Effective School Leadership to Support Innovative Teaching: Mathematics Education Using the Thinking Classrooms Framework

by

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Abstract

Manitoba students are struggling in mathematics. In the 2020/21 school year, 12.8% of Grade 9 students failed to earn their mathematics credit on their first attempt; this nearly triples to a 34.2% failure rate for Indigenous students (Manitoba Education and Early Childhood Learning, n.d.). Additionally, on the 2019 Pan-Canadian Assessment Program (PCAP), Grade 8 students in Manitoba had mean scores below the Canadian mean in all mathematics subdomains (O'Grady et al., 2021). Liljedahl (2016, 2021) found that students struggle to learn mathematics in traditional classrooms because teachers are planning lessons that do not require them to actively think. In response, he developed the Thinking Classrooms framework for teaching mathematics; it's use has exploded in Kindergarten to Grade 12 classrooms in Manitoba, across Canada and around the world. While much research has been done to develop the framework and recommend effective practices for teachers, none has examined the role of school leaders who are expected to support it. This is problematic because policymakers are expending large amounts of money, time, and physical resources for teachers to create their own Thinking Classrooms while school leaders are left to muddle through. This study asks, what are the optimal practices for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools? An interview-based qualitative research approach was used to learn from the experiences of teachers and school leaders in a large metropolitan school division located in Manitoba. The results are useful for school leaders who want to support their own teachers' implementation of the Thinking Classrooms framework and improve the education of mathematics.

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Dedication

To my wife, Angie, my children, Elizabeth and Jonathan, and my parents, Linda and Jim. Thank you for your love, encouragement and support. Each of you has inspired me to ask questions, be curious, and never stop learning.

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Chapter One: Introduction

Background

In September 2016, I was asked to take on a leadership role in my high school as the Mathematics Department Head. I had been teaching Grades 7 to 12 Mathematics for seven years and would describe myself as a fairly traditional high school teacher at that point in my career. Like most other high school mathematics classes, my lessons began with a review of the previously-assigned homework questions, followed by the introduction of a new topic; as a part of teaching new ideas, I completed one or more example problems on the whiteboard while my students followed along and copied it into their notebooks. I then provided a few similar problems, in some instances only changing one or two numbers, for my students to try on their own. After reviewing the solutions to these problems as a class, the remainder of the period was used to solve similar questions individually or in small groups. This lesson structure closely aligned with the "activate, acquire, apply" model that was promoted by many of my education professors in university and was not unlike my own experiences as a student. While I incorporated student collaboration, problem solving and inquiry throughout the semester, looking back I would describe these important elements of mathematics education as extras to the specific mathematics outcomes being taught.

One of my first duties as a department head was to attend a meeting, chaired by the divisional mathematics consultant, with mathematics department heads from other high schools in Winnipeg. It was during this meeting that I was introduced to some of the research done by Dr. Peter Liljedahl on Building Thinking Classrooms. The meeting chair passionately argued that Liljedahl's research showed that students in traditional mathematics classrooms

were not thinking; at best they were mimicking what the teacher had done during the example problems and at worst they were doing nothing at all (Liljedahl & Allan, 2013). Perhaps most troubling was Liljedahl's (2016) realization after visiting many mathematics classes, "In each class, I saw the same basic behaviour – an assumption, implicit in teaching, that the students either could not or would not think" (p. 362). I found this idea very unsettling and wrestled with the thought that perhaps my own students were not thinking.

A couple of months went by and, by all accounts, the semester was not unlike any of the ones I had taught before: I had stuck with the tried and true "activate, acquire, apply" model; my students appeared to be learning the mathematical ideas I taught; parents were happy with the grades students were receiving; and, my principal and vice-principal seemed genuinely pleased with my efforts as a teacher and new department head. One lunch hour, however, I had an "aha" moment that forever changed my perspective on the teaching and learning of mathematics.

While students would often eat lunch in my classroom while seeking extra help or feedback on an assignment, during this particular lunch hour, three students on the school Graduation Committee asked if they could use a couple of tables in my room to plan for the June dinner and dance. I obliged and, as a result, overheard a remarkable conversation. The students had been tasked with providing a $500 deposit by 5:00 p.m. on the following day for the rental of decorations. However, two of the students had an $80 daily withdrawal limit on their debit card and the remaining student had a $100 weekly limit. For quite some time, the students wrestled with the problem of getting $500 to the rental company by the deadline. In the end, the students decided that it was impossible—even if they used a bank machine the

maximum number of times over two days, (4 x $80) + (1 x $100) was only $420. At no point did the three students, all of whom had exceptional grades in my Grade 12 mathematics class, demonstrate problem-solving skills. Only when I interjected and suggested that they think outside of the box—borrowing from friends, asking the school to write a cheque, having a parent put the deposit on a credit card, or using a debit card in person at the rental company (as debit transaction limits are often higher than cash withdrawal limits)—did the students realize that this was not an unsurmountable task. As an observer to their conversation, it instantaneously became overwhelmingly clear to me that Liljedahl (2016) was correct—my students were not thinking and, embarrassingly, I was unconsciously planning my daily lessons to account for that. That evening I started my own journey to create a Thinking Classroom.

Description of the Thinking Classrooms Framework

Liljedahl (2020a) provides fourteen optimal practices for thinking, collectively known as the Thinking Classrooms framework, that teachers are encouraged to implement in their mathematics classrooms:

1. Use thinking tasks.
2. Form frequent visibly random groupings.
3. Use vertical non-permanent surfaces.
4. Defront the classroom.
5. Only answer keep thinking questions.
6. Give tasks early, standing, and verbally.
7. Give check your understanding questions.
8. Be intentionally less helpful.

9. Create and manage *flow*.
10. Consolidate from the bottom.
11. Use meaningful notes.
12. Evaluate what you value.
13. Communicate to students where they are and where they are going.
14. Report out based on data (not points). (p. 45)

What follows is a brief description of each optimal practice.

For the first and sixth optimal practices, Liljedahl (2020a) encourages teachers to consistently "use thinking tasks" (p. 45) and "give tasks early, standing, and verbally" (p. 45) in their classrooms. In mathematics, thinking tasks require student problem-solving, communication and collaboration. Liljedahl (2021) notes, "Good problem-solving tasks require students to get stuck and then to think, to experiment, to try and to fail, and to apply their knowledge in novel ways in order to get unstuck" (p. 20). To prevent students from mimicking, good problems are also unique; they are unlike other problems the students have previously solved. This ensures that the students are truly thinking about the problem and not just replicating a previous thought process. Additionally, Liljedahl (2021) found that teachers should orally pose the problem at the very beginning of class. This quickly hooks students into the day's learning and encourages them to focus on mathematics immediately.

The second and third optimal practices concern how students are grouped and where they work. While there are many approaches teachers can use to group students (teacher-chosen, student-chosen, proximity-based, random, etc.), Liljedahl (2014) found that frequently placing students in randomly-formed groups of three had both academic and social advantages.

Within less than a month of consistently using of visibly random groupings, Liljedahl (2014) observed: students would work in any group; all students fit in; there was an increase in idea sharing in the classroom; students relied less on the teacher for answers, but more on others in their own group and in other groups; and, student engagement and enthusiasm went up. It is interesting to note that the students had to observe that truly random groups were being formed (by choosing a card, for example) for these benefits to occur. In addition, Liljedahl (2019) found, "Groups are more eager to start, there is more discussion, participation, persistence, and no-linearity when they work on… whiteboards" (p. 302). He goes on to state that each group should stand while they write on a vertical whiteboard or other vertical non-permanent surface with a single dry-erase marker that is shared by the group.

The fourth optimal practice examines how the furniture in a classroom is placed. Liljedahl (2021) found that student thinking is increased when teachers *defront* their classrooms by placing the furniture in a non-linear and unsymmetrical arrangement that has no obvious front. Such an arrangement puts less emphasis on the teacher—there is no front for the sage on the stage—and subconsciously encourages inherently messy processes like problem-solving and thinking. By contrast, classrooms with neat rows or symmetrical pods of desks discourage thinking.

Optimal practice number five encourages teachers to only answer student questions that promote further thinking and optimal practice number eight suggests that teachers should deliberately offer less support. Liljedahl (2021) found that all student questions can be sorted into three distinct categories: proximity, stop thinking and keep thinking questions. The first type of question is asked only because the teacher is in close proximity. Often the student

could figure out the answer or the answer is irrelevant; the student only asked a question because it was easy to do so with the teacher nearby. The second type of question leads to an end of the thinking process. In mathematics classrooms, "is this right?" is a classic example; if the teacher responds positively, the student can stop thinking as the problem is solved. Finally, the third type of question, keep thinking questions, provide students with additional information that is necessary to continue solving a problem. Liljedahl (2021) found that teachers should only answer keep thinking questions as they are the ones that promote thinking. Additionally, he found that teachers build student autonomy by encouraging students to rely on their peers for help and providing less of it themselves.

The seventh optimal practice relates to homework. Liljedahl (2021) explains that homework should "… be a safe place for students to make mistakes as they check their understanding… So, we stopped calling it homework and started calling it *check-your-understanding questions*" (p. 125). Instead of providing a set of traditional homework questions that the student submits to their teacher, Liljedahl (2021) found that students should be provided with questions and answers so that they can self-assess and reflect upon their own understanding of a concept. He also discourages teachers from collecting student solutions to the questions. Combined, these practices encourage student thinking and remove any incentive to cheat or copy from others.

Optimal practice nine recommends that teachers keep students in flow by providing timely hints and extensions as they work on problems. Describing flow, Csikszentmihalyi et al. (2014) note:

> Flow is a subjective state that people report when they are completely involved in something to the point of forgetting time, fatigue, and everything else but the activity itself... Attention is fully invested in the task at hand, and the person functions at his or her fullest capacity." (p. 230)

The authors go on to explain that there are three conditions necessary for flow: clear goals throughout the activity, a balance between the person's ability and the challenge they face, and instant feedback. Liljedahl (2018) builds on the idea of flow by stating that mathematics teachers should provide students with timely hints and extensions to ensure that there is a balance between the students' ability and the challenge level of the problem(s) they are solving. If a problem is too easy, students can become bored and stop thinking; conversely, if a problem is too difficult, students can become frustrated and also stop thinking.

The tenth and eleventh optimal practices examine how teachers help students consolidate their understanding of mathematical concepts and ideas. While many teachers consolidate by orally reviewing the lesson's content and processes, Liljedahl (2021) makes an important observation about this method:

> If all students could learn by having us just tell them how to do it, we would not have any of the problems that we have in mathematics education today. For over one hundred years the dominant pedagogy was teaching through telling. If that had worked, then all students would have been in our highest streams, and all students would have gotten the highest marks. But that has not been the result.

Instead, Liljedahl (2021) found that teachers should lead a guided gallery walk of the vertical non-permanent surfaces to consolidate learning. During this walk, students are shown example

solutions from other groups and are asked to decode what they were thinking; the teacher adds commentary and highlights any important information. Importantly, the walk is started with an entry-level (basic) solution that all students can find meaning in and continued through to the most advanced. Liljedahl (2021) describes this as "leveling to the bottom" (p. 172).

Notetaking is another method teachers use to consolidate student learning. Instead of having students copy the teacher's notes or use fill in the blank notes, Liljedahl (2021) found that students should be given autonomy to write their own meaningful notes for use in the future. While the teacher can support this process by providing graphic organizers or highlighting ideas that they may want to write down during the guided gallery walk, each student ultimately creates their own notes. These notes should contain example solutions, annotations and reminders that they would need to solve a similar problem, or to use a similar process, in the future. While Liljedahl (2021) found that traditional notes prevented student thinking, autonomous meaningful notes promoted it.

The final three practices describe the different assessment processes in a Thinking Classroom. Liljedahl (2021) found that teachers need to regularly evaluate and provide timely feedback on student learning behaviours in the classroom; he suggests using continuum rubrics or t-charts to illustrate and discuss co-constructed evaluation criteria. Additionally, Liljedahl (2021) found that students need to be consistently provided with opportunities to self-evaluate and reflect upon their own learning behaviours. To assess their learning, he emphasizes the importance of formative assessment strategies and outcome-based assessment for students. Liljedahl (2021) notes, "to help students navigate their learning, the information we need to communicate to them is the information that helps them know not only what they know, but

also what they don't know" (p. 234). To that end, he recommends that students be given a table containing all of the outcomes and sub-outcomes for each unit so that they are able to keep track of what they have learned and what they still need to learn. Finally, to determine term and final grades in a course, Liljedahl (2021) found that teachers should use outcome-based assessment to triangulate each student's most recent evidence of learning through observation, product and conversation.

