I do try to get myself into classrooms as much as I can. The last couple of months, it’s been tough because you’re new and you’re trying to set everything up.

Finally, Charlotte emotionally described the pressure that she felt with regard to improving mathematics, stating,

like the math. We haven’t met about the math yet and I’m going ‘Oh my God’. Like, I can feel this inside of me, ‘Okay, Charlotte, like you’ve got to do this now.’ So, that’s what I find. Some of it is tough.

One area where Charlotte felt confident was in her ability to observe and assess classroom activities. She stated, “I am such a believer that if I walk into a classroom I can often see and feel just in the atmosphere and the environment engaging students in real authentic activities.” Having spent 27 years teaching seems to make Charlotte feel well prepared for judging the quality of learning activities.

5.1.4 Reflection.

Reflecting on what Charlotte shared during the interview, it seems that her recent appointment as principal at Citadel school, coupled with her lack of experience in the role of principal, were significant influences on how she was leading the improvement of mathematics achievement in her school. At the time of the interview, Charlotte had not taken any tangible action towards addressing mathematics achievement, despite acknowledging feeling pressure from the district to take action. District pressure only resulted in Charlotte feeling anxious, but did not lead to action. Charlotte justified not having taken action by explaining that she first had to build relationships with teachers. This seems like a plausible explanation for inaction, but Charlotte also admitted not being familiar with leading improvement efforts was also a factor. Despite this inaction, Charlotte still projected to her staff, and to me during the interview that she had a clear vision and was not paralyzed by her anxiety or lack of knowledge. Rather she seemed to project her identity as a take-action kind of leader whose actions were calculated and intentional. Charlotte knew exactly what she wanted to see in mathematics classrooms: fewer textbooks and more inquiry. Charlotte also felt strongly that cleaning up junk-filled rooms, getting school finances in order, and setting up a bully awareness program were absolutely necessary first steps on the road to improving mathematics achievement. That said, viewed through a sensemaking lens, these actions may also be evidence of Charlotte justifying her actions retrospectively in order to her maintain identity as a competent leader. According to Weick (1995), retrospection and identity maintenance are two core characteristics of the sensemaking.

5.2 Jackie and Affluence School

Affluence School is a Kindergarten to Grade six school that serves a predominantly affluent, suburban neighbourhood in a city in Ontario. The school has a population of just under 200 students, which was a decline from the over 300 students that the school served ten years earlier. The decline was likely the result of fewer young families living in the area. On staff there were 17 educators, many of whom had been at the school for well over a decade. A review of EQAO results shows that for the past four years, the Grade six results in reading and writing were above the provincial average, whereas the Grade six results in mathematics and the Grade three results in all areas were below the provincial standard.

At the time of the interview, Jackie was in her fourth year as the principal of Affluence. Prior to her current school, Jackie had spent four years as the principal of another elementary school, three years working at the district level, and nine years as an intermediate (Grade seven and ten) math, science and technology teacher.

5.2.1 School improvement needs.

Jackie believed that her school was not as successful as she thought it could be. She described it as fitting into “the Doug Reeves category of lucky: not necessarily learning, but lucky, where EQAO scores have typically been very high.” This statement refers to the work of Doug Reeves (2006), an educational researcher who uses the term “Lucky School” to describe schools in which achievement results are strong despite the low quality instruction.

Jackie described many issues that she felt were impeding student academic achievement at Affluence School, but many of these issues centred around what she described as “the mindset of teachers.” Jackie explained that pervasive throughout her school was “A mindset that if [students] don’t come from certain areas or certain families, then they’re really not going to

amount to anything.” Jackie felt that many Affluence teachers held the view that some students are “not worth my effort as a teacher” and “it’s okay if you fail”. She shared that she had repeatedly overheard conversations wherein teachers said things like, “Oh my God, my students are so weak. It’s awful,” and “I don’t want to teach [the weak group of] kids. I want to teach [an academically inclined class].” Jackie also shared that she had found a concerning trend in the school’s EQAO data that reflected the detrimental impact of teachers’ mindset. Jackie explained that she had noticed that,

there’s also a little bit of a racial profile that is evident in the data too. So I was able to show them that the kids who were getting [level] ones and twos in EQAO all come from the same neighbourhood. The townhouses, and in this neighbourhood those are the lower income [residences].

Again, this finding seemed to fit well with Jackie’s overall feeling that the mindset that many Affluence teachers had was detrimental to student progress.

Another problem that Jackie perceived was the use of ineffective teaching strategies and unwillingness to learn new strategies. Jackie believed that there was, “No ownership on the part of my teachers to take a look at professional decisions that they need to make to enhance learning.” Jackie felt that some “teaching staff has been here a very long time”, and that rather than trying to become better teachers, they tended to blame everything except their instructional practices. She shared that teachers often said things like,

it’s the weak students. The parents aren’t doing their homework. The parents aren’t doing this. The parents aren’t doing that. This student needs a [psychological assessment]. We need more Educational Assistants. The [special education] teacher needs...

With regard to mathematics, Jackie more specifically articulated a belief that many Affluence teachers were resistant to change. As a result, she felt that there was “very little growth happening in terms of the initiatives that are supposed to be in place”. For example, Jackie felt that teachers had not bothered to develop a good understanding of “Math Inquiry”, an instructional approach being promoted by Jackie’s district as well as by the province (Ontario Ministry of Education, 2016). Jackie shared that she felt that to her teachers, “Math Inquiry” simply involved “throwing up what comes out of a textbook and having that as sit down in groups and answer.” According to Jackie, Affluence teachers felt that their approach to teaching mathematics was effective, and so they had not bothered to adopt this new approach to teaching mathematics.

5.2.2 Approach to improvement.

Given that Jackie felt strongly that teacher mindset was impeding student progress, it was not surprising that she highlighted that, “we’re working mindset.” Jackie explained that this involved “debunking the myth” that some students were capable and others weren’t. Fortunately, Jackie explained that she was “starting to see a change there. I’ve seen a huge change in a few of the teachers and it is having an impact.”

With regard to teaching mathematics through inquiry, Jackie recognized that she had “work to do in terms of helping them [teachers] to understand what it really looks like and why we need to do it”. Jackie explained that, “I’ve targeted one specific area of the school, and that’s my primary to be working on co-teaching and co-planning through inquiry with the support from a [district mathematics coach].”

Although she had a clear idea of how to improve mathematics in her school, Jackie shared that she found it “very challenging.” She shared about one “teacher was causing all kinds of difficulty in the school” and explained further,

three [other] teachers who are influential and extremely [were] fixed in their mindset, and so when I start turning up the heat on the academic side, they are slinging mud in any way they can.

Jackie believed that, “there is a culture that has worked its way into the school and anytime any new change is brought in those powerful ones will immediately shoot it down.” Jackie seemed to have a sense of what needed to be done to improve her students’ academic achievement, but she also felt that she faced a resistant staff that made it a challenge to bring about the changes that she felt were necessary to improve student achievement in mathematics, as well as in other curriculum areas.

5.2.3 Influences on leadership.

Jackie shared that a significant impact on her resilience as a leader was the eight very challenging years that she spent as a high school teacher at the beginning of her career. She described how she spent much those first eight years, “being tossed around to different classes and working in a department that was “an absolute mess”. She described being given some of the toughest assignments in the high school” and simply being told, “well you know, you can handle everything.” Jackie shared that she went to her principal at the time and said, “I can’t do this anymore I’m not being given any opportunity to perfect any part of my craft. I keep getting yanked out and put out all over the place.” She decided to quit her job and move to another district, where unfortunately, things weren’t much better. There Jackie witnessed “very inappropriate and highly unprofessional” behaviour which was ignored by her principal. Jackie

felt that this “moral discrepancy” was unbearable and so she began looking for another position within her district. After few unsuccessful attempts, Jackie did obtain a district level position that involved analyzing school achievement data. Although not conflict free, Jackie described working at the district-level much more favourably. She explained that her supervisor was “a very inspirational as a leader” who told her, “You’re wasted here. You need to be in a school.” So, having experienced much challenge over the course of her teaching career that taught her “how to work very flexibly and adaptably”, Jackie felt that she was well prepared to become a principal.