Central Issue

While creating a Thinking Classroom I had the support of many educational leaders: the divisional mathematics consultant, my Principal and Vice-Principal, other teachers (both at my school and other schools), and, through professional development sessions arranged by my school division, Liljedahl himself. All of these people played an important role, in different ways and to varying degrees, in the successful transformation of my own classroom teaching practice.

I have since had the privilege to lead and support other teachers who were creating their own Thinking Classrooms as a Mathematics Consultant, Program Lead, Vice-Principal, and now, Principal. All of these interactions have caused me to reflect upon the support I was given and look for ways of helping others achieve their own success. While Liljedahl (2021) has studied over 400 classrooms during the past fifteen years to come up with the Thinking Classrooms framework and fourteen optimal practices for encouraging students to think, there is currently no literature that specifically examines how school leaders can support teachers in this endeavour. This is problematic for school leaders like myself, who are left to mix and match strategies from other research in the fields of mathematics education and educational

administration with their own classroom experiences and prior knowledge. Knowing optimal practices for school leaders to support teachers that are establishing Thinking Classrooms in Kindergarten to Grade 12 schools provides important guidance for school leaders and eliminates some of the current guesswork.

Urgency

Teachers around the world are implementing the Thinking Classrooms framework in their classrooms. An X (formerly Twitter) search for the hashtag *#thinkingclassroom* returns countless posts and pictures from educators across the globe who are putting Liljedahl's (2021) research into action. In Manitoba, school divisions have hired Liljedahl on numerous occasions. He has provided professional development to hundreds of educators over the past six years from: Winnipeg School Division, St. James-Assiniboia School Division, Pembina Trails School Division, Hanover School Division, Seven Oaks School Division, Brandon School Division and Red River College Polytechnic. The Manitoba Rural Learning Consortium (mRLC), a group of rural school divisions that collaboratively coordinate professional learning for their teachers, and the Association for Supervision and Curriculum Development (ASCD) Manitoba have also brought Liljedahl to Manitoba to work with teachers (Liljedahl, 2020b). As more and more teachers implement the Thinking Classrooms framework, it becomes increasingly important for school leaders to know how to effectively support it.

Research Question

The purpose of this interview-based qualitative study was to analyze the ways that school leaders support teachers who are establishing Thinking Classrooms in Kindergarten to Grade 12 schools. This provided insight into the methods and strategies that school leaders are

currently using, as well as the different types of support that are offered. Once current practices were identified, it was possible to determine which contributed to successful implementation of the Thinking Classrooms framework. The central question to my research was: what are the optimal practices for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools? Two subquestions that guided the study were:

1. What do school leaders think are effective practices and supports (financial, material, time, professional development, etc.) that they provide to teachers who are implementing the Thinking Classrooms framework?
2. What do teachers who have implemented the Thinking Classrooms framework perceive as the most valuable practices and supports that they have received from their school leaders?

By individually interviewing teachers who have implemented Thinking Classrooms and school leaders, I have learned effective methods, strategies, and supports for school leaders who wish to support the framework. While it is possible that individual schools might need different resources based on unique characteristics such as grade range, student population, mobility rate or socio-economic status, this study did not reveal significant variations in support due to these factors.

Significance

This study is significant for many education stakeholders: scholars, school leaders, teachers, policymakers and students. First, as previously discussed, there is currently a gap in the scholarly literature that this research helps to fill; this thesis adds to the general body of

knowledge in the fields of mathematics education and educational administration. Second, school leaders benefit by learning from the experiences of others who are encountering similar situations. This increases awareness and knowledge of the best practices for supporting Thinking Classrooms implementation amongst school leaders. Third, as awareness and knowledge amongst school leaders increases, teachers will benefit from better support.

Policymakers, fourth, invest millions of dollars each year into professional development for their staff. In the 2021-22 school year, the Winnipeg School Division budgeted $9 179 018 for instructional and other support services, including $2 522 825 for curriculum consulting and development (including administrative costs), $2 459 380 for professional and staff development, and $2 595 172 for other; the remaining $1 601 641 was budgeted for library / media centre (Manitoba Education, 2021b). Another school division that Liljedahl has worked with, Pembina Trails School Division, budgeted $6 715 290 for instructional and other support services, including $848 883 for curriculum consulting and development (including administrative costs), $1 526 802 for professional and staff development, and $559 453 for other; the remaining $3 780 152 was budgeted for library / media centre (Manitoba Education, 2021a). Given the large amount of money spent annually, policy makers will benefit from knowing how school leaders can better support teachers who are part of large-scale professional learning opportunities like Thinking Classrooms. This also helps them plan future professional development sessions.

Finally, because successful implementation of the Thinking Classrooms framework results in increased student thinking, problem-solving, engagement, and achievement in Kindergarten to Grade 12 mathematics classes (Liljedahl, 2021), students benefit from teachers

having the necessary supports to implement it well. It follows that parents generally want their child to achieve academically and so, by extension, this research benefits them through the positive effects it has on students.

Definitions

Thinking Classrooms is a reform-oriented and research-based framework that includes 14 optimal practices for thinking in Kindergarten to Grade 12 mathematics classrooms (Liljedahl, 2021). Le et al. (2006) explain that reform-oriented pedagogy "encourages inquiry-based activities and the skills of intellectual conversation: asking questions, discussing alternative approaches to problems, presenting reasons for answers to questions, and making connections between old and new knowledge and between superficially disparate topics" (p. 2). The Thinking Classrooms framework examines fourteen variables that have an impact on student thinking during class and provides research-based practices for teachers to increase student learning (Liljedahl 2016, 2021).

A leader can be thought of as anyone who influences, supports or guides the work of others. In addition to the principal and vice-principal, school leadership roles can vary from school to school, depending on the grade level and size. In high schools, department heads, as leaders in the school, play an integral role by providing instructional leadership, mentor-coaching, and general support to teachers. In middle schools, team leaders collaborate with a grade or subject-based team to address students' learning needs, review student achievement, and provide teachers with instructional support. In elementary schools, much of this work falls to the school resource teacher. Students, parents and community members can also all assume leadership roles within a school through student or parent advisory councils.

In this study, *school leader* is defined as principal or vice-principal. They are the ones who are ultimately responsible for all aspects of instructional programming, resource allocation, teacher effectiveness, and student achievement in every school. Both their direct and indirect actions have an impact on the teaching and learning of a school (Bendikson et al., 2012). As the authors note, "The effective principal manages the environment to optimise learning (indirect instructional leadership) and provides guidance and support for other school leaders or teachers to improve the quality of instruction and the achievement of all students (direct instructional leadership)" (p. 4). While it is true that others can demonstrate leadership by supporting a teacher with the implementation of the Thinking Classrooms framework, this is most often arranged (or at the very least approved) by a principal or vice-principal.

Delimitation

The *math wars* are a series of longstanding disagreements between those who support traditional and reform-oriented approaches to mathematics teaching and learning (Schoenfeld, 2004; Kilpatrick, 2009). One such battle is currently taking place in western Canada, with the Western Initiative for Strengthening Education in Math (WISE Math) group using results from large scale national and international assessments to argue for a return to traditional approaches through the media (Chernoff, 2019). This research project does not seek to enter the *math wars* debate by questioning if the reform-oriented methods advocated by the Thinking Classrooms framework are the best way to teach mathematics. Educators and advocates on both sides have already invested too much time, effort and resources into this war (Reys, 2001). This study focuses on effective leadership practices in instances where the decision to implement the Thinking Classrooms framework has already been made. Whether or

not the Thinking Classrooms framework and other reform-oriented practices are superior to traditional methods is left for others to debate.

Anticipated Limitations

As use of the Thinking Classrooms framework has expanded rapidly around the world, tens of thousands of teachers and school leaders have been directly involved in its implementation. This creates a limitation for this study as it is impossible to understand the experiences of every single person who has been involved; this is further complicated by the fact that use of the Thinking Classrooms framework expands each day across countless locations. It is clear that trying to interview or collect data from every possible participant would have been an insurmountable challenge. To overcome this limitation, a purposeful sample, as explained in Chapter Four, was used to collect the experiences of school leaders and teachers at a limited number of school sites.

As discussed in the fourth chapter under Participants, the potential participants for this study are teachers and school leaders from the William Norrie School Division (pseudonym). This particular school division, like others in Canada, has policies and processes in place that regulate the scope of any research that involves their students, staff, and/or school communities. Because of this, my study was limited to the extent that the William Norrie School Division was willing to participate. While I received approval from its research advisory committee to complete my study without restrictions, the results are limited to the perspectives of those who volunteered to participate. Some teachers and school leaders may have chosen not to participate due to the many challenges of the COVID-19 pandemic, including an extensive workload, among other factors.

Thesis Overview

In Chapter Two, I explain the objectives and process of carrying out my literature review by introducing some of the current literature related to three themes: school leaders' involvement in teacher professional development, agency, and collective teacher efficacy. The chapter situates my thesis within these themes by making connections to each. I conclude the chapter by identifying a substantial gap in the current literature that my thesis seeks to fill.

In the third chapter, I introduce the theoretical lens for my thesis, based on the work of Leithwood (2011). He suggests a framework of sixteen core leadership practices that can be grouped into four categories. Leithwood's (2011) framework was valuable as it provided a guide for identifying and understanding the optimal practices of school leaders who are supporting teachers' implementation of the Thinking Classrooms framework.

The fourth chapter describes the methodology of my research. It identifies my own world view, the participants for my study, the proposed methods of gathering and analyzing data, ethical considerations, the processes and procedures for ensuring credibility and trustworthiness, my own positionality, and potential sources of researcher bias. It also explains my assumptions, the study's limitations, and makes further connections to the current literature.

The fifth chapter summarizes the findings of this research project. It discusses the connections between the findings, Leithwood's (2011) theoretical lens, the reviewed literature and the Thinking Classrooms framework. Chapter Five also answers the study's research question and two subquestions, revealing four themes that provide eight optimal practices for school leaders who want to support their teachers' implementation of the framework.

Finally, the sixth chapter concludes this thesis. It offers a summary of the study's findings, makes further connections to existing literature, builds upon Leithwood's (2011) theoretical framework, and offers suggestions for future research. Perhaps most important, the conclusion offers considerations for school leaders who want to put the study's findings into practice. It then ends with some final closing remarks.

Chapter Two: Literature Review

Introduction

Much research has been done over the past decades on the importance of educational leadership. According to Wahlstrom et al. (2010), school leaders have a large effect on instructional quality, student learning and student achievement. Specifically, the authors explain:

> As we began our work five years ago, we argued that leadership is second only to classroom instruction among all school-related factors that contribute to what students learn at school. Five years later, we are even more confident about this claim. (p. 6)

More recently, Grissom et al. (2021) conducted a review of the research on school leadership that has taken place since the year 2000. They found that "Effective principals are at least as important for student achievement as previous reports have concluded—and in fact, their importance may not have been stated strongly enough" (p. xviii). Further, when Grissom et al. (2021) examined the impact of principals on specific subject areas, they determined that effective principals have a positive influence on student achievement in mathematics.

While leadership is clearly important in schools, determining how effective school leaders improve learning and student achievement is another question altogether. To that end, May and Supovitz (2011) found that educational researchers have primarily studied school leadership using four different lenses, including: practice, style, process, and scope of effort. They define practice as specific acts that school leaders do (i.e. observing classes, managing school resources, facilitating teacher collaboration, fostering collective teacher efficacy, etc.); style as how school leaders carryout their role (i.e. managerial leadership, transformational

leadership, distributed leadership, etc.); process as the ways school leaders facilitate change (i.e. promoting reflection, encouraging innovation, implementing continuous improvement plans, etc.); and, scope of effort as the amount of support given to individual teachers, groups of teachers, and the teaching staff as a whole. And while it is likely that any of these four lenses, or any combination of them, would be useful in determining optimal practices for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools, for the purposes of this thesis I will focus on what school leaders do—their practice.

To become familiar with similar studies and to build on existing research and scholarship on my research topic, I completed a literature review using Google Scholar, the University of Manitoba catalogue, and other online search engines (from 2021 to 2023). Keywords used for this search included: thinking classroom principal; thinking classroom leadership; and thinking classroom support. Despite my best efforts, I found no relevant published literature that examined school leaders' support of the Thinking Classrooms framework. Liljedahl, a pioneer in this area of educational research, confirms that my area of study is currently a gap in the literature (P. Liljedahl, personal communication, April 7, 2022). This gap is somewhat unsurprising as the Thinking Classrooms framework is relatively new in comparison to other pedagogical approaches that have been around for decades. Because there are no other published studies on my thesis topic, it follows to reason that my research is unique. The findings that come from my study help to fill the gap in the literature that currently exists; they also provide practical advice for school leaders who want to support teacher practice and have a positive impact on student learning. This makes my research both necessary and beneficial.

With no published studies on my research topic, I sought similar areas of literature that my project could be positioned amongst. A closer examination of how teachers learn about and implement the Thinking Classrooms framework offered a few hints of where to look. First, many teachers learn how to implement the Thinking Classrooms framework by attending one or more professional development sessions. Although it is true that some may buy Liljedahl's (2021) book and study the framework on their own, every participant in this study will be connected to a school that has been part of a Thinking Classrooms professional development cohort. This fact provided the first two search terms for the literature review: school leaders support of teacher professional development and collective teacher efficacy.

An examination of the Thinking Classrooms framework provided the last hint for the literature review. While it is possible that some teachers are already implementing all fourteen of the optimal practices for thinking discussed in Chapter One, most teachers need to change aspects of their classroom practice to fully implement the Thinking Classrooms framework; the ability to exert control in order to change one's teaching practice is closely tied to the concept of agency. Additionally, optimal practice number three, the use of vertical non-permanent surfaces, often requires the acquisition of new supplies (Liljedahl, 2019). Teachers who implement the framework decide how they go about acquiring the necessary resources and school leaders choose where to allocate the limited resources in a school. These ideas provided a third search term for the literature review: teacher agency.

With newly identified terms to look for related literature, additional searches were completed using Google Scholar, the University of Manitoba catalogue, and other online search engines. The following keywords were used: school leaders' support of teacher professional

development; collective teacher efficacy; and teacher agency. Search operators were used to isolate words, combine terms, include specific terms, and limit the results. These searches produced vast amounts of relevant literature that was used to position my study amongst three themes: school leaders' involvement in teacher professional development, agency, and collective teacher efficacy. What follows is a brief review of each theme.

Theme One: School Leaders' Involvement in Teacher Professional Development

Effective teacher professional development can lead to increased achievement and better learning outcomes for students (Kennedy, 2016). This is why school divisions spend millions of dollars each year on professional development, as noted in Chapter One. Further, school leaders play an important role in teacher professional development and teacher learning. By focusing on what each teacher requires to improve their practice, principals can increase teacher learning by providing the necessary resources and opportunities for collaborative learning (Kim and Lee, 2020).

It is important to note that teacher professional development can be done individually or as part of a group. Individual professional development activities are those that are engaged in without colleagues. Examples of this include reading a professional book, reflecting upon one's practice, or learning in situ while teaching students. Collaborative professional development is often done as part of a teacher learning community. In a narrative analysis of forty previous studies on teacher learning communities, Vangrieken et al. (2017) note that there is no common structure for such communities. Teacher communities can be formal or informal, include stakeholders from inside and/or outside of the school, be top-down or grassroots, and vary in size. Additionally, the authors found that strong school leadership,

respect, and trust were critical to the success of collaborative professional development. Some of the strong leadership practices that were identified as helpful for supporting a teacher learning community are: organizing the community, allocating resources towards it, communicating clear expectations, encouraging collaboration and participating as an active and equal member. Respect and trust between all members of a teacher community (including school leaders and teachers) were found to be vital to its success; they allowed groups to move past personality conflicts, differing ideas, group conflict and challenging situations. Because the Thinking Classrooms professional development sessions were offered by the William Norrie School Division at a divisional level, some participants in my study were members of school-based teacher communities attending the larger division-based sessions together. This created a communities within a community situation, revealing different dynamics of school leadership, trust and respect at both a divisional and school level.

During the Thinking Classrooms professional development sessions, school leaders from the participating sites are invited to join as a part of the cohort. Hilton et al. (2015) found that when school leaders attend professional development sessions with teachers, there is a positive influence on the teachers' learning process, the teachers' ability to enact new practices, and on the learning of the leaders themselves. As Ringler et al. (2013) explain:

> For teachers, it was important that by attending the workshops principals understood the content of the professional development and what it should look like in the classroom. More importantly, it was important for the teachers to know that principals understood the time requirements that went with the implementation. The message that teachers received from their principals was that this training is important and any

> help I am going to give needs to be based on a thorough understanding of what is being learned. (p. 8)

But school leaders have busy and demanding schedules; they cannot always be present and engage in learning with their teachers. In a survey of public-school principals in Ontario, Wang et al. (2023) found that 86.5% of the 1 434 respondents believed that they did not have enough time to complete their work. This is further compounded by the fact that, "The competing, if not conflicting expectations from (federal and state/provincial) educational authorities, teachers, parents, students, and various interest groups often pose significant challenges to principals' work and add to the complexity of principals' role" (Wang et al., 2022, pp. 51-52). And so, while all school leaders were invited to the professional development sessions, not everyone was able to attend.

Bredeson and Johansson (2000) agree that school leaders play a significant role in the professional development of teachers, but they caution that principals should not be the ultimate authority responsible for teacher learning. They explain, "Our view is that highly effective principals work to move teachers toward greater levels of independence and professional autonomy" (p. 398). And while it is true that school leaders are ultimately responsible for evaluating the effectiveness of teachers and helping them set continuous improvement goals, teachers who are involved in their own professional development decision making are more likely to benefit from it.

Theme Two: Agency

Agency currently has multiple abstract meanings in research literature (Goller & Paloniemi, 2017), but it can be generally described as the ability of one or more people to act

and/or the process of one or more people undertaking an act (Imants & Van der Wal, 2020). Part of social cognitive theory, Bandura (2001) notes three sources of agency, "… direct personal agency, proxy agency that relies on others to act on one's behest to secure desired outcomes, and collective agency exercised through socially coordinative and interdependent effort" (p. 1). While agency is well represented in literature, teacher agency—related directly to the acts carried out by teachers—is less so (Vongalis-Macrow, 2007).

Interestingly, while one might assume that teacher agency is universally accepted as beneficial in education, this is not the case. As Biesta et al. (2015) explain:

> Some see teacher agency as a weakness within the operation of schools and seek to replace it with evidence-based and data-driven approaches, whereas other argue that because of the complexities of situated educational practices, teacher agency is an indispensable element of good and meaningful education. (p. 624)

In Canada, this tension is commonly seen in the area of standardized assessments and provincial exams. While policymakers and politicians argue that these types of assessments ensure Canadian students are not falling behind their global counterparts, many teachers protest that some of their agency as professionals is being taken away.

Agency is closely connected to this research study for at least two reasons. First, school leaders have a substantial amount of power and control in the decision making that takes place in a school; individually and collectively they carry out many acts within a school and can choose at any time whether to act or not. For example, school leaders decide the vision, mission and goals of the school. They also decide who receives the resources (professional development, financial resources, time, etc.) necessary to meet them. At any time, school

leaders can choose to take actions that they believe will benefit the school. While there are laws, regulations, and policies intended to ensure that they use their power and agency in the best interests of students, in reality school leaders have many freedoms.

Second, like school leaders, teachers have a substantial amount of power and control in the decision making that takes place in their classroom and during their lessons. Also, like school leaders, teachers individually and collectively carry out many acts and can choose whether or not to act. For example, while Manitoba Education sets the curricular outcomes for each grade of mathematics instruction in Manitoba, teachers are left to decide how the outcomes will be taught, the order in which they are taught, and in most cases how student learning will be assessed. In relation to the Thinking Classrooms framework, teachers also have the agency to decide the extent that they align their own practice with the fourteen optimal practices. While it is true that a school leader may try to impose certain teaching practices in classrooms, in reality it is nearly impossible to enforce adherence to them. There is an expression that "teaching can be the loneliest profession in the world." This speaks to the ability of most teachers to close their classroom doors and teach in isolation if they so choose.

Theme Three: Collective Teacher Efficacy

A part of agency, Bandura (2000b) explains that self-efficacy "refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given levels of attainments" (p. 16). Perhaps most easily portrayed by the children's story *The Little Engine That Could*, self-efficacy is closely connected to agency because one's actions are largely derived from one's belief that they will be successful (Maddux, 2002). Bandura (2000a)

proposed that efficacy can also have an impact on the actions of groups of people working together. He found:

> People's shared beliefs in their collective efficacy influence the types of futures they seek to achieve through collective action, how well they use their resources, how much effort they put into their group endeavor, their staying power when collective efforts fail to produce quick results or meet forcible opposition, and their vulnerability to the discouragement that can beset people taking on tough social problems. (p. 76)

This idea can be extended specifically to a group of teachers. Collective teacher efficacy "refers to the judgement of teachers in a school that the faculty as a whole can organize and execute the courses of action required to have a positive effect on students" (Goddard et al., 2004, p. 4). Because collective teacher efficacy leads to increased student achievement (Goddard & Goddard, 2001; Ramos et al., 2014; Donohoo, 2017), this is an important concept for educators. In fact, in an ongoing meta-analysis of factors influencing student achievement, Hattie (2021) lists collective teacher efficacy as number two. With an effect size of d=1.36, it has an impact on student learning over three times the baseline of d=0.40.

Hoy and Miskel (2013) offer four sources of collective teacher efficacy that mirror Bandura's (1977) four sources of self-efficacy: mastery experience, vicarious experience, social persuasion, and affective state. According to the authors, mastery experience comes from successfully completing a related task; vicarious experience is learning and developing efficacy from the success of others; verbal persuasion encourages that success is possible; and, in schools with high levels of collective teacher efficacy, the affective state of the school allows teachers and school leaders to better deal with stress, conflict and anxiety. Hoogsteen (2020)

notes that while each of these sources are correlated with increased student achievement, the directionality is not fully understood; like the chicken and egg problem, it has not been definitively proven whether collective teacher efficacy leads to greater student learning, student learning leads to greater collective teacher efficacy, or more likely, some combination of both.

Conclusion

The existing literature focuses on teacher professional development in various curriculum areas. Because the Thinking Classrooms framework is new, there is a large gap in the literature with no relevant or published studies that specifically examine the school leaders' role in supporting the framework. This literature review, however, revealed three related areas of study that are important to this research project: school leaders' involvement in teacher professional development, agency, and collective teacher efficacy. This chapter also justified a need for this interview-based qualitative study by identifying the above-described gap in the literature and positioning the study amongst it.

Chapter Three: Theory

Introduction

Educators are bombarded with quantitative data on a regular basis. This data is used by policymakers, school leaders and teachers to measure the effectiveness of schools and plan for continuous improvement. In Manitoba, focus is placed on provincial achievement test scores, credit attainment, midyear formative assessments, attendance rates, suspension data, and Pan-Canadian and international assessments like the Programme for International Student Assessment (PISA); extra emphasis is placed on numeracy and literacy achievement. Teachers and school leaders are often asked to answer questions of "how much?" and/or "how many?". Questions like "how much has the class average in Grade 12 Pre-Calculus Mathematics increased from last semester?", "how many students were suspended in the first term?" and "how many students passed Grade 9 English this year?" are regularly used for reflection, evaluation, and planning purposes.

Quantitative data provides one way of examining the operations and programming of a school. Lipton and Wellman (2012) go so far as to suggest that school leaders should depersonalize data used in schools, "Using neutral language, such as *these data* or *this chart*, rather than *your students* or *our performance results* objectifies the data, making them easier to talk about" (p. 32). However, education at its very core, is a human endeavor. Knowing "how many?" and/or "how much?" only highlights successes and challenges; it does nothing to reveal the cause or offer suggestions for improvement. By focusing on quantitative data in schools—by depersonalizing data—educators fail to paint a complete picture of what is happening for students. By conducting an interview-based qualitative study using the

framework described below, I relied on human elements to figure out what is really happening in these schools.