As a principal Jackie had much confidence and believed that she had many leadership strengths:

I am exceptionally good at understanding what people need, not in a judgemental way, but in taking a look at what their strengths are and where they need to grow, how to place them effectively, how to read the situation, how to know where each one is currently and how to move them forward.

Jackie also shared that she stays “on top of what is current in research in education”, has “a particular interest in special education.” Further she explained,

if I’m doing my job in terms of knowing what trends are in education and reading educational material and research, then I should be following what is happening. So coming down the pipes, I’m making sure that my school improvement plan is meshing with the board priorities.

Jackie also shared that her school district and the Ministry of Education had an influence on how she led. She explained that she wanted to ensure that her improvement efforts were well aligned with the direction from the Ministry and the district. Jackie explained, “Are there things

that I do that are not 100% according to what is being espoused by the central system? Yes,” but she also acknowledged her school improvement efforts should be “based on the context of the school, that’s important.”

The influence of Jackie’s school district and the Ministry of Education was not always positive. She shared, for example that she was sometimes frustrated by external demands. In particular, Jackie described a situation wherein she felt like she was “being stepped on” when a district leader made her change a goal that she had included on her school improvement plan. Jackie also described the frustration of needing to abide by rules when they were not in the best interest of children, explaining that sometimes it was like “having your hands tied by stupidity”. As a result, Jackie was selective about the external initiatives that she adopted. She explained, “I’m making sure that if there are essential things that teachers need to know, they’re getting that, but I’m also filtering, too”.

5.2.4 Reflection.

Reflecting on the anecdotes that Jackie shared during the interview, it seems that her approach to leadership was predominantly adversarial. Jackie cited many examples of Affluence teachers being resistant to change, ignorant of effective instructional practices, and at times quite unprofessional. As such, Jackie focused her school improvement efforts pointing out and correcting deficiencies, negative mindsets and misunderstandings. Jackie felt that it was necessary to take an adversarial approach, however she also recognized that this resulted in some teachers reacting negatively towards her efforts. Looking at Jackie’s approach to leadership through a sensemaking lens, it seems that she is sensitized to notice and interpret teacher resistance, ignorance and unprofessionalism. It is also plausible, although not verifiable, that another principal would notice other teacher behaviours, or would interpret teachers in a different

way. For example, what Jackie interprets as being resistance could be interpreted by another principal as being a lack of confidence. From the sensemaking perspective, it is also plausible that Jackie is “enacting” her environment (Weick, 1995). Mills, Thurlow and Mills (2010, p.185) explain that like a self-fulfilling prophecy, “the environment that has been created by the sensemaker reinforces his or her sense of credibility”. Thus, Jackie perceives resistance and so takes an adversarial approach, which results in more resistance, confirming Jackie’s initial opinion.

5.3 James and Suburb School

Suburb School is an elementary school located in a newer, “pretty much middle class” suburban neighbourhood. It has a population of just under 500 “very well behaved” students and a staff of 51 educators. Students generally performed very well on provincial EQAO assessments, although on the most recent assessment, only between 35% and 40% of Grade six students reached the provincial standard in mathematics.

James was in his fourth year as principal of Suburb School. He had been an educator for 36 years, and a principal for 18 of those years. James had also been the principal of three other schools over those years. His school leadership experience was at least three times longer than that of any of the other principals who participated in this study.

5.3.1 School improvement needs.

James described his school in very positive terms. He shared that he was “very fortunate” to be the principal of Suburbs School, and was happy to have “great parent support”. While James saw his school’s strengths, he also recognized that there was room for improvement. He specifically mentioned two areas, namely student mathematics achievement and teacher technology use.

With regard to mathematics, James described his school's needs succinctly, but also very specifically. James shared that the challenges that his school had been experiencing with mathematics "has been consistent" and, that he and his staff believed that a deficit of "basic fact skills" was a significant factor. James shared that he and his staff had "been looking at it [basic computational skills] very closely" and,

one of the things we have noticed in our school is that children in math seem to do very well especially in Grade three, and then once they start getting into Grade four, five six, it seems that the scores are going down.

As a result, James and his staff felt that building students' computational competence was important. He shared that,

one of the initiatives we have started this year is going back to the basic facts, so every classroom from Grade one to six, as a matter of fact, even my Kindergarten to Grade six, we start with three to five minutes every single math class with a basic facts drill practice review.

James also shared that he and his teachers believed that making better use of mathematics manipulatives might also enhance the development of students' computational skills. He explained that,

we are really looking at the style of teaching, and one of the things we are really looking at is the manipulatives that are being used at the Grade four, five and six as well. So we're just wondering if there is a relationship between hands on education in math Kindergarten to grade three, and then there is nothing in Grades four, five and six.

Beyond mathematics, James highlighted only one other area where he felt improvements were needed. James explained that "another big focus at our school is, of course, technology."

He thought that “technology is critical in student success and our teachers and our staff are at different levels.” Some teachers at Suburb School were “very strong in technology”, whereas others are “weaker, although there is support for those weaker teachers.” James added that, “for some it [learning to use technology] is a very slow process.”

James was brief in how he described the areas in which he felt his school needed to improve, but he was also very specific.

5.3.2 Approach to improvement.

A central feature of James’ approach to leading improvement in his school was the importance of relationships. During the interview, it became very clear James believed strongly that building relationships with all members of the school community was a vital aspect of leadership and school improvement. For example, James shared,

I think it is really important for student success and teacher success that we build relationships with staff and students. I think we get more from students and more from staff when there is a relationship which is mutually respectful.

He also explained that,

your relationship with any staff member will depend on the amount of push that you can give. I really do feel that if there is a relationship between a staff member and the administrator, that staff member will be more open to change, more open to accept new initiatives than if there is no relationship.

James’ belief in the importance of fostering strong relationships was clearly evident in the process that he used for school improvement. He explained that the process he used in developing his school improvement plan involved soliciting input from many people. James shared,

I try to get feedback from everybody including ECEs, EAs. So we first start with our SIP team and so that is about eight members of the school staff and I have representation from every division, so that is my primary, my kindergarten teacher, kindergarten ECE, a English and French English teacher in the primary, English and French teacher in the Junior grades, and I also have a [special education] staff member present in that. I think it's very important to keep everybody's perspective so everyone feels a part of the team and then we'll do what we do, once we have researched, we come up with a draft SIP plan.

This collaborative process, James explained, for the most part, results in a plan that was widely accepted by staff. Further, the collaborative process that James used also fostered the development of strong relationships between James and his staff.

5.3.3 Influences on leadership.

Having been a principal for nearly two decades, it wasn't surprising that James drew upon his past experiences to guide his current approach to leading. This was clear when James made statements such as, "what I always do, no matter where I am..." and "in my previous school [...] we found that it had a major difference." While James mentioned that he was looking to retire in three years' time, his long history as a principal made him seem comfortable and capable and in no rush to leave the role.

It was also clear that James' school and staff had a significant influence on his approach to leadership. For example, when describing his school's improvement needs and efforts, James repeatedly used the pronoun, "we", as in "we noticed", and "we decided". Further, the decision to focus explicitly on developing basic mathematics skills did not reflect the focus of district and Ministry mathematics improvement efforts. James was very aware of this, and shared that,

I know a couple of superintendents have concern that we had the basic facts skills, that we were reviewing three to five minutes before math class. They had a bit of concern that it was part of the SIP plan. They don't believe that research shows that it is a great use of time, although our researcher with the board disagrees with that...There is a direct link between basic facts and student success in Math.

James clearly felt that focusing on basic skills was the right thing to do, especially since it was important to, and supported by his teachers, even though it meant diverging from what others thought should be done. James explained that "new Ministry initiatives that seem to come down fast and furious", but he felt strongly that it was important "to prioritize what's coming down from the Ministry, what's coming down from our board and what is really important in schools."