Theoretical Lens

Leithwood (2011) suggests that successful school leaders regularly implement about sixteen core practices that can be grouped into four categories, "setting directions, developing people, redesigning the organization, and improving the instructional program" (p. 57). This framework of practices was chosen as the theoretical lens for this research project because it highlighted four specific areas to focus on while studying school leaders who are supporting the Thinking Classrooms framework. What follows is a brief description of the four categories and their connection to this thesis.

Category One: Setting Directions

Leithwood (2011) identifies four practices that are essential for school leaders to set direction in a school. They include: "… *building a shared vision*, *fostering the acceptance of group goals*, *creating high performance expectations*, and *communicating the direction*" (p. 59). And while many think of communication as verbal, it is important to note that it can actually take many forms: non-verbal, visual, written, listening, etc.. As a whole, these four practices raise awareness and align the focus of school staff. This allows them to work towards both individual and collective goals.

In Manitoba and other Canadian provinces, high-quality mathematics instruction that includes a focus on problem-solving is perhaps the most important goal of the mathematics curriculum. Manitoba Education (2013) states that "Learning through problem solving should be the focus of mathematics at all grade levels" (p. 12). Further, they assert that "If students

have already been given ways to solve the problem, it is not a problem, but practice. A true problem requires students to use prior knowledge in new ways and contexts" (p. 13). It is worth noting that this approach does not align with the traditional, teacher-directed classroom I described at the start of Chapter One; I was not taught mathematics in this manner and did not start my own teaching career this way. Most teachers and school leaders did not experience this approach to teaching and learning mathematics either (Boston et al., 2017). For all of these reasons, it is important for school leaders to have a vision for high-quality mathematics instruction, including a focus on problem-solving, when setting directions in the school.

Category Two: Developing People

Leithwood (2011) notes three practices that are necessary for school leaders to successfully develop people in a school. They include: "… p*roviding individualized support and consideration*, *offering intellectual stimulation*, and *modeling appropriate values and practices*" (p. 60). Further, Leithwood (2011) notes that these practices serve two purposes. First, they increase the skill level and knowledge of the school's staff so that they have the ability to work towards the school's vision and meet the school's goals. Second, they provide motivation while at the same time reinforcing expectations for continuous improvement. While this motivation can come directly from the school leader, it can also come from experiencing success while learning about and trying something new.

The practices associated with developing people are relevant to this thesis because the Thinking Classrooms framework requires teachers to acquire a substantial amount of knowledge and skills; both of which need to be applied consistently in order to achieve the

goals and vision of high-quality mathematics instruction. Specifically, optimal practices one through eleven require teacher capacity for problem-posing, student problem-solving, collaboration, cognitive challenge, deep mathematical understanding, making connections, discussion, and consolidation. In order to successfully implement the framework, many teachers need to learn entirely new practices while refining others. This knowledge and skill can be provided directly by the school leader or by proxy. For example, a school leader may seek out professional learning opportunities for teachers or bring an expert into the school to support an area in which the leader is not an expert. In either case, the school leader plays an important role in maintaining the staff's motivation and ensuring that everyone is moving towards the school's vision and goals. As the teachers experience success while learning about and implementing the framework, their level of motivation increases further and comes from within.

Category Three: Refining and Aligning the School Organization

In order to refine and align the school organization, Leithwood (2011) identifies four essential practices for school leaders: "… *building collaborative cultures*, *restructuring the organization to support collaboration*, *building productive relationships with families and communities*, and *connecting the school to the wider community*" (p. 60). Together, these practices create the structures and processes that are necessary for staff members to apply the knowledge, skills and motivation gained through the practices associated with developing people. Leithwood (2011) stresses the importance of this category, noting, "there is little to be gained by increasing people's motivation and capacity if working conditions will not allow their effective application" (p. 60). He goes on to further suggest a connection between working

conditions and motivation, noting that teachers are more likely to be motivated if they believe that they are situated for success. Finnigan (2012) agrees, stating that while school leaders should press for high-quality instruction, this needs to take place in an environment of trust and support.

This category is important to this thesis because in order for teachers to learn about and successfully implement the Thinking Classrooms framework, it is necessary for school leaders to have the right structures and processes in place at school. Some examples of these necessary structures and processes include: creating opportunities for collaboration through professional learning communities, grade group meetings or staff meetings; adjusting the timetable to allow for team-teaching, mentoring or additional preparatory time; sharing information about the framework with families to defend and alleviate any concerns about a non-traditional approach; and, arranging opportunities for teachers to connect with colleagues at another school or organization. In addition to setting the teachers up for success, these structures and processes also motivate teachers by providing the conditions for it to happen.

Category Four: Improving the Instructional Program

Leithwood's (2011) final category, improving the instructional program, is composed of five practices for school leaders: "… *staffing the program*, *providing instructional support*, *monitoring school activity*, *buffering staff from distractions to their work*, and *aligning resources*" (pp. 60-61). He explains, "this category includes practices intended to significantly improve the core technology of schooling: the processes of teaching and learning" (p. 60). Further, Leithwood (2011) notes that the practices associated with this category have the greatest impact on students in the classroom.

Identifying and understanding the numerous ways that school leaders try to improve the instructional program is an important part of this thesis. Beyond communicating a vision for the Thinking Classrooms framework in their schools, school leaders need to ensure: there are sufficient staff in place; teachers have access to support from other professionals, both inside and outside of the school; there are structures and processes in place to monitor student achievement; teachers are able to focus on their work; and, teachers have the physical and financial resources necessary to implement the framework. While the practices identified in the first three categories support the overall implementation of the Thinking Classrooms framework, it is the practices identified in this fourth category that directly impact the extent to which teachers are able to implement it with students in the classroom. This makes category four, improving the instructional program, of particular interest.

Conclusion

The sixteen core leadership practices identified in Leithwood's (2011) four categories, "setting directions, developing people, redesigning the organization, and improving the instructional program" (p. 57), provide a strong foundational roadmap for this thesis paper. They bring insight, organization and focus to the many dimensions of successful principal and vice-principal practice; this was especially useful when analyzing the participants' experiences in order to answer the research question and subquestions and determining optimal practices for school leaders who want to support their teachers' implementation of the Thinking Classrooms framework. With a theoretical lens in place, in the next chapter I describe the methodology of the study. I examine my own positionality as a researcher and outline the processes and procedures that were used to carry out this research project.

Chapter Four: Methodology

Introduction

The purpose of this chapter is to outline my own philosophical world view and research study processes, including participant selection, data collection methods, ethical considerations, credibility, data analysis, and interpretation. Each aligns with the theoretical framework explained previously in Chapter Three and has been carefully designed to answer the research question posed in this thesis.

Paradigm

Before discussing my research process, it is important to acknowledge my own philosophical worldview. As a teacher, my paradigm closely aligns with social constructivism; I believe that each person's learning is constructed from their experiences, prior knowledge, and interactions with others. I also believe that everyone is capable of learning mathematics at a high level, period. If someone is struggling to learn a mathematical idea, it is not because they are incapable of learning it, it is because they have not yet had the right experiences and opportunities to learn. In my opinion, the Thinking Classrooms framework provides a wide-range of high-quality learning opportunities and experiences for all students; this is why it is so important for us to understand how school leaders can best support its implementation.

Creswell and Creswell (2018) note that in social constructivist research, "the goal of the research is to rely as much as possible on the participants' views of the situation being studied" (p. 8); I designed this research project as an interview-based qualitative study that utilizes a semi-structured interview guide because it aligns with this goal. It is the participant's perspectives that allowed me to gain a deep understanding of how school leaders support

teachers who are implementing Thinking Classrooms. By combining the experiences of all participants, I arrived at a set of meaningful practices that school leaders can utilize to support the framework's implementation in the future. While the participants' views were obviously subjective, it is important to note that my interpretations of their multiple experiences were also subjective; this is why I acknowledge my own biases later in this chapter.

Methodology

Interview-based qualitative research has been chosen as the guiding methodology for this study. As Kvale (2007) states:

> The qualitative interview is a key venue for exploring the ways in which subjects experience and understand their world. It provides a unique access to the lived world of the subjects, who in their own words describe their activities, experiences and opinions. (p. 9)

In essence, the goal is to understand and describe human experiences. Unlike quantitative research, this is carried out by the researcher in an open and reflective manner (Kvale, 2007). I believe that such an approach was appropriate for this study as it enabled me to leverage my own knowledge and experience with the Thinking Classrooms framework; this allowed me to interpret, learn from and create a more robust account of the participants' experiences.

Kvale (2007) suggests seven stages for conducting interview-based research that I adhered to as the general methodology for this study. They are: "1. Thematizing… 2. Designing… 3. Interviewing… 4. Transcribing… 5. Analyzing… 6. Verifying… 7. Reporting…" (pp. 35-36). These seven stages provide a roadmap that guided the journey of this research. To

conclude this section, I discuss how each stage has been interwoven into a previous chapter or is included in subsequent sections.

During the first stage identified by Kvale (2007), the researcher must determine the purpose and theme of the study. This has been discussed previously in Chapter One; I wanted to determine optimal practices for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools. It is from the lived experiences of teachers and school leaders that I made recommendations for others who wish to do the same. The second stage is reflected throughout this thesis; it includes planning the study as a whole and takes into account how all seven stages allowed me to answer my research question in a moral and ethical manner.

The remaining stages have not yet been discussed and are described in greater detail in subsequent sections. The third stage forms the basis of the methods section; I collected data by conducting individual interviews with multiple participants using a semi-structured interview guide. Stages four through six form the basis of the data analysis plan which is also detailed in a later section. Finally, stage seven was completed at the conclusion of the study; I communicated the findings of my study in this thesis so that others may learn from it. Viewed as a whole, interview-based qualitative research was a justified methodology for all of the reasons discussed above—it allowed me to better understand the lived experience of supporting the implementation of the Thinking Classrooms framework from the participants' perspectives.

Participants

The William Norrie School Division is a large metro school division in Manitoba that has provided on-going professional development on Thinking Classrooms to over 150 teachers and school leaders from many (30+) schools over the past six years. The professional development is available to any school, Kindergarten to Grade 12, within the school division. Each school is able to send a team of teachers and school leaders to engage in a series of professional learning sessions with other schools that is led by Liljedahl and members of the school division's mathematics support team. Additionally, each school team is able to participate for up to three years as part of a *New, Returning,* or *Returning – Year Three* cohort. To encourage the active participation of all schools, substitute costs are paid for by the school division. In general, the professional development series has been well-received by school leaders and teachers across the division; this is evident by the fact that the series fills up quickly, resulting in some schools being put on a waitlist for future sessions. For the purposes of this study, the professional development series provided a large pool of schools and participants to gather data from.

All participants have been part of establishing Thinking Classrooms in a school, either as a teacher or as a school leader. To select the participants for this study, I asked the William Norrie School Division to identify schools that have participated in the Thinking Classrooms professional learning cohorts and send a recruitment email to the school leaders and teachers at these schools. The recruitment email provided an overview of the study, my contact information, an explanation that participation in the study was voluntary, and noted that the study was limited to the first six eligible school leaders and six eligible teachers (twelve participants in total) that responded. For clarity, the participant inclusion criteria for this study was: teachers who have participated in the William Norrie School Division's Thinking

Classrooms professional learning cohorts and their school leaders, as previously defined. Thus, the exclusion criteria was: everyone who does not meet the inclusion criteria, including all students and minors.

Creswell and Creswell (2018) note that there is no scientific or specific manner of determining the number of participants needed for a qualitative study. Kvale (2007) offers simple advice, suggesting "interview as many subjects as necessary to find out what you need to know" (p. 44). He goes on to suggest that the number of participants needs to be large enough for the researcher to be able to generalize responses and answer the research question, but small enough that it is still possible to analyze all of the information gathered. Considering this guidance, for this study I used a sample of six teachers and six school leaders. This brought the total number of participants to twelve. A contingency plan to interview up to an additional four school leaders and four teachers was made in case the first twelve interviews did not produce enough data; this was not necessary as the data from the first twelve interviews was robust. Table One displays the twelve participants' pseudonyms, their roles and the grade level(s) at which they have implemented or supported the Thinking Classrooms framework.

Table 1

Participants

Pseudonym	Role	Grade Level
Alex	Teacher	Elementary
Beth	Teacher	Elementary / Junior High
Cam	Teacher	Elementary / Junior High
Diane	Teacher	High School
Erin	Teacher	Elementary
Faye	Teacher	High School
Gina	School Leader	Junior High / High School

Hannah	School Leader	Elementary / High School
Ian	School Leader	Elementary / Junior High / High School
Jen	School Leader	Elementary / Junior High
Kate	School Leader	Elementary
Luke	School Leader	Elementary / Junior High

Methods

Before looking at each research method and instrument that was used as a part of this study, it is important to note a distinguishing feature of qualitative research. In qualitative studies, the researcher is an instrument. It was through my own subjective interpretations that the experiences of the participants were collected, interpreted, analyzed, and reported.

To gather the data for my study, I conducted individual interviews with each participant. The duration of each interview was approximately one hour. To help guide my questioning, I created two semi-structured interview guides. Appendix A is the semi-structured interview questions for teachers; Appendix B is for school leaders. Each contains questions and prompts that were designed to provide insight into each participant's experience implementing or supporting the Thinking Classrooms framework. Using a semi-structured interview guide allowed the flexibility to ask related questions as discussion with the participants progressed; this provided better opportunities to gain a deeper understanding than other research instruments, like a questionnaire, would have provided.

To conduct the interview, I offered to meet each participant in person at a mutually agreed upon private location, at a mutually agreed upon date and time. Due to different levels of personal comfort with in person meetings and the unpredictable nature of the ongoing COVID-19 pandemic, I also offered to meet each participant using the virtual platform Zoom. For in person meetings, I offered to purchase each participant a beverage and light snack as a

small token of appreciation for their time. Prior to starting the interview, I engaged each participant in small talk in an effort to build comfort, rapport and trust. To ensure an accurate reporting of the information each participant provided, I used my smart phone to record the audio of our conversation and then transcribed each interview using an online software application called Otter.

In addition to interviews, I used memoing to capture my own thoughts, wonderings, reflections and feelings throughout the research process. Birks, Chapman and Francis (2008) explain that memos can serve many functions and, "these functions can be described using the mnemonic 'MEMO': Mapping research activities; Extracting meaning from the data; Maintaining momentum; Opening communication" (p. 70). Having a collection of memos to analyze and reflect upon benefited the data analysis and writing process. Additionally, memoing allowed me to maintain a heightened awareness of my own positionality throughout the research study.

Data Analysis Plan

As quoted earlier, Kvale (2007) suggests three stages during which data analysis takes place in an interview-based qualitative study: "4. Transcribing… 5. Analyzing… 6. Verifying…" (p. 36). The data analysis process began while I was checking the accuracy of each interview transcript. As I listened to each audio file and corrected the transcript, I started to write observer comments and notes in the margin beside the participants' responses. These comments included a brief summary of the response, highlighted important elements, noted my own thoughts, drew parallels and contrasts to other participants, and started to generalize

common themes. As described later in Credibility, I utilized peer debriefing to seek further feedback and comments on my process and thoughts.

After I finished interviewing and transcribing, I reread all of the transcripts and highlighted common threads within the transcripts and observer comments. I then started to work on the fifth stage above—analyzing. First, I tagged each response with a single word that was representative of its essence. Once all of the transcripts were tagged, I reviewed, sorted, and grouped the tags with Leithwood's (2011) theoretical lens in mind to create a draft set of codes. I then went back through the first transcript and coded it using the comment feature in Microsoft Word by selecting text and noting the code and page number in the comment. I made adjustments to the codes where necessary and followed the same process with the remaining transcripts, going back to recode all of the previous transcripts whenever an adjustment to the codes was needed. Once all of the transcripts were coded, I used a Python script to export all of the coded data into a Microsoft Excel spreadsheet. The script went through each Microsoft Word file and copied the selected text, code and page number from the comments. This allowed me to form themes by sorting, filtering and analyzing the coded data in Microsoft Excel according to participant pseudonym, position (school leader or teacher), and code. With the themes established, I conducted the sixth stage—verifying; some of the strategies I used to verify my results are discussed below in Credibility. Following regular conversations with my advisor, I went back to review and reanalyze my data, codes and themes as a part of the peer debriefing process. Finally, I completed the final stage—reporting. I wrote a draft thesis paper, revised multiple times based on feedback from my advisor and committee members, and published a final copy to share the results of my study.

Ethical Considerations

Creswell and Poth (2018) suggest many ethical considerations for qualitative researchers. While this research was of minimal risk to myself and the participants, I still needed to seek approval from the University of Manitoba Human Ethics Office before commencing any field work. For this study, the most applicable concerns included: participant selection, power and authority, obtaining informed consent, confidentiality, data management, data storage and reciprocity. In this section I describe how each issue related to my study and the steps I took to minimize any ethical concerns.

While participants and participant selection has been previously discussed, it is important to note that I was the Vice-Principal of a school in the William Norrie School Division when the study interviews were taking place. This was an ethical issue as I had a position of power and authority over the teachers from my school that were engaging in the Thinking Classrooms professional development opportunity. To avoid any possible ethical concerns related to my position, teachers and other school leaders from my school were specifically excluded from participation in the study.

My previous roles in the William Norrie School Division as Mathematics Consultant and Program Lead created further ethical considerations concerning power and authority. While these were technically not supervisory positions, principals and vice-principals often relied upon my feedback and advice to make decisions about teaching practices and student learning. This could be perceived by some as having influence and indirect power. Additionally, due to my previous involvement as a planner, co-facilitator, and facilitator of the Thinking Classrooms professional learning series, many of the potential participants were already known to me. It is

also possible that they may have felt a duty to participate in the study due to interactions we had when I was carrying out the responsibilities of my previous roles. I minimized this ethical dilemma by emphasizing in the recruitment email and research participant information and consent form that participation in the study was voluntary; there were no negative repercussions (real or perceived) for choosing to not participate in the study. These two statements helped alleviate any potential pressure one might have felt to participate.

The process of obtaining informed consent was also an important ethical consideration. For this study, I achieved this by providing each person with a copy of the research participant information and consent form (Appendix C) at least one week prior to the interview for their review. I also reviewed the form with them prior to starting the interview, offered to answer any questions they had, and had them sign two copies; one copy was for them to keep for their records and reference, the other I kept for my own records. This ensured that all participants were fully aware of the purpose of the study, the participant selection process, the study procedures, possible risks and discomforts, benefits to participating, confidentiality, the process and timelines for withdrawing one's data from the study, and who/how to ask questions. In addition to collecting their signed consent form, I had each participant verbally consent to participating in the study at the start of the audio recording for their interview.

Confidentiality was an important ethical consideration in this study because the participants could be embarrassed if their personal thoughts and experiences became public knowledge. Additionally, because teachers were asked to comment on aspects of their school leaders' support, there was the possibility of reprisal if individual responses were identifiable. To ensure confidentiality, I did not use any real names in this thesis or the transcripts. Instead,

directly identifying information was removed through the use of pseudonyms. As an extra precaution, all identifying information was stored separately in a code book. This final thesis paper includes individual quotations within a generalization of the essence of the participants' experiences.

Closely connected to the issue of confidentiality was data management and storage. This study was approved by Research Ethics Board 2 at the University of Manitoba. Using a combination of physical and electronic security, I met all of the Board's requirements for data security and storage. A copy of the protocol approval letter is included in Appendix D.

A final ethical consideration was reciprocity. At the in-person interviews, I offered to purchase each person a beverage and light snack as a small token of appreciation for their time. At the end of the study, I will also provide each participant with a summary of the results. For participants who are school leaders, this information might be particularly useful as they continue to support Thinking Classrooms implementation. For participants who are teachers, the results could be beneficial if they take on leadership roles in the future. Both types of participants may also find the summary to be of general interest.

Credibility

As Stahl and King (2020) note, credibility is important to a qualitative study as it asks the question of "How congruent are the findings with reality?" (p. 26). While reality is subjective and dependent on each person's perspectives and experiences, validation in a qualitative study can be done through many different processes, including audio-recording, transcription, member checking, triangulation of different sources of data, and peer debriefing (Creswell and

Poth, 2018). What follows is a discussion of how each of these processes were used to ensure the credibility of this study.

I utilized audio-recording to ensure that I was able to accurately capture the information provided to me by the participants. This allowed me to listen to our conversation, over and over again if necessary, during the transcript checking process. In addition to audio recording, I used memos to capture any important information that may not be auditory in nature. For example, facial expressions, tone of voice, and hand gestures are all important parts of communication that were not captured by the audio-recordings. It was important for me to capture this part of the conversation in my notes so that I was able to incorporate it into the results. Sarcasm was another element that was not always evident in the audio recording; it was important to note any instances of sarcasm as its true meaning was the opposite of what was said aloud.

Checking the transcript of every interview allowed me to accurately capture each conversation and immerse myself in the story of each participant. It also laid the foundation of the data analysis stage of my research, as each transcript was eventually coded in order to interpret the participants' experiences. It is important to note that even transcription is a subjective process. As McMullin (2021) explains, "the transcriber… has to make subjective decisions throughout about what to include (or not), whether to correct mistakes and edit grammar and repetitions" (p. 2). I attempted to limit the subjectivity in this aspect of my study by transcribing each conversation word for word. I was also mindful during the data analysis portion that verbal speech and written speech are inherently different; each have different

structures and purposes. I used my field notes in conjunction with the transcripts to ensure that my final results were as congruent with the participants' reality as possible.

Member checking was an opportunity for the participants in my study to review their transcripts and ensure that I accurately captured their thoughts and experiences. It also provided an opportunity for them to change a portion of their story, or further elaborate by offering additional details that were left out during the interview process. Perhaps most importantly, member checking helped reduce the level of subjective interpretation that was inherent to the transcription process; it allowed the participants to check that the transcript reflected their reality of their experiences instead of my perception of their reality. While it was impossible to completely remove my own subjectivity from the process, member checking helped to limit it and ensured overall credibility.

Triangulation of data sources contributes to the credibility of a study by illuminating generally consistent patterns and explanations for differences across participants, time, and location (Patton, 1999). While individual interviews provided the data for this study, triangulation was achieved by interviewing multiple participants, from several school sites, with different roles (school leader or teacher). Having this wide-array of perspectives ensured that I was able to provide an in-depth and authentic answer to my research question. That is, I was able to credibly suggest practices for school leaders who want to support teachers that are establishing Thinking Classrooms in K-12 schools based on the multiple experiences and perspectives of my participants.

As Henry (2015) explains, "In peer debriefing, the researchers discuss their work with disinterested peers and requests their engagement to question the researcher's work in a

consistent and systematic fashion" (p. 26). Peer debriefing adds to the credibility of the study by providing a sober second look at the research process, data, and findings. For this study, I have asked my advisor and committee members to debrief my work. This provided a fifth process, in addition to audio-recording, transcription, member checking, and triangulation, that lends credibility to the results of my study.

Researcher Positionality

I am a 42-year-old white male who lives in Manitoba, where I was born and raised. I hold university degrees in Science and Education, and a post-baccalaureate diploma in Inclusive Special Education. As explained in the first chapter, I have both established my own Thinking Classroom as a teacher and supported others who are doing the same as a school leader. While my personal experiences have guided me towards my research question and form the impetus of this study, my positionality is a potential source of bias and may have also influenced the way I was perceived by the participants. However, reflecting upon my own positionality illuminated two different ways that I was able to actively acknowledge and/or attempt to limit researcher bias.

First, I spent a significant amount of time crafting non-leading questions for the semi-structured interview guide; in an effort to ensure that the questions were appropriate, I edited and revised them on numerous occasions. I also asked my committee members to review them and provide feedback on their substance and neutrality. Having non-leading questions was important because it ensured that the participants' responses reflected their thoughts and experiences, without influence from my own previous experiences.

Second, it was important for me to carry out the interview in a friendly and open-minded, manner. Because of my experiences and firm belief in the Thinking Classrooms framework, I sometimes strongly agreed or disagreed with the participants' responses to one or more questions. If this agreement or disagreement was evident in my tone or body language, a participant could have exaggerated or changed their responses to align with my own views; this would have provided an inaccurate account of the participant's experiences. However, being aware of this scenario allowed me to take steps, such as practicing asking the interview questions in a mirror beforehand, to prevent it.