James' beliefs about the importance of having strong relationships, and honouring his staff's beliefs made choosing an improvement goal that diverged from the preferred district direction was worthwhile.

5.3.4 Reflection.

From what James shared during the interview, it seemed that that his past experiences and the value that he placed on his relationships with staff members were very influential in how he approached the improvement of mathematics achievement in his school. James made sense of the improvements needed in mathematics by recalling past experiences. Similarly James seemed to feel confident in involving his staff in developing improvement goals and strategies, because he had done so successfully in the past. Of course, viewing James' approach to leading mathematics improvement through a sensemaking lens provides a plausible, alternate explanation. If James' identity is considered, involving staff in goal and strategy setting could be

a way to mask the limits of his own understanding of mathematics pedagogy. James' shared approach could also be motivated by his own lack of assertiveness. By approaching the improvement of mathematics achievement the way he does, James' identity as a competent leader who has faith in his staff is nurtured. Unfortunately the interview with James did not offer any evidence to confirm nor refute this alternative interpretation.

5.4 Peter and Country School

Country School is located on the outskirts of a small town. It serves families from the town, as well as from the rural region that surrounds the town. The school has a population of between 350 and 400 elementary level students and a staff of 33 educators, including a part time vice-principal. EQAO assessment results over the past four years have been below the provincial average in reading, writing and Mathematics at the Grade three level, and just above the provincial average in reading and writing, and below the provincial average in Mathematics at the Grade six level.

At the time of the interview, Peter was in his third year as principal of Country School, which was the first school in which he was principal. Prior to his tenure at Country School, Peter had worked as a teacher for 12 years, and for ten years at the district level facilitating professional learning for teachers and principals in the area of mathematics.

5.4.1 School improvement needs.

Peter described the school in positive terms. He felt "the parents are very respectful" and "the children in general are very respectful", although he added that "there are always little blips". That said, Peter also shared that he was told the year before he got to the school "was really a rough year", but it seemed that he didn't really think that that was the case any longer, and instead thought that the school on a good track.

With regard to the results of EQAO assessments, Peter shared that his school's mathematics results were generally lower than the reading and writing results. More specifically, Peter shared that his Grade three students had a "particularly rough year" last year. Peter wasn't sure about why the mathematics scores were lower at the Grade three level. He reflected,

one of the things that was interesting was, ever since I got here there was lots of turnover in the primary staff - it could be maternity staff, x over y, or retirement, so I never felt I got a good handle, or I never felt that strong about the math instruction at the primary level because we never seem to get anywhere.

Having said that, Peter added, that he felt that "this year it is going a lot better". By contrast, Peter felt that because of the professional learning in which his Grade four, five and six teachers had been involved, "they definitely had some more current ideas in their mind."

Peter shared that his perception of what would help improve mathematics outcomes in his school differed somewhat from what his staff felt. Peter held a strong belief that developing teachers' facility with "three part math", an instructional approach well aligned with Peter's constructivist views, was vital. By contrast, Peter's teachers felt that students needed to develop their computational skills. To overcome the conflicting ideas about how to improve mathematics outcomes, Peter explained that, "we decided that we wanted to start with number talks and number strings and that came from the teachers", but he also explained that his intent was to "move forward from there as well."

5.4.2 Approach to improvement.

Peter described his leadership style as being the 'polar opposite' of being an authoritarian leader. Peter explained,

One of my issues with being a principal has to do with control because I really don't like having control. I really don't like being the one who makes the final decision and I really don't like people feeling that they have to behave in a certain way when I'm there or that there is some sort of hierarchy. I really, really don't like that.

While Peter recognizes that this is a liability, it was also clear that he saw it as a strength.

Peter shared that,

I think I'm a good listener and problem solver. So I really try to hear the other side of the story and that is one of the things that gets me into trouble though, because I think I'm good at that. That's why I can see everyone's point of view, like the parent that is angry at parent council, I'm thinking, 'Well, I can really understand what she is saying.'

This same desire to listen and not push people extended into Peter's leadership of mathematics improvement in his school. When determining improvement goals, Peter said that he "would try to keep my thinking back a little bit and really try to listen to what they have to say and where their thinking is [...] It's more using their professional knowledge. I just feel like if you choose something that they don't buy into, I don't think that is going to work at all."

Peter admitted that his non-authoritarian approach to leadership led to conflicts with a former vice-principal at the school. He explained that this vice-principal was, in his opinion, 'headstrong' and 'very much a pusher'. Frustrated by her approach to leadership, Peter told her:

I don't believe in that [approach]. I think we have to talk to the teachers, just like we talk with the students. We have to really start developing relationships with these people that we're working with and we have to figure out where they're starting from, like what are they currently doing and what can we do to help them move forward in their teaching, rather than come in like a bulldozer.

5.4.3 Influences on leadership.

Throughout the interview, it was very clear that Peter had a strong comfort with mathematics. He shared that mathematics was always something that he “really enjoyed and really embraced.” He took mathematics courses in university, and did a master’s in the area of measurement and evaluation, which was ‘very mathematical’, tutored high school math, and at the time of the interview, was teaching an Additional Qualifications course focused on teaching elementary mathematics. As Peter shared, it was clear that he “loved teaching mathematics” and saw himself as a “math leader” in his school. These experiences, he believed, had a strong influence on the type of school leader that he was.

Peter also shared that his approach to leadership was greatly influenced by “a lot of experience working with kids.” He believed that leadership was similar to “the three part lesson”, in that “you take the kids work and use that to actually propel them further in a constructivist way without telling them exactly the answer or how you want them to do it.” In the same way, Peter explained that with teachers, “It’s more using their professional knowledge.” Peter explained, “I would rather put my thinking on hold and weave it into the conversation as the year progresses.” Peter’s beliefs about how children learn was clearly influenced his beliefs about how to lead school improvement with teachers.

Similar to the impact of working with students, Peter also shared that his own children helped to reinforce his beliefs about learning. Peter explained,

one of the things which has really helped me, too, with my family is the fact that I can see it in my own kids, because they’re young. So I can see the whole constructivist paradigm and what that kind of looks like...because I’m living it at home as well. You know it’s the same sort of philosophy.

As for the influence of district and Ministry initiatives on his leadership, Peter described enjoying engaging in workshops wherein he could construct new ideas along with the staff. He also shared that he appreciated the school improvement accountability structures put in place by his school district, suggesting that they are “an interesting dynamic”. He explained, “you want to be accountable too, so, I mean I believe that what they’re trying to do is genuine.” Peter also expressed appreciation for Renewed Math Strategy resources, and professional learning support.

5.4.4 Reflection.

Peter’s approach to leading the improvement of mathematics achievement in his school seems to be heavily influenced by his comfort with mathematics and his constructivist beliefs, which were in turn influenced by his past educational and work experiences. Peter shared many anecdotes that highlighted his familiarity with mathematics pedagogy and provide evidence that support of the authenticity of the claim that Peter is a ‘math person’. Still, Peter seemed to believe that his teachers could not be “bulldozed” into shifting their beliefs and practices. As a result, Peter acknowledged holding back his own thinking so that teachers’ ideas might be brought forward into professional learning discussions.

5.5 Mallory and City School

City school is located in an older, urban neighbourhood in a city in Ontario. It has between 250 and 300 students. The school “serviced a large community of new Canadians and new immigrant families” who were “new to the country and getting themselves established so poverty and living below that poverty line was definitely common.” To serve these students, the school had a stand-alone English Language Development class that had about 12 newcomer students in it. These students only had limited prior school experience. The school also had “a pocket [...] of generational poverty” within the community, that is, long-time Canadian families

who spoke English, but “for whom their lives were very, very challenging.” With regard to provincial EQAO assessments, fewer than 20% of students had met the Provincial Standard in Mathematics over the past five years.

Mallory, the principal of City School, was an educator with 25 years of experience. She had spent the first six years of her career as an elementary school classroom teacher and then the next 14 years as a special education teacher. Mallory was then appointed the vice-principal of Urban School. After only seven months in the position, the principal of the school retired, and Mallory became the principal. At the time of the interview, Mallory had been the principal of Urban school for four and a half years.

5.5.1 School improvement needs.

Mallory described a variety of challenges that were primarily the result of having such a significant population of newcomer families. Mallory described how these families typically wouldn't register their children for school until they “saw the yellow school buses drive by” in the fall. The result of the last minute registrations was a school population that has “fluctuated” greatly, and as a consequence there were “a lot of classrooms collapsed, and reorganization and that kind of thing.” She shared that the large number of newcomer families also meant that “we had a very large population of students whose first language was not English and who had actually never been to school.” She added that “they were new to the country, getting themselves established so poverty and living below that poverty line was definitely common.” Because school was not familiar to many families, Mallory felt “there wasn't order”. Mallory described regular school activities such as student dismissal time as being “just a crazy revolving door.” Mallory felt that these families needed to learn how the public education system and social services worked:

They needed to understand the report card. They needed to understand the services in their area. They needed to know how to access services. They needed to know what the Children's Aid is, and why I cannot parent my children the way I'm used to parenting my children.

Further, Mallory also recognized that language development was a vital need for the majority of students in her school. Mallory explained that "in classrooms, typically 80% [of students] were Early-Step English Language Learners". This meant that in many classrooms "the only English speaking person in the room was the teacher." As such, language development was without question, a priority for Mallory.

That said, Mallory also recognized improvement needs in the area of mathematics. As she explained, "the problem with math, I really believe, is the gap between where we want them to be, and working with worksheets and textbooks, is too big." Mallory also believed that mathematics achievement suffered at her school because some teachers were using "old fashioned" practices. She described working with one teacher who had "been teaching with a textbook for 20 years" and "believes very strongly that they just need to know their math facts, where the research is showing now that automaticity and flexibility is going to come as a by-product of deep understanding." Mallory wondered, "So how do you move that person?" Mallory felt that "it is a belief system" and that as a teacher, "part of your responsibility as a professional is to keep up, to feel current, to be a part of current research and changing thinking."

Mallory believed that "they really needed to see and work with those accommodations for mathematics learning so it was a bit like how we are asking teachers to run a mathematics classroom where you are more in tune with what students are understanding and where you are understanding how to move them."

5.5.2 Approach to improvement.

Mallory explained that she “didn’t want to see mathematics as sort of a conflicting priority.” Still, Mallory felt that, the work they were “doing in literacy would impact mathematics.” And so, Mallory explained how “they were taking the best practice for literacy and trying to implement it in math.” Teachers were taking literacy practices, such as guided instruction and beginning to use them in mathematics: “when you are working with a small group of children, what is it that the other children are doing that is purposeful, that is self-managed, that is, you know, not a waste of time. And that is no different than when you are working with a small group in math.” Mallory also explained how they “were trying to figure out a good place to start for English language learners” to develop their mathematics skills.

Mallory also felt that a key challenge for improving mathematics achievement was that “deep conceptual understanding was not there with our educators.” She went on to explain, “The mathematical experiences that they had gone through were not what we were asking them to do with their kids.” To address the issue, Mallory explained how,

we had to put some time into that because some were absolutely challenged by the curriculum, some needed a place to start, some needed a coach, some need a really good resource to find out where their children are, like a gap closing resource, something like that. So math wasn’t like literacy in that people’s needs were much more diverse.

Mallory felt that key to improving mathematics were “our conversations one on one, principal/teacher. We were in a position to be quite honest, because if you are able to tell me where you are at, I’m able to help.” Mallory also shared that she had a “true belief that the people that I’m working with are professionals.” This meant that central to her approach to

helping teachers improve was to have “respectful conversations” with teachers to discuss what “you need in order to move your children”. Mallory felt that,

if you treat people the way you think they need to be treated, then they tend to behave a bit more that way. So it is not just saying you should be behaving like a professional, it’s out of respect for my belief that you are one. This is our conversation today.

In this way, Mallory encouraged her teachers to begin “on their own professional learning journey” and to become “reflective practitioners” who seek their own professional learning and “don’t really require a PLC”.

5.5.3 Influences on leadership.

The time that Mallory worked as a special education teacher seemed to have a significant influence on her perception of the needs in her school and her approach to leadership. More than any other principal interviewed, Mallory spoke extensively about topics pertaining to special education, including “tiered interventions”, having “high expectations” for students who were struggling, “accommodations and modifications”, “assessments”, “tracking”, “interventions”, and students working “below grade level expectations”. As Mallory emphasized, “looking at students with special education needs” was an important dimension of her school’s improvement work.

More specifically, Mallory’s special education perspective was evident in her thinking about mathematics. As she explained, “The problem with math, I really believe, is the gap between where we want them to be, and working with worksheets and textbooks, is too big.” The solution, Mallory believed was that teachers “really needed to see and work with those accommodations for mathematics learning.” Mallory went on to explain that it was how “we are

asking teachers to run a mathematics classroom, where you are more in tune with what students [need].”

Mallory also shared a story from when she was a mathematics student to highlight her beliefs about teaching and learning. She shared:

I remember in grade nine. We were seated according to test scores, we were all in rows. So the brain row as it was affectionately called then, never moved. They may have shifted, but they never moved. The vegetable row, the row that didn't do well never moved, and the middle two rows moved. So how did that work? If you were stupid you were stupid and if you were really smart, you were really smart and it never really changed.

With regard to factors outside of the school, Mallory was well connected to other principals and district personnel, which also seemed to have an influence on her leadership. She described working “really closely” with curriculum experts “who were phenomenal”, and being involved in a “principal network” that met monthly to discuss “problems of practice”.

Mallory also spoke about “doing the research” and on two occasions during the interview, referred to professional literature that had helped to shape her thinking and practice. This was particularly evident in her use of terminology such as “moral imperative”, “reflective practitioner”, “learning community”, “deep conceptual understanding”, “story swapping”, and putting “faces on the data”, terms that she would have likely become aware of through her professional reading or through contact with district or Ministry personnel.

Like the other principals, however, Mallory also had had experiences involving the district that she felt were not supportive. For example, Mallory explained how a school improvement initiative that she was pursuing “was quite a bit different from what others were

doing and interestingly it wasn't as supported as you might think it was". As a result, she described having "a three hour meeting" with district staff to explain her reasoning behind the initiative.

5.5.4 Reflection.

Reflecting on what was shared by Mallory during her interview, it seems that her approach to leading mathematics improvement is influenced by the characteristics of the students that her school serves, by her limited comfort and familiarity with mathematics, her great comfort and familiarity with leading the improvement of literacy achievement, her past experiences working as a special education teacher, and her interactions with teachers, district support personnel, principal colleagues, and professional literature. Mallory's case highlights the breadth of factors that can influence the way in which the leadership of mathematics improvement is enacted.

With each case summarized holistically, an understanding of the many intertwined factors that influenced how each principal approached leadership in their school was gained. In the next chapter, the four themes that emerged from a cross-case comparison will be described and discussed. The four themes capture essential qualities that were common to the sensemaking praxis of all five principals.

Chapter 6: Discussion

The purpose of conducting this study was to gain insight into why the five elementary school principals led the improvement of mathematics achievement in their schools the way they do. In the previous chapter, each case was summarized as a whole in order to provide a full picture of the intertwined factors that influenced the principals' perceptions, interpretations and enactments of leadership. In this chapter, the five cases were compared with one another in order to identify similarities and differences evident between the cases. Careful analysis of those similarities and differences led to the emergence of four themes pertaining to why the principals in this study lead the improvement of mathematics achievement in their schools the way they did. Each of the four emergent themes will be described and discussed below. Excerpts from the interviews will be used to illustrate the themes, and references will be made to leadership and sensemaking research literature to help explain each theme.