It should be noted, however, that my positionality and my membership in the organization were also beneficial to the study. Beyond the ethical considerations and potential sources of bias described previously, being an insider provided numerous benefits, including a broader perspective, pre-established comfort, trust and rapport, and the ability to ask better follow-up questions than an uninformed observer could; all of which allowed me to collect richer and more robust data. These benefits are in line with the work of Edwards (2002), who notes, "The peculiar benefit of deep insider research is the knowledge the researcher brings concerning history and cultures, and an awareness of body language, semiotics and slogan systems operating within the cultural norms of the organisation or group" (p. 72). Reflecting upon my own experiences and knowledge allowed me to leverage them to enrich my analysis and results. While I do not believe that it is possible, or even desirable, to completely remove all aspects of one's psyche and function like a robot while conducting a study, being aware of my own positionality helped me harness my own experiences while designing and conducting this study; it also helped me take steps to avoid unduly influencing the results.

Assumptions

While every attempt was made to design this research project in a comprehensive and thoughtful manner, assumptions were necessary for some unprovable aspects. First, and perhaps most important, I assumed that there were some common practices for school leaders supporting the Thinking Classrooms framework that could be drawn from the experiences and perspectives of the participants. However, it was possible—although highly unlikely—that each school leader and teacher had gone about implementing and supporting the Thinking Classrooms framework in their own unique way. While this would have been surprising, it was impossible to test this assumption without conducting the research project itself. If after completing the study I had found that there were no shared practices, this would have been an interesting finding in itself. Such a result could have also indicated that the number of participants was too small.

A second assumption, closely related to the first, was that my participants' characteristics were of enough similarity to provide insight into the topic being studied. In other words, I assumed that my participants' experiences implementing the Thinking Classrooms framework were similar enough that I could establish themes from their responses. While divergent views on some aspects of implementing or supporting the framework added to the richness of the overall results, I assumed that there would be commonalities to the experience. To help mitigate this assumption, I chose a purposeful sample as outlined previously in the Participants section.

Finally, I assumed that the participants answered the questions truthfully during the interview and member checking process. This was a necessary assumption because there is no

way that I can determine what a participant's perception of reality is without receiving authentic responses. In other words, there is no way that I can prove or disprove that they are lying about what they experienced when establishing Thinking Classrooms as a school leader or teacher. It should be noted, however, that the interview questions did not deal with sensitive issues; such questions, by their very nature, could have led to evasive or dishonest responses. Additionally, I took many steps to encourage honesty that have been previously described in the Ethical Considerations section: I managed issues of power and authority; I obtained fully informed consent (including the right to not answer a question or withdraw from the study completely); I safeguarded privacy; and, I engaged in acts of reciprocity with my participants.

Limitations

There are limitations, in general, to all forms of qualitative research. Of particular concern to this study, Anderson (2010) states, "research quality is heavily dependent on the individual skills of the researcher and more easily influenced by the researcher's personal biases and idiosyncrasies" (p. 2). As a novice researcher, the results of this study are limited by my own knowledge and skills. While I have completed the required coursework of my master's program, spent a great amount of time learning about the qualitative research process, and crafted a detailed study plan that included strategies for managing my personal experiences and sources of bias, I lack any significant previous experience carrying out a large research study.

Additionally, the study design itself created a limitation. The participants for this study are teachers and school leaders from a large metropolitan school division in Manitoba. The Thinking Classrooms framework has been implemented in classrooms around the world and it is

possible that the experiences of the study participants are different from those in other locations. Regional differences such as cultural expectations, urban versus rural settings, socio-economics, school design, mathematics curriculum, etc. could prevent the findings of this thesis from being directly transferable to other locations. They are, however, descriptive enough that a reader from another region can gain insights from my study, which they can apply to their own particular support of the framework in their context. It is my hope that this thesis contributes to the scholarly research in the fields of mathematics education and educational administration, and is helpful for any school leader who is supporting the implementation of Thinking Classrooms.

Chapter Five: Findings and Discussion

Introduction

The purpose of this qualitative research study was to determine optimal leadership practices for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools; optimal practices are those that are most likely to create the conditions for successful implementation of the Thinking Classrooms framework. Given that teachers and school leaders have different perspectives and job-related responsibilities, the study was guided by two subquestions:

1. What do school leaders think are effective practices and supports (financial, material, time, professional development, etc.) that they provide to teachers who are implementing the Thinking Classrooms framework?
2. What do teachers who have implemented the Thinking Classrooms framework perceive as the most valuable practices and supports that they have received from their school leaders?

Having two subquestions ensured that the viewpoints, experiences and voices of both teachers and school leaders were included in the findings.

Six teachers who are currently implementing the Thinking Classrooms framework and six school leaders were interviewed. While completing the data analysis process described previously in Chapter Four, four themes that are closely related to the research question clearly emerged:

1. High quality professional development.
2. Teacher learning at school.

3. School leaders are learners.
4. School leaders set direction.

The four themes are closely related to the three areas of study previously identified in the literature review (school leaders' involvement in teacher professional development, agency, and collective teacher efficacy), many of the core leadership practices identified by Leithwood (2011) and the Thinking Classrooms framework itself. What follows is a description of the four themes, an examination of the topics associated with each theme and a discussion of each.

High Quality Professional Development

Theme one, high quality professional development, provides the first answer to the main research question. That is, the first optimal practice for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools is:

1. Ensure teachers are aware of, and have the opportunity to attend, high quality professional development about the framework.

This theme also illuminates important aspects of the Thinking Classrooms professional development sessions for teachers and school leaders. It encompasses how school leaders and teachers become aware of upcoming professional development, what takes place during the professional development sessions themselves and the resulting reflection and/or changes to practice. In total, five closely connected topics form this theme:

1. Awareness of professional development opportunities.
2. Professional development models research-based instructional practices.
3. Professional development provides mastery experiences.

4. Professional development provides ongoing and collaborative learning opportunities.
5. Reflection upon and/or changes to practice.

It is important to note that while the topics are shown above in a list, and discussed below in order, this is not meant to imply a linear process. As an example, some teachers start their journey with the Thinking Classrooms framework after reflecting upon their practice. It is their reflection that causes them to seek out professional development opportunities while they continue to reflect upon and change their practice. One does not need to start at topic one and progress through topic five. Likewise, the participants in this study did not describe each topic in a specific order. Instead, they experienced and spoke about the topics in a non-linear, interconnected, recurring and often simultaneous manner.

It is also worth noting that all of the participants praised the Thinking Classrooms professional development sessions and spoke fondly of them. But what made the sessions of high quality and worth pursuing? According to both the teachers and the school leaders, this came down to three things: modeling, mastery experience and ongoing collaborative learning opportunities.

Awareness of Professional Development Opportunities

In order for school leaders and teachers to participate in high quality professional development opportunities, they need to, at one point or another, become aware of the professional development opportunities that exist. While this may seem to be trivial, it was significant enough that almost every participant could recall how they first heard about the Thinking Classrooms professional development sessions. For many, this initial awareness came through the sharing of a memo or email; some heard about upcoming Thinking Classrooms

sessions at another mathematics professional development they were attending; others learned about them as part of a pilot project their school was participating in with other schools in the William Norrie School Division. Although how the study participants became aware of the Thinking Classrooms professional learning sessions may seem unimportant on the surface, further analysis revealed important ideas for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools. These ideas are best explained by examining the experiences and perspectives of both the school leaders and teachers.

The school leaders revealed many behind-the-scenes things that occurred before a professional development opportunity was shared with teachers. These included: learning about the professional development opportunity, considering whether or not it would be beneficial for teachers, deciding which teachers should attend, allocating funding for substitutes and even negotiating with the school division for extra spots at the session. Evidence of this behind-the-scenes work was found throughout the school leaders' responses. For example, Ian (school leader) spoke about the need to actively seek out professional learning opportunities for teachers. He remarked:

> Well, for me, it's opportunities, right? I'm not a math person. But if I want them to be good at that thing, or to have that skill, or to develop their skill set in a certain area, then I'm seeking resources that can help them achieve that goal. Right?

Hannah (school leader) explained how she sought permission from the school division for every teacher in her school's mathematics department to attend the Thinking Classrooms professional development sessions. She recalled, "… I begged to have all ten math teachers

attend together as a group." And while she ultimately received approval, it came at a significant cost. She noted, "… I took ten teachers when only one was allowed. So, we had to pay for the nine subs, for three days, for them to go." The school leaders also spoke about their own need to learn about and believe in the Thinking Classrooms framework prior to involving teachers. Gina and Jen, for example, both learned about the Thinking Classrooms framework prior to becoming school leaders. As Gina explained, "A lot of it was seeing it in action after attending the PD session. So, when I came over, I ensured everybody was taking the PD sessions that were available." Like the other school leaders, Gina's own learning and experiences directly influenced her decision to involve teachers in the professional development sessions.

The teachers, however, rarely spoke in detail about any of the work done by their school leader(s) to make the professional development opportunities possible. As explained by one teacher, Alex, "… in terms of admin, her role has essentially just been setting up the PD opportunities. Like, again, I don't know exactly how it works, what schools get invited and stuff like that." This sentiment was shared by the rest of the teachers, all of whom seemed generally unaware of the behind-the-scenes work that the school leaders described. From the teachers' perspective, creating awareness of the professional development opportunities was merely a simple act of sharing of information.

Like most teachers, Faye learned about the series through a memo sent from her school leader. She noted, "It would have been a PD that we signed up for. Our admin. shared a memo or something with us." Another teacher, Erin, had a similar experience. She remarked, "Because I was sort of the math person at the school, the principal would have just sent me… It

would have been in a memo or something." Other teachers, like Alex, first learned about Thinking Classrooms indirectly through another initiative arranged by their school leader. He explained, "… the first time I heard of Thinking Classrooms was when our school got involved in, um… I don't know if you'd call it a pilot project, but essentially PD where we went to another school." And although Cam (teacher) learned about the sessions from the divisional mathematics consultant, his school leader still played an indirect role. He said, "It was all done, I guess indirectly. Like the email was forwarded to me. That's about as far as it [the school leader's involvement] went." As illustrated above, it is important to note that every teacher in this study became aware of the Thinking Classrooms professional development sessions as a direct or indirect result of the actions of their school leader(s). This aligns with the work of Leithwood (2011) and Kim and Lee (2020), who both found that school leaders play an important role in providing and sharing opportunities for teacher professional learning.

Beth, like the other teachers, found out about the Thinking Classrooms professional development sessions from her school leader. But she also made an interesting observation about a school leader's ability to decide whether upcoming professional development opportunities were voluntary or involuntary. Beth explained:

> Well, in my experience, like being in the classroom for 13 years, it's different from leader to leader. Some said, "oh, the division's making us do this, so you have to go." Some said, "here's a great opportunity, because you know... reason X, Y, and Z." Some said, "I don't know why you have to go, but you're going because the division sent out a memo." That's kind of my experiences with that.

Beth's observation illustrates the influence that school leaders have on teacher professional development and the varying levels of agency that teachers have in choosing whether or not to participate. For Beth, however, participation in the Thinking Classrooms professional development sessions was completely voluntary. She said, "… it was totally voluntary, teachers wanting to come to it. So, that appealed to me as well. That it wasn't being mandated, you had to truly have an interest in it. So, I definitely wanted to [attend]." But Beth also offered a warning against blindly mandating professional development for teachers, stating:

> … when something is mandatory, if I don't understand what I'm gonna get out of it, or if I don't understand the purpose of it, or if I don't understand how it's going to affect my kids positively, I don't respond well to mandated initiatives.

Having the ability to exert her own agency and choose whether or not to attend the professional development sessions was clearly important to Beth. It was ultimately part of what drew her and others towards the Thinking Classrooms sessions. This is an important point for school leaders to remember.

While the teachers were generally unaware of the behind-the-scenes work done by their school leaders prior to sharing information about the Thinking Classrooms professional development opportunity, both groups spoke about the process through which they became aware of the opportunities that existed. The teachers' responses, however, revealed an important nuance for school leaders to be aware of when sharing professional development opportunities about the framework. Specifically, school leaders need to consider individual teacher agency; a session that is offered on a voluntary basis is received differently than one that is mandated. Further, if a school leader chooses to make a professional development

session compulsory, it is important for them to understand the benefits of attending the session and be able to communicate a legitimate reason for mandatory attendance. This needs to be more than "because I said so" or "because the division is making us."