6.1 Theme 1: Multi-dimensional Awareness

The first theme that emerged from analyzing and comparing the cases was that all principals were very aware of multiple dimensions of their school contexts, or perhaps more accurately, principals saw some features of their school contexts as being particularly relevant to their leadership. Principals were aware of the distinct features of the communities that their schools served, the improvement needs in their schools, and the disposition of staff members towards change and professional learning.

In describing her school community, it was not surprising that Mallory highlighted that her school had "a very large population of students whose first language was not English and who had actually never been to school" and whose families "were just getting themselves established so they didn't understand the [school] system." It was also unsurprising that Mallory

was aware of “a pocket in our community of generational poverty, so English speaking families and children for whom their lives were very, very challenging.” By highlighting the makeup of her school community, Mallory was also highlighting that this “was a tough population to reach,” and a significant influence on her approach to the leadership of her school.

By contrast, James’ school community might be considered somewhat more mundane than Mallory’s school. Still, James identified features that he felt were relevant to his leadership. James shared that his school served a community that was “pretty much middle class”, wherein “our students are very well behaved” and produce “great student work as well”, adding that he felt “very fortunate to have great parent support.” While perhaps less pressing than the community that Mallory’s school served, James highlighted features that were relevant to his leadership. In essence, James described a school community that was capable and supportive, thus allowing him to lead in a way that he might not be able to do otherwise.

Perhaps most surprising of all descriptions of school context of all was that shared by Jackie. When asked to describe her school community at the beginning of her interview Jackie, shared that her school community had a “very low percentage of ELL” and a “very low percentage of diversity”. This stood out during the data analysis because unlike the other principals, Jackie described what her school community wasn’t, as opposed to what it was. Jackie could have described her school community as a homogeneous suburban community, but she chose to highlight the lack of ELL students and lack of presumably racial diversity. While Jackie’s purpose for doing this was not clear initially, later on in the interview when describing issues her school faced, these descriptions became very pertinent. Jackie’s unique description of her school community was a key element of the narrative she was constructing for her school community.

Principals also seemed aware of how mathematics was being taught in their schools, or rather how mathematics was not being taught in their schools. Charlotte shared, for example, that she was “seeing a lot of textbook use” and “a lot that would have been done 10 or 15 years ago.” Charlotte also added that she would “like to see some new ways of doing things. A lot more of inquiry and things like that.” Similarly, Mallory shared a story about a teacher who had been “teaching with a textbook for 20 years” and “one teacher who believes very strongly that they just need to know their mathematics facts” while she believed that developing “deep understanding” in mathematics was more important. Jackie saw the problem with mathematics at her school was teachers “throwing up what comes out of a textbook and having that as sit down in groups and answer” while she believed that using a “math inquiry” was what teachers should be doing. Finally, Peter shared that he “never felt that strong about the mathematics instruction at the primary level because we never seem to get anywhere” while he clearly wanted his teachers to be using the “three part math lesson” structure. Peter added that he felt that his Junior teachers “had some more current ideas in their mind” about mathematics instruction. With the exception of James who didn’t share anything observations about mathematics instruction in his school, the other four principals interviewed had a strong awareness of the way in which mathematics was being taught in their schools. More specifically, all principals were very aware of how mathematics instruction was not aligned with the vision that they had of what effective mathematics instruction looked like.

Principals were also very aware of teachers’ disposition towards change and professional learning. Charlotte, for example felt that at her school “there’s some resistance, too. You talk about the growth and the fixed. There’s a couple of fixed.” A similar sentiment about teachers’ disposition by Jackie who described teachers who were “extremely fixed in their mindset, and so

when I start turning up the heat on the academic side, they are slinging mud in any way they can.” By contrast, Mallory shared with regard to teachers accepting change that “I know there were some things that were very hard for them and they really struggled with the approach” and James shared that, “once in a while we disagree, but I think for the most part we agree.” All principals seemed to be aware of how their teachers responded to change and professional learning.

The contextual awareness that all principals made evident through their interview responses is finding was surprising. While effective school leadership research clearly notes the importance of contextual awareness to leadership success, it also subtly implies that unsuccessful leaders may not be always contextually aware (Hitt & Tucker, 2016; Waters, Marzano & McNulty, 2003; Day, et al., 2009; Leithwood et al. 2008; Robinson, et al., 2008; Militello et al. 2013; Robinson, et al., 2009; Hallinger 2010; Leithwood, 2012; Gurr, 2017; Leithwood, 2017). Within the context of the Ontario Leadership Framework, for example, Leithwood (2012, p. 13) explains that the value of leadership practices found to be successful in research “depends on leaders enacting them in ways that are sensitive to the specific features of the circumstances and settings in which they work and the people with whom they are working.” Similarly Gurr (2017, p. 20) highlights that “successful school leaders fine tune their responses to the context and culture in which they lead to optimise school success” which seems to imply that unsuccessful school leaders do not “fine tune their responses.” The evidence from this study clearly shows that all principals were very contextually aware. This is not to suggest that the principals in this study were also “successful” as such a finding is beyond the scope of this study. What it is suggesting is that more important to success than contextual awareness, might be the specific contextual features that principals attend to, and how they interpret and respond to those features.

6.2 Theme 2: Confidence in Plausible Perceptions

Sensemaking is not about truth and getting it right. Instead, it is about continued redrafting of an emerging story so that it becomes more comprehensive, incorporates more of the observed data, and is more resilient in the face of criticism (Weick, Sutcliffe & Obstfeld, 2005, p. 415).

Another theme that seemed to emerge from the analysis of the interview data was that principals were all confident in their ability to perceive and interpret what they perceived. As a result, principals also seemed to be confident in how they understood of their school contexts.

When asked about her strengths as a leader, Jackie shared that she was,

exceptionally good at understanding what people need, not in a judgemental way, but in taking a look at what their strengths are and where they need to grow, how to place them effectively, how to read the situation, how to know where each one is currently and how to move them forward.

Similarly, Mallory shared that she had “a fierce sense of right and wrong.” She explained that “I don’t get muddled by a situation or something complex. It is very clear to me what is right and what is not right.” Even Charlotte, a brand new principal shared that she believed that as strength of hers was her ability to perceive and interpret. Charlotte, stated, “I am such a believer in that if I walk into a classroom I can often see and feel just in the atmosphere and the environment engaging students in real authentic activities.” Having self-confidence in being able to perceive and understand what was going in their school contexts seemed to be a quality shared by all principals in this study.

This confidence allowed principals to make bold statements about their schools. Perhaps the best example of this comes from Jackie, who made comments such as when she shared that

she believed that there was “no ownership on part of my teachers to take a look at professional decisions that they need to make to enhance learning” or that there was “very little growth happening in terms of the initiatives that are supposed to be in place” or that there was “a little bit of a racial profile that is evident in the data.” Like the other principals, Jackie made strong pronouncements about her school context that were presented as certain facts, as opposed to tentative or uncertain hypotheses or opinions.

To principals, their observations and their interpretations of those observations were irrefutable, and alternate explanations seemed improbable if not impossible. This dynamic is highlighted by Weick (1995) who points out that in sensemaking certainty is not necessary for action. Rather, only plausibility is necessary. It is not clear whether the principals in this study were conflating plausibility with certainty, but whether they were or not is moot. As Helms Mills, Thurlow and Mills (2010, p. 185) explain, “We do not rely on the accuracy of our perceptions when we make sense of an event. Instead, we look for cues that make our sensemaking seem plausible.” By using informed plausibility as a threshold for moving forward, sensemaking can be quick and action oriented. It seems that the principals at the focus of this study saw their plausible opinions as certainty in order to allow them to take the actions they wanted to take.

Of note, however, as was pointed out by Helms Mills, Thurlow & Mills (2010, p. 185), by relying only on plausibility, “we may distort or eliminate what is accurate and potentially rely on faulty decision making in determining what is right or wrong”. Weick (1995) suggests that faulty decision making is especially problematic when the sensemaker holds a leadership position, as is the situation in this study. Weick (1995, p. 2) explains this as “the fallacy of centrality,” wherein “experts overestimate the likelihood that they would surely know about the

phenomenon”. Put another way, because of their central position in the school, principals may make the supposition that they are best equipped to decipher what is going on in their school. Thus, their tentative assumptions about their school contexts are articulated as if they were indisputable facts, even though they were only conjectures. While sensemaking literature highlights that plausibility, rather than certainty is all that is needed for the sensemaker to take action, it seems that sensemakers had to believe that their perceptions were accurate in order to act, even though they were only plausible.