Professional Development Models Research-Based Instructional Practices

Liljedahl's use of modeling was a central focus of both the school leaders' and teachers' description of the structure of the professional learning sessions. The participants spoke about an active learning environment where Liljedahl modeled each of the Thinking Classrooms framework's optimal practices for them to learn about through experience. One school leader, Kate, described the structure and environment, remarking, "Well, Peter really showed you how to implement Thinking Classrooms in your own classroom through his facilitation. So, you learned through his modeling." This importance of learning through experience was echoed by all of the school leaders and teachers. Like others, Alex (teacher) recalled:

> I remember them being structured in a way that really modeled the Thinking Classroom way. You know, we were up at, at a whiteboard... We were in triads, we were put into random groups to get there. We were presented problem solving questions. So it was, it was not a lecture, it was much more of a showing of like, this is how we can do it. This is how it works. This is the way essentially.

In addition to modelling, the school leaders appreciated the research behind each of the optimal practices. As Luke (school leader) explained:

> I think things have to be grounded in research, or else they're only guesses. If we don't have a strong research base, then the work can't be as intentional from the teacher. Research helps us with those in the moment decisions, those instructional decisions that

> you're making, not only for a class over a period of time, but also in the moment. So, if you have a good foundation of research, it'll push you and allow you to make informed decisions.

This was also important to the teachers. As Cam (teacher) stated, "So, it's all these little tiny things that he [Liljedahl] looks at, the response, and the best way to actually do things in practice. It's practical research." From the participants' perspective, it was the combination of modeling and research that made the professional development sessions both engaging and thought-provoking opportunities for learning.

Additionally, both the school leaders and teachers spoke at length about the skill and charisma of Liljedahl, the facilitator at the sessions. The school leaders, however, wondered if it would be possible for anyone other than Liljedahl to get the same level of buy in at a professional development session on the Thinking Classrooms framework. Hannah (school leader) commented:

> Well, I think Peter was definitely key. I'm not sure that I would have seen the same momentum if it was somebody else. Because he's done the work himself and so he has all the answers to the questions. Like right away. When you give him a problem, like I don't have money to buy a whiteboard, he has 500 quick solutions to help you out. But he also created some momentum. It's kind of like in the inclusion world, we can only get so far. If you have someone like Shelley Moore come in, you get this great momentum. But if you had just me presenting, it's like, yeah, whatever. So, Peter himself, I think was important.

This was echoed by another school leader, Ian, who also wondered if Liljedahl's personality was essential for success:

> In terms of implementing it, yeah, Peter Liljedahl does an excellent job of selling his product… I think I have many of the same kind of characteristics as he does and I don't know how it would work with everyone. I don't know if those things are required or if they're just a bonus? That's just a question.

Luke (school leader) was most direct, stating bluntly, "The facilitator mattered. There was immediate buy in from people that attended the sessions with Peter [Liljedahl]." The teachers, too, recognized the facilitation skills of Liljedahl. Diane (teacher) remarked, "I have to say that Peter [Liljedahl] is very special. He's super charismatic." Another teacher, Faye, recalled "His process was fantastic." But unlike the school leaders, they did not seem to worry about what would happen if Liljedahl himself was not facilitating the session. And while the William Norrie School Division was fortunate to have Liljedahl facilitate the professional development sessions, the school leaders have highlighted a potential problem for widespread adoption of the Thinking Classrooms framework. Liljedahl is one person and can only facilitate a finite number of sessions. If he is an essential element of the professional development session's success, it may be difficult to replicate his knowledge, personality and facilitation style on a larger scale. At the very least, it will require finding facilitators who have a similar approach, level of skill and charisma.

Additionally, all of the teachers commented on how the professional development sessions were unlike any other professional development opportunity. This is an interesting

observation because teachers participate in countless professional development sessions and so it is significant when one stands out from the rest. One teacher, Beth, explained:

> … it's different from so many other professional development days where you sit, and you're being talked at. So many professional development days are, I don't know if ironic is the right word, but they're contradictory to what good teaching is. So, it's kind of funny that we're a group of teachers and someone's teaching us in a way that we would never teach like. Like sitting in a room for two and a half hours without movement breaks, or without any discussion with your tablemates, or without any think time, or without actually moving around and collaborating and thinking critically. Many professional development days are just like that. So, Peter [Liljedahl]'s sessions are the exact opposite of that.

Erin (teacher) had a similar memory, stating, "You know, at other PDs you'll get up and move sometimes to switch groups or whatnot. But for the most part, you're sitting. So, this was very different in that way." From the participants' perspectives, what made the sessions different, and ultimately effective, was the facilitator's skill, charisma and ongoing use of modeling throughout each of the sessions. These three factors are important for school leaders to keep in mind because effective professional development is connected to better learning and increased achievement for students (Kennedy, 2016).

Professional Development Provides Mastery Experiences

While the structure and environment of the professional development sessions were important to the participants, so too was the success that they experienced while they were there and the knowledge and skills that they acquired. This supports the work of Hoy and

Miskel (2013) and aligns with Leithwood's (2011) belief in mastery experience as an essential component of developing people. Like others, Luke (school leader) recalled, "When you're standing at the board, you're trying to solve a problem. That's the fun part. But you're also learning how to apply this in your own classroom." Another school leader, Kate, remembered learning about one of the optimal practices – flow. She stated, "What interested me the most was really the concept of flow." This sentiment was shared by the teachers, who also experienced success while learning about the Thinking Classrooms framework. Like others, Erin remarked, "Obviously, I learned a lot about it after going." Another teacher, Cam, agreed. He commented, "I feel like I actually know what I'm supposed to do when I leave. Like, it gives me a tool I leave with rather than just a lesson plan, right?" And while all of the participants shared stories that described how they successfully learned about the Thinking Classrooms framework at the professional development sessions, they also revealed three things that were important to their success: the ability to be vulnerable, perseverance and flow. For the school leaders, the sessions also offered an opportunity to learn more about leading adult learning by observing Liljedahl in action.

Vulnerability. In order to successfully learn about the Thinking Classrooms framework, the school leaders and teachers had to be vulnerable. But the participants often found comfort in the problem-solving process and the type of problems that were used by the facilitator to ensure that everyone could enter in and contribute. Hannah, a school leader, described the problems, "They were just that low floor, high ceiling. So, you could jump right in, anyone could jump in." And although he is not a math specialist, Ian (school leader) found comfort in being able to contribute to the problem-solving process in other ways. He shared, "I've always

found that I could, even if it was a math thing where I was uncomfortable with the subject matter, bring something else to the group to help the group find success." Being able to contribute, regardless of prior knowledge, created a sense of security for the participants. This was mentioned by Beth (teacher), "… obviously there's people who have different mindsets about math, but nobody ever felt bad about where they were at in the learning." And while the school leaders also described a need to be vulnerable, it was the teachers who best articulated why it was essential for learning about the Thinking Classrooms framework. Erin, a teacher, explained:

> I think being vulnerable is important. If we really wanted to learn this and really wanted to try and understand it through the experiences that he provided, like solving multiple problems and living it, in order to participate fully, you really had to be vulnerable. You had to say what you thought during the math problems. Maybe you were right, and maybe you were wrong, but you had to speak your mind.

Another teacher, Faye, agreed and emphasized the need to feel comfortable taking risks. She recalled, "But I think as a group, we felt comfortable taking a risk there. That taught you what it felt like to take risks… it was a really good way to make you feel what the students would feel." Overall, every participant experienced success while learning about the framework, due in part to their ability to be vulnerable while experiencing it. This aligns with the findings of Finnigan (2012), who notes a need for trusting and supportive environments.

Perseverance. In addition to being vulnerable, many participants mentioned a need to persevere in order to successfully learn about the Thinking Classrooms framework. Gina, a school leader, described an experience that was similar to many of the participants:

> … there were many times when people were struggling with whatever problem or question that we'd been given. And as adults, we're no different than kids sometimes, we just want to be given the answer. Or we want someone to check if our answer is right. But he gave time for us to go through that struggle.

It is important to note that the participants were not alone in their struggle. One teacher, Faye, described how Liljedahl encouraged them to carry on and utilize the knowledge of others in the room:

> … he would encourage us to be resilient. That's part of that frustration. Teaching us, you know, that you just have to keep trying and try different ways. Look around the room and see what other people are trying. Use all of those tools that are part of the process and don't give up.

Every participant had the support of others in the room and Liljedahl, the session facilitator. This allowed them to build their efficacy through vicarious experiences, as described by Hoy and Miskel (2013). Additionally, the productive struggle experienced by the participants was often powerful in changing their attitudes and beliefs towards problem solving. Gina, a school leader, observed, "Even throughout one day… you could definitely tell people's reaction to the struggle changed. Because I think that it takes time to change that mindset." As illustrated through the participants' experiences, it is clear that perseverance and engaging in productive struggle (with the right support) were important elements for success while learning about the Thinking Classrooms framework.

Flow. In a couple of ways, flow was reported by the school leaders and teachers as another important part of successfully learning about the framework. On one hand, it was

important for the participants to learn about the idea of flow and how to achieve it in their classrooms. Kate, a school leader, recalled, “Well, Peter shared this graph about flow... we learned more about what flow actually is and how to get in flow.” But perhaps even more important than learning about flow, every participant talked about how they experienced it first-hand. Luke (school leader) recalled, “… we were all doing a problem. Then I looked up and realized 45 minutes had gone by. And that whole time, it wasn't a social conversation. We were really on task and talking about the problem.” Gina, like the other school leaders, also lost track of time. She said, “The time flew by. All of a sudden, it's the end of the day and you're thinking, where did the day go?” It was not just the school leaders who experienced the power of flow; the teachers shared the same sentiments. Like other teachers, Beth said, “I felt like time went by really fast.” This was echoed by another teacher, Cam, who explained, “You kind of lose track of time while you're doing a task. That would happen often.” Erin (teacher) became so immersed in the learning experience that everything else faded away. She remarked, “There could have been a train going through the room and I wouldn't have noticed.” Being in flow allowed each of the participants to become fully engaged in problem solving and learning about the Thinking Classrooms framework. Combined with their ability to be vulnerable and persevere, flow also helped the participants overcome difficulties and complete challenging tasks. It is important for school leaders to consider these three elements when planning or choosing professional development for teachers on the framework. This will provide them with opportunities for mastery and vicarious experience that has a significant impact on the learning that they take back to their classrooms.

Leading Adult Learning. While the teachers and school leaders described many of the same mastery and vicarious experiences while learning about the Thinking Classrooms framework, it is interesting to note that many of the school leaders also focussed on Liljedahl himself. They believed that beyond learning about the framework, the professional development sessions were also an opportunity for them to learn more about facilitating adult learning. This would improve their skills as leaders and allow them to more effectively lead learning with the teachers in their schools. Ian, a school leader, recalled:

> I'm often very much paying attention to him [Liljedahl] because I think that leading adult learning, as a school administrator, is a key component of our job. That's often kind of under looked a little bit. So, I'm often hyper-focused on what he is doing.

Jen, another school leader shared a similar focus. She remarked, “Half of the time I watch what Peter [Liljedahl]'s doing during a session to see how I can then take that to work with my teachers.” This demonstrates the school leaders’ recognition of their own responsibility to lead adult learning. They took advantage of the opportunity to learn from Liljedahl with the goal of using some of his techniques in the future with their own staff.

Professional Development Provides Ongoing and Collaborative Learning Opportunities

In addition to the structure of the Thinking Classrooms professional development sessions and the mastery and vicarious experiences provided by them, the participants spoke at great length about their ongoing and collaborative nature. While this can be seen throughout all of the participants responses, one school leader, Gina, summarized it well, stating, “[There were] Lots of opportunities for schools to talk as a team, schools to talk with other school

teams, leaders to talk with other leaders." Jen, another school leader, pointed out the value of school leaders being able to collaborate with other school leaders:

> But to be able to build community with colleagues was great. Building community with principal colleagues is different than building community with my teachers. Because ultimately, at the end of the day, I still supervise them. So, it's a bit of a shift, but being able to have a community with fellow principals and vice principals is great. I'm able to hear what their experiences are… it's so important to have that networking.