6.3 Theme 3: Partially Idiosyncratic

[Sensemaking] is an active process of constructing meaning from present stimuli, mediated by prior knowledge, experiences, beliefs and values that is embedded in the social context within which people work (Ganon-Shilon and Schechter, 2016, p. 3)

Another theme that emerged from the data analysis was that principals seemed to notice different aspects of their school contexts, and interpreted and responded to those contextual features somewhat idiosyncratically.

This is not to say that differences in what principals noticed, or how they interpreted and responded were not due to contextual differences. To the contrary, contextual differences also seemed to play an important role in the enactment of leadership. For example, Mallory explained that her staff were, “were taking the best practice for literacy and trying to implement it in math.” This was different from how other principals in this study approached the improvement of mathematics, but the difference seemed to be due to contextual differences. Mallory’s teachers had had extensive professional learning related to “guided reading” instruction. As such, Mallory use “guided reading” as a springboard for improvement mathematics was more a response to context than it was to an idiosyncrasy of Mallory’s.

That said, there were many examples from the interviews where principals' observations, interpretations and actions seemed to be influenced idiosyncratically, that is influenced by principals' beliefs, skills, experiences, rather than contextually. Mallory, for example shared her belief that, "Mathematics is pretty interesting because you can feel pretty smart and pretty dumb pretty quick." She also shared that she believed in the importance of fostering "a healthy math learning community" so that students "can believe they can achieve in math", "feel smart" and "don't have math anxiety." After mentioning mathematics anxiety, Mallory recounted a story from when she was a Grade nine student, wherein she was made to feel that "if you were stupid you were stupid and if you were really smart, you were really smart and it never really changed." Of all the principals interviewed, Mallory was alone in expressing her views about mathematics anxiety. As such, it is plausible that Mallory's own comfort with mathematics may have influenced the attention that she gave to mathematics anxiety in her own school.

Another example of an idiosyncrasy was Jackie's focus on executive functioning skills in her school improvement plan. No other principal mentioned executive functioning skills. Jackie, however, shared that the focus was in part due to observations that she had made of the students in her school, but also "because of my own desire to learn and research." Jackie felt it was a priority for her to "to be on top of what is current in research in education." In this case, the focus on executive functioning skills was in part driven by the school context, and in part by the principal's personal interest.

Other idiosyncratic improvement foci were expressed by James and Charlotte. James was alone in mentioning that "Another big focus at our school is of course is technology. I think technology is critical in student success." Charlotte was alone in mentioning cleaning out junk and decorating walls that she saw as "a new beginning for some" and a place "where we have to

go first before we move to the next.” Logical reasons could be given for James and Charlotte’s idiosyncratic improvement foci. James’ school was running well, and had no urgent improvement needs, presumably leaving James and his staff with the time and energy to improve technology. As for Charlotte, she clearly expressed that she was unsure about how to improve mathematics, stating, “The whole forming of a SIP plan is something new for me. I have the vision but putting it down and really making it happen and implementing it will be the challenge for me. And that’s what I’m working on now.” Charlotte also shared that,

I haven’t gotten there yet, because if I go in, they don’t know me just yet. To go in and to discuss curriculum with many would be challenging. I want to wait for that, I want to wait until at least term two for that, because I think curriculum and how it is delivered, that would take some trust that I can build with them and go through some of it.

Charlotte’s strategy was to make an effort to improve her school in areas where she felt confident, and defer areas that were new to her until later. Thus, it can be seen that Charlotte’s idiosyncratic effort was rooted in sensemaking logic.

A final example of an idiosyncrasy worth examining is the way in which Peter approached the improvement of math. Peter, of course, was the principal who “loved teaching mathematics” and had had ample experience leading mathematics improvement efforts for his district. Of all principals interviewed, it would have not been a surprise that Peter had taken a direct or assertive approach to leading the improvement of mathematics achievement in his school. Yet, this was not the case. When asked why he didn’t just tell his staff what he wanted, Peter responded, explaining, “I purposely didn’t do that because I didn’t feel that was best pedagogy to use with the adults so to speak, like the best way to go with the adults.” While Peter

had a strong mathematics background, he also had very strong beliefs about how people learned. Peter explained,

we have to really start developing relationships with these people that we're working with and we have to figure out where they're starting from, like what are they currently doing and what can we do to help them move forward in their teaching, rather than come in like a bulldozer and say, "Okay, we're all going to do this and we're all going to do that."

Thus, while Peter wasn't alone in taking a less assertive approach to improving mathematics, the reasons for which he took his approach were unique. While Peter had a deep understanding of mathematics, it seems that how he used this understanding had to align with his beliefs about how teachers learned and changed.

Research highlights that sensemaking can be idiosyncratic as it involves personal factors such as their prior experiences, identity, knowledge, and emotions (Spillane, Reimer & Reiser, 2002). In this study, the principals' personal factors seemed to influence how they perceived and interpreted their contexts, as well as influenced how they enacted their leadership in response. Charlotte's limited experience as a principal seemed to influence what she was doing to improve student's mathematics achievement, just as James' many years of experience as a principal influenced what he was doing. Similarly, Mallory's years as a special education teacher influenced her leadership just as Jackie's experiences dealing with challenges over her career seemed to have influenced her approach to leadership. This is not to say that the context within which each principal was leading did not have an influence on the enactment of leadership. As Ganon-Shilon and Schechter (2016, p. 2) point out "school leaders' sense-making is nested in multiple and often conflicting school contexts." Rather contextual factors, along with personal

factors seemed to influence principals' sensemaking, and thus how they enacted leadership. The multiple, overlapping, mutually influential contextual and personal factors seemed to produce idiosyncratic, potentially unpredictable results. That said, there always seemed to exist, either explicitly stated by the principals involved, or implicit in principals' responses some reasoning that underlay the results.

6.4 Theme 4: Indirect Approach to Mathematics Improvement

Also noted in analyzing the interview data was that principals mentioned needs in their schools and improvement efforts that they had taken that did not pertain directly to the improvement of mathematics achievement, but did indirectly.

Jackie, for example described how her school had made "mindset" a school improvement goal. Jackie shared that

without a belief that you can learn, or with a belief that you can't do it or you're not going to try, anything we do, whether it is executive functioning, or whether it is math instruction or reading, if you don't have a mindset that will promote growth, you're going to shut down.

For Jackie, shifting mindset was a prerequisite for improving mathematics instruction and achievement.

Mallory highlighted that before addressing instructional and learning needs, addressing behaviour was a priority. She shared that "as a leader, a part of my job is to ensure that a healthy learning environment is there for our students. And given our needs, that was a tall order. Behaviour was a thing." Mallory believed that behaviour was impeding learning. She explained, "So we couldn't get there. We wasted a lot of time," adding that "we need to get to the bottom of it if we are going to make significant change." As a result, one of Mallory's first

improvement efforts was to implement a policy in which students did not speak in the hallways. While the policy was not directly related to learning, Mallory, and her staff felt it was an essential condition for enhancing learning in the classroom.

Charlotte also took an indirect approach to improving mathematics, that is, by not even attempting to make any changes, as she was new to her school. She explained “when you come in you don’t want to feel like you’re imposing things that are unreasonable so you want to be very simple.” Thus nurturing relationships with her staff was a necessary first step for improving mathematics.

Even Peter took a rather indirect approach to improving mathematics. In line with his belief about how people learn, Peter shared that he didn’t impose a mathematics improvement goal on his teachers. Rather, he held it back. Peter explained “so, I have an idea of what I’m thinking. Sometimes it happens, sometimes it doesn’t happen, I would rather put my thinking on hold and weave it into the conversation as the year progresses, but I’m not saying that I disagree with the two things that were chosen. I think they are good things to work on, but I think we have to move forward from there as well.”

The finding that principals’ efforts to improve mathematics were often indirect was not surprising. Nelson and Sassi (2000), Stein and Nelson (2003) and Eacott & Holmes (2010) all highlight the importance leaders’ knowledge of mathematics for leading improvement efforts in the area of mathematics. Differences in mathematics knowledge may account for the different ways in which principals approached, or avoided leading the improvement of mathematics improvement in their schools. An alternate explanation is that in a school there are potentially many intervening factors that may confound leadership efforts. For example Dumay, Boonen & Van Damme (2013, p. 225) found that the impact of principals’ leadership efforts on student

achievement in mathematics is “mediated by teacher collaboration and collective efficacy.”

Further, Eacott and Holmes (2010) highlight the importance of attending to seemingly unrelated facets of context when attempting to lead the improvement of mathematics achievement. Thus, while principals such as Mallory who addressed behaviour, Jackie who addressed mindset, and even Charlotte who was building trust may have been indirect in their approach, they may have also been purposefully strategic.

6.5 Summary

In this chapter, the four themes that emerged from the cross-case analysis were described, and where possible, linked to existing scholarly literature. First, the analysis revealed that principals were all aware of multiple dimensions of their school contexts, although not all principals were aware of the same contextual dimensions. Second, the analysis revealed that all principals were very confident in their perceptions, interpretations, and understandings of what was going on in their schools. Third, the cross-case analysis revealed that principals’ perceptions, interpretations and actions were all partially idiosyncratic, that is they reflected personal factors such as beliefs and past experiences as much as they reflected school contexts. Finally, the cross-case analysis revealed that principals approached the improvement of mathematics in their schools indirectly, that is, principals attended to other issues that they felt were necessary prerequisites for improving mathematics achievement. These four themes were common among all five of the principals interviewed for this study.

Chapter 7: Conclusion

So, why did elementary school principals lead the improvement of student mathematics achievement in their schools the way they did? In short, principals' leadership efforts reflected their sensemaking. All five of the principals had strong, confident perceptions of the contexts within which they were leading. They perceived characteristics of their school communities, of the way in which mathematics was being taught in their schools, and how their teachers felt about change and professional learning. Based on those perceptions, or rather the principals' interpretation of those perceptions, they decided on a course of action. In addition it was found that principals' beliefs, sense of identity, past experiences and other personal factors played a significant role in their sensemaking. Personal factors influenced what principals noticed in their school context, and how they interpreted what they noticed. Thus, the influence of personal factors made the enactment of leadership for mathematics improvement quite idiosyncratic. Finally, it was found that principals often tried to improve mathematics through indirect means. Instead of working on mathematics improvement directly, principals seemed to be working on creating the conditions in which mathematics improvement could take place, like building relationships, improving mindset, and improving literacy skills.

7.1 Closing Remarks

This study was motivated in part by my professional interest in understanding why leaders seem to lead in different ways, despite the fact that research tells us that "Almost all successful leaders draw on the same repertoire of basic leadership practices" (Leithwood et al. 2008). Experiences that I had had as a principal such as observing a lesson alongside another principal, but coming to vastly different conclusions about the lesson, left me wondering how our opinions could vary as much as they did, and what impact these differences would have on how

we enacted leadership in our own schools. Context, it seemed to me, had to play a role in influencing the way principals led, but the relationship between context and leadership actions was not obvious.

Through a literature search, I happened upon the concept of sensemaking (Weick, 1995). It seemed to provide a plausible explanation for why principals might lead in different ways, despite their schools being relatively similar. According to the sensemaking literature, people's actions are driven by their interpretations of what they notice in their environment. Sensemaking literature also highlights that what people notice, how they interpret it, and the actions that they take as a result are influenced by, among other things, people's past experiences, their beliefs and values, their emotions and skills, by policies and organizational structures, and by their interactions with other people. Thus, the design of this research study took shape.

The design of this study had to balance rigour and practicality. Interviews were seen as a relatively easy way of gaining an understanding of the thinking that underlies principals' leadership of mathematics improvement, although that understanding was relatively superficial, compared to the insights that could be gleaned from a more in depth case study. Still, by conducting five cases that could be compared, and having an 'insider's view' of school leadership, and by being aware that my own sensemaking would influence my perceptions of the interviewed principals' sensemaking, I felt that useful insights could be gained.

The analysis of the interview data revealed insights that were both expected and unexpected. Having read much about sensemaking prior to conducting the interviews or analyzing the interview data, I was not surprised to find evidence of principals' sensemaking, of how they noticed different aspects of their school contexts, how they interpreted what they had noticed, and how their actions reflected their interpretations. This finding was well aligned with

what I had observed in working with other principals, that our opinions and actions differed, not because some of us were contextually sensitive, and others were not, but rather because we were all processing what we were observing in different ways. On the other hand, I was surprised to find that past experiences played as significant a role as they did in principals' sensemaking and that principals' confident assessments of their school contexts were only based on fleeting experiences and tentative assumptions.

Since becoming aware of sensemaking, it has had a profound effect on my own leadership. I have become more aware of how my approach to leadership is influenced by my own perceptions and interpretations, and that the way I 'read' a situation is not the only way in which a situation can be read. As such, I believe that I have become more cautious in assuming that my opinions are correct, and more understanding of why others opinions may differ.

My awareness of sensemaking has also helped me to gain a better understanding of my own evolving beliefs about improving mathematics education. As a mathematics consultant for my district a dozen years ago, I became a strong advocate for teaching through problem solving (Stigler and Hiebert, 1999). Since then, new experiences such as working at a school with a group of very experienced teachers, working at a school serving a largely impoverished community, and being exposed to cognitive science research through social media, I have shifted or perhaps more accurately, I have re-shaped my thinking. I believe that having an awareness of sensemaking has helped me to let go of some past beliefs and develop some new beliefs, all the while being aware that my own sensemaking, is just that, my own sensemaking.

7.2 Implications

While this study was small, and its results are not generalizable, it does help to highlight the role that sensemaking plays in the enactment of leadership. More specifically, the

methodology and the findings of this study have implications for future research as well as for practice. Each of these areas of implication will be discussed below.

7.2.1 Future research.

For many years, educational leadership research has pointed out that “effective leadership means more than simply knowing what to do; it means knowing when, how, and why to do it.” (Waters, Marzano and McNulty, 2003, p. 2). By looking at school leadership through the lens of sensemaking, an understanding of how leaders figure out what leadership practices to enact, and how to enact those practices can be gained. The findings of this study suggest that examining the enactment of leadership through the lens of sensemaking can yield insights into why school leaders enact leadership the way they do. As such it is a promising avenue for future school leadership research.

7.2.2 Policy and practice.

For practitioners, including school and district leaders, policymakers, and leadership developers, understanding that sensemaking influences how contexts are perceived, interpreted, and acted upon has the potential of providing much insight. Leaders who are aware that sensemaking influences their perceptions, interpretations and actions, may be better able to compensate for biases and undesirable dispositions. Similarly, an awareness of the sensemaking processes involved in understanding policy and leading school improvement will allow district leaders to support principals’ sensemaking. Scholars have highlighted the challenges and lack of progress with regard to improving mathematics outcomes for students (Hiebert, 2014; Eacott & Holmes, 2010). Perhaps giving consideration to the role that sensemaking plays in the leadership of mathematics improvement efforts in school improvement research and in leadership

effectiveness research has the potential of having a positive impact on the practices of school leaders and their outcomes.

7.3 Limitations

Three limitations are noted for this study. One pertains to the number of participants, one pertains to using a single source of data, and one pertains to the contextual framework. Each of these limitations will be discussed below.

This study, being a small, qualitative study with few participants constrains the conclusions that can be drawn as well as the generalizability of those conclusions. While the number of participants met the threshold of saturation (Creswell, 2013), the sample was not representative. Further, the interviews were limited in duration and scope. As such the findings only provide a plausible explanation of why the principals interviewed led the way they did. More data would need to be collected from a greater number of principals for more general conclusions to be made.

The reliance on a single interview for each case was also a limiting factor in this study. During the data analysis, it also became very clear that it was very challenging to determine the accuracy of what the principals were sharing. Scholars highlight that sensemaking involves actively constructing a situation from circumstance (Weick, Sutcliffe & Obstfeld, 2005). It was impossible to tell whether the principals' perceptions were accurate, or even if they were plausible. This study of sensemaking would have been enhanced by the use of multiple data sources, whereby the accuracy or plausibility of the principals' perceptions could be assessed through triangulation. For example making in situ observations, interviewing other staff members, or conducting multiple interviews with the principal over time could bolster the robustness of the data.

The conceptual framework also limited the findings of this study. Viewing leadership as a sensemaking praxis assumes that principals' actions are based on a cognitive process that is influenced by personal, social and contextual factors. While plausible, and promising, the use of the framework may have overemphasized certain dimensions of the praxis of leadership, while neglecting others. Further, using the sensemaking as a framework for research results in what could be considered a vicious sensemaking cycle in which as the researcher, I was engaged in sensemaking about principal sensemaking. In sum, "People are complex, their social systems are complex, their morals and values and where they come from are complex. Postmodern researchers try to be true to this complexity, while still doing 'research'" (O'Leary, 2014, p. 14). Thus the design and conceptual framework used in this study are a necessary compromise that enhanced insight, but also limited the transferability of the findings.

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Appendix I: Participant Information Letter

Dear Elementary School Principal,

School leadership matters. In fact, it has been said that the impact of school leadership on student learning is second only to teaching. In an effort to better understand the factors that influence how elementary school principals decide to approach improving student mathematics outcomes in their schools, I am conducting a research study. If you would consider participating in a 45-60 minute interview for this study, please read on.

The study involves interviewing between 4 and 8 elementary school principals. The goal of the interviews will be to better understand how principals make sense of various contextual and personal factors in deciding how to improve mathematics outcomes for students.

The interviews will be conducted one-on-one, and will take place from at a time and location that is convenient to you (e.g., before school or after dismissal in you). Participant identity, as well as any other identifiable information will be kept confidential through the use of pseudonyms.

This research study is being conducted for my Master's thesis at the University of Ottawa under the supervision of Dr. Stephanie Chitpin. It should also be known that I am currently an elementary school principal, working for the Ottawa Catholic School Board.

If you are willing to participate in the interview, please email me at xxxxx@uottawa.ca. Participants will be selected on a first come, first served basis.

Many thanks for considering becoming involved.

Paul Gautreau

Appendix II: Participant Active Consent Form

Project title: Principal sensemaking and leading school improvement in mathematics

Name of researcher and supervisor contact information:

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Invitation to Participate: I have been invited to participate in a research project conducted by Mr. Paul Gautreau under the supervision of Dr. Stephanie Chitpin for his Master's Thesis at the University of Ottawa.

Purpose of the Study: The purpose of this research project is to examine the thinking of elementary school principals that underlies the approach to leadership that they take to improve student mathematics outcomes.

Participation: My participation will consist of participating in an interview focused on how I, as an elementary school principal, make sense of contextual and personal factors in deciding how to improve mathematics outcomes for students. The time needed for this interview is approximately 45-60 minutes. This will take place at a time and location convenient to me. Mr. Paul Gautreau will audio-record my responses. I will be given the option of reviewing the transcript of my interview if I wish.

Assessment of risks: It is recognized that the disclosure of identifying information may have negative consequences. As such, Mr. Paul Gautreau has reassured me that no identifying information will be disclosed through this research project. Further, Mr. Paul Gautreau has reassured me that I may decide to stop the interview at any time if I become uncomfortable.

Benefits: By sharing my thinking pertaining to the leadership efforts to improve mathematics outcomes for students, I will have the opportunity to reflect on my own leadership practices. In a broader sense, I will also be contributing to deepening our understanding of educational leadership.

Privacy of participants: I have received assurance from Mr. Paul Gautreau that the information I share will remain strictly confidential. My identity, as well as the identity of my school, other

people, and my school district will be protected through the use of pseudonyms. The contents will be used only for this Master of Arts in Education thesis.

Confidentiality and conservation of data: The data will be used for the purpose of the completion of the Master's Thesis. I have been assured that the audio recording and transcripts will be kept in a secure manner at the researcher's home during the research. Upon completion of the project the data will be stored by Mr. Paul Gautreau in his home and in the office of Dr. Stephanie Chitpin for five years following the end of his Masters defense. At the end of this time, all audio recordings and transcripts will be shredded and electronic data will be erased.

Voluntary Participation: I am under no obligation to participate and if I choose to participate, I can withdraw from the study at any time and/or refuse to answer any questions, without suffering any negative consequences. If I choose to withdraw, all data gathered until the time of withdrawal will be destroyed.

Acceptance: I, _____ [*Name of participant*], agree to participate in the above research study conducted by Mr. Paul Gautreau as part of his Master's Thesis at the Faculty of Education, University of Ottawa under the supervision of Dr. Stephanie Chitpin.

If I have any questions about the study, I may contact Mr. Paul Gautreau.

If I have any questions regarding the ethical conduct of this study, I may contact the Office of Research Ethics and Integrity, University of Ottawa, Tabaret Hall, 550 Cumberland Street, Ottawa, ON, K1N 6N5 Tel.: (xxx) xxx-xxxx Email: xxxxx@uottawa.ca

There are two copies of the consent form, one of which is mine to keep.

Participant's Name

Signature

Date

Researcher's Name

Signature

Date

Appendix III: Interview Protocol

Principal Sensemaking and Leading School Improvement in Mathematics

Date, time and location of Interview: _____

Interviewer: _____ Interviewee: _____

Introduction: First of all, let me thank you for agreeing to participate in the interview. I have 4 groups of questions about school improvement in your school. We should be done in about 60 minutes. Through this interview and other interviews that I'll be conducting, I hope to be able to better understand the thinking of elementary school principals that underlies the approach to leadership that they take to improve student mathematics outcomes. Although these questions are written down, they are only intended to guide our conversation. I'll be recording our conversation, but when it is transcribed, all identifying information will be omitted. Your responses will also be treated carefully so that your identity is not revealed.

Questions:

1. **PERSONAL BACKGROUND:** Tell me a bit about yourself:
 - a. What is your educational background? What did you study?
 - b. How long did you teach? Where did you teach? What did you teach?
 - c. How long have you been a school administrator (vice-principal or a principal)? Where have you worked as a school administrator? Have you held any other positions in education?
 - d. What is your philosophy of education? What do you believe and value about teaching and learning?
 - e. How would you describe yourself as a leader? What are your strengths? What are your weaknesses?
2. **SCHOOL COMMUNITY:** Tell me a bit about your school:
 - a. How many students are there in the school? How many staff members?
 - b. How would you describe the socio-economic status of students in your school?
 - c. How would you describe the culture in your school among students? Among staff?
 - d. What are some of your school's strengths? What are some of your school's needs?
3. **MATHEMATICS TEACHING AND LEARNING:** Tell me about mathematics in your school:
 - a. How is mathematics achievement in your school? What are your EQAO results?
 - b. How is mathematics taught in your school? What are the strengths of mathematics teaching and learning in your school? The weaknesses?

- c. How is your school approaching the improvement of student outcomes in mathematics? What is your role in improving student outcomes in mathematics? How is it going?
- 4. LEADERSHIP INFLUENCES: Tell me about what influences your leadership practices:
 - a. What factors do you think have influenced the way in which you are approaching the improvement of mathematics outcomes? How do you think have those factors have influenced the leadership actions you have taken? (As necessary, cautiously probe without leading with regard to personal beliefs, identity pedagogical content knowledge, external mandates, school characteristics, leadership skills and style.)

Conclusion: Many thanks for taking the time to be interviewed. Do you have any questions?