From the school leaders' perspectives, being able to collaborate with others was clearly an important part of the learning process.

These sentiments were shared by the teachers. Like other teachers, Faye pointed out the value in having teachers learning with and from each other. She remarked, "That's the best PD you can have. Learning and sharing resources between teachers… That's the way it should be." Another teacher, Erin, also recalled the collaborative nature of the sessions, stating:

> It was different because you were working in a team. You weren't working alone. You were working in a group of three… you weren't reliant on just your own knowledge. You could talk through the problem with your colleagues. The whole purpose was to model collaboration.

Like the school leaders, the teachers believed that collaboration was an important part of the learning experience that made the Thinking Classrooms professional development sessions unique. The participants were in clear agreement on this point.

While collaboration was an important part of the professional development, the participants recalled not always being able to collaborate with colleagues that they were

attending the sessions with from the same school. One school leader, Luke, explained, "I wasn't always with my teachers because of the random groupings. So, it was hard to have learning conversations with my teachers right then and there." This meant that the school leaders had to seek out time to collaborate with their school teams. Some did this by taking advantage of short breaks or pauses in the sessions. Gina, a school leader, recalled:

> There was lots of opportunity to find that in the sessions… you'd have a little bit of downtime in between him speaking and each problem… So, you can do a quick roundtable with each other. We did a lot of that both in our school groups and in our random groups…

This time was often used to share thoughts, ideas and wonderings, consider how the Thinking Classrooms framework could be implemented in their own school context, share resources, and brainstorm solutions to challenges that the participants were encountering back at school.

Like the school leaders, the teachers were not always able to collaborate with others from their schools because of the random groupings at the professional development sessions. Alex, recalled, "Peter had it so you're working with people from different schools all the time." Another teacher, Diane, agreed. She remarked, "While we were there, we'd be happy if we were in the same group together. But we might not have ever actually worked in a group together because everything's random." And while Erin (teacher) encountered the same situation, she still found time to collaborate with her colleagues. In fact, having time to collaborate with colleagues from the same school was so important, the participants sometimes gave up the opportunity to go out for lunch to do so. Erin explained:

> Often when people go to a PD, it's an opportunity to go out for lunch with colleagues. You don't have that opportunity during a regular school day. You sort of just bring your lunch and do the same thing each day. So, yeah, absolutely it's significant. We'd stay at the PD over lunch to meet. That's not something that I've ever done before at a PD.

Unquestionably, the teachers also valued having opportunities during the professional development sessions to collaborate with colleagues from their school.

In addition to wanting time to collaborate with colleagues from the same school during the sessions, the participants also spoke at length of the value of ongoing collaboration and professional development; this sentiment was shared by both the teachers and school leaders. Ian, a school leader, explained:

> Well, I really think that it's important to have consistency. I think it's important to have consistency and I think it's important to have, longevity is the wrong word, but it can't be one and done. When I think of some of the other initiatives that have rolled through here, even if it's a year, it's a year and then it's gone. Whereas for Thinking Classrooms, we're on year six. I think that's been a really positive thing.

This was echoed by Alex (teacher) who appreciated the ongoing nature of the professional development sessions. He remarked, “It was never a one and done sort of thing. It's something that we've revisited, Peter [Liljedahl] has been back every year kind of thing. That jumps out at me, just the continuity of it and the long-term focus.” Both the school leaders and the teachers believed that it was important for the Thinking Classrooms professional development sessions to occur regularly over an extended period of time. Some of the reasons given for this was that ongoing professional development allowed ample time for collaboration, reflection upon and

changes to practice. All of which are important for school leaders to consider when planning for professional learning.

Reflection Upon and/or Changes to Practice

Lastly, the participants spoke at length about the need for high quality professional development to offer opportunities for reflection that ultimately result in changes to practice. For both the school leaders and teachers, the Thinking Classrooms sessions led them to reflect upon their practice and inspired them to learn about and try something new. Ian, like other school leaders, believed that reflection was a vital component of being a professional. He stated, "… being reflective, as a professional, is absolutely essential if we want to be good instructors or leaders or whatever." The Thinking Classrooms professional development sessions provided the intellectual stimulation necessary for reflection, as evidenced by Gina (school leader) who believed that they forced her to reflect upon her practice. She wondered, "Whenever I left there, I thought, okay, all right, how could I try that? Or how could I support people in trying that?" These thoughts were not limited to the school leaders; the teachers had many of the same thoughts. Like Alex (teacher) who recalled, "You know, it got me wondering if it would work for me as well" or Diane (teacher) who started thinking about how the framework could be implemented in her own class. She remarked, "I was imagining what it would look like in my own classroom. Like I said, I was very convinced that this was how I would do things moving forward."

It was after this initial reflection brought on by the professional development sessions that the school leaders and teachers started to make change. One teacher, Cam described the change process as a cycle, noting, "My role is just to go there, try to learn the strategies, go

back and work with the students to see what I can learn, and then come back with questions. Then just keep doing that until I get better." A similar process was largely described by all of the participants, indicating that each of them had a sufficient sense of agency to make changes to their practice. Every participant reported starting to implement the Thinking Classrooms framework by trying one or more of the first three optimal practices from Liljedahl (2020a); they began using good problems, visibly put their students into random groups and/or had their students work on vertical non-permanent surfaces. This is unsurprising as Liljedahl (2020a) recommends these as a starting point for implementation.

It is important to note that implementing the Thinking Classrooms framework was not a small change. Both the school leaders and teachers commented on how different the Thinking Classrooms approach was from traditional approaches to teaching mathematics. Notably, Jen (school leader) drew parallels to Canadian residential schools while reflecting upon the difference between the framework and the traditional way of teaching mathematics. She stated:

> For me, personally, every time I see desks in rows, I right away picture residential schools. I just can't unsee that kind of archaic teaching method where children should be seen and not heard. Where they need to sit there and work by themselves. They thought there was no benefit in learning from each other, what could they possibly learn from each other? They just needed to listen to the authority in the room. So, for me, it's kind of a trigger.

The framework's novel approach was also noted by the teachers. Diane, a teacher, remarked, "I think it was just a completely different approach to, you know, how we were

teaching math concepts to students." Another teacher, Faye, compared it to her own experience as a math learner in school. She recalled:

> I mean, if I think back to my whole time in math, it was my teacher at an overhead projector. That was what we did. We took down the teacher's notes and then worked through the questions. That's what you did. No one worked together. Everyone was in rows. So, I mean, it's a lot of mindsets to change.

But for the participants, the changes and work that needed to go into implementing the Thinking Classrooms framework was worth it because of the positive impact it was having. The school leaders and teachers spoke in unison about the need for change.

Additionally, both the school leaders and teachers were motivated to move away from traditional approaches to teaching mathematics by the benefits the framework offered for students. Like the other school leaders, Gina noticed the positive impact the Thinking Classrooms framework was having on the students and their learning environment. She drew comparisons between classrooms, remarking:

> The difference when you walk past a classroom that is using the Thinking Classroom, versus one that's not, when it comes to community, is that you can see they truly are a community of learners that work together and support each other and learn together.

Luke (school leader) also pointed out how quickly the framework made a difference:

> It's really interesting how teachers see the impact immediately. They see the engagement level rise right away. I think that historically, engagement is one of the pieces of learning that we've neglected. But what keeps you going, what keeps me going, what keeps others who love learning going is the engagement.

The teachers, too, noticed the difference that the framework was making in their classrooms. As Beth (teacher) explained:

> … I pulled random students to get student voice for how it made them feel. That was enough to convince anybody. That data, the kids' feedback, was just unbelievable. How it increased their confidence, their engagement, their understanding of math, all of those things.

Cam echoed the same thoughts, recalling, "But here's the thing, you start noticing how the kids are responding to what you're doing. So, I'm like, holy crap, this is great." The impact on the students and their success provided some of the impetus for the participants to continue reflecting upon and changing their practice; it reinforced that they were on the right track and provided motivation for further implementation of the framework.

Summary

The first theme, high quality professional development, illuminated what the school leaders and teachers thought were important aspects of the Thinking Classrooms professional development sessions. Both groups were widely in agreement in their answers to this study's two subquestions. That is, the teachers and school leaders shared the same views on what effective practices and supports were needed in the area of professional development. First, both groups needed an awareness of, and opportunity to attend, the professional development sessions on the Thinking Classrooms framework. Second, the professional development sessions needed to have certain elements that made them of high quality. Both the teachers and school leaders agreed that high quality professional development: models research-based instructional practices; provides the participants with multiple opportunities for mastery

experience; allows the participants to collaborate with colleagues from their schools and others; is ongoing and sustained over a prolonged period of time; and encourages the participants to reflect upon their own practice and make changes.

All of the leadership practices described by the school leaders and teachers in this theme align with one or more of the sixteen core leadership practices suggested by Leithwood (2011). As this theme is centred around professional development, it is unsurprising that many connections can be made to the core practices in Leithwood's (2011) category of developing people, including: negotiating for extra spots at the professional development sessions and paying for additional substitutes; finding an effective and skilled facilitator to model research-based practices; ensuring a safe professional learning environment for teachers to be vulnerable while gaining mastery and vicarious experiences; providing opportunities for reflection; and, leveraging the success of students to provide motivation. But other parallels can be drawn too, such as: increasing one's own facilitation skills and awareness of the framework in order to set directions and for *communicating the direction*; ensuring that teachers have opportunities to collaborate with others inside and outside of the school to bolster the core practices of *building collaborative cultures* and *connecting the school to the wider community*; and, learning about the framework and trying new practices as part of *offering intellectual stimulation*. Taken together, all of these connections demonstrate the alignment of Leithwood's (2011) general framework of leadership practices with the specific findings in the first theme of this thesis; it has provided a solid foundation of the leadership practices that are essential to providing high quality professional development on the Thinking Classrooms framework. What this thesis paper has added, however, is relative context, specific

considerations and additional factors that are necessary for applying Leithwood's (2011) general framework of leadership practices to support the Thinking Classrooms framework.

And while this theme examined many aspects of the professional development sessions which primarily occurred outside of the schools and were led by Liljedahl, it is still important for school leaders to understand their significant components as Liljedahl cannot facilitate every session worldwide. Even though the William Norrie School Division was fortunate to have him as the facilitator of their Thinking Classrooms professional development up until now, there will come a point when the sessions need to be led by someone else. It is up to the school leaders to ensure that regardless of who facilitates the sessions, they still maintain the key characteristics of high-quality professional development as defined above. It is also up to the school leaders to ensure that the teachers receive the proper support before and after the professional development sessions. The remaining themes examine the optimal practices and support provided by school leaders at school.

Teacher Learning at School

The second theme, teacher learning at school, examines how school leaders support adult learning at school and provides three answers to the main research question. Based on the findings, the second, third and fourth optimal practices for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools are:

2. Establish a safe and collaborative school environment where teachers are able to take risks in their practice.
3. Give and seek out timely feedback on the framework's implementation.

4. Provide physical resources (especially whiteboards), time and structures for collaboration, and the assistance of professional support staff.

This theme also examines the environment of the school, the role of feedback, the allocation of time and resources, the opportunities for colleagues to collaborate, and additional professional support provided to teachers. In total, six closely connected topics are included:

1. Feeling safe to take risks.
2. Giving and receiving feedback.
3. Having the right resources.
4. Release time to learn more about the framework.
5. Structures and opportunities for collaboration.
6. The role of professional support.

And like the previous theme, it is important to note that while the topics are displayed above in a list, and discussed below in order, this is not meant to imply a specific order. The participants discussed the above topics in an interconnected, recurring and often simultaneous manner.

Feeling Safe to Take Risks

Safety and risk-taking was important to the school leaders. As a whole, the school leaders chronicled numerous approaches that they took to encourage risk-taking and to ensure that the teachers felt safe when making changes to their practice. These included: encouraging teachers to make mistakes and model risk-taking in front of the students; going into classrooms and implementing the Thinking Classrooms framework alongside the teachers; having conversations with parents/guardians to explain and defend the new approach; offering coaching and moral support to teachers; being approachable and having an open office door;

encouraging teachers to ask questions and share their challenges; instigating conversations about practice and encouraging reflection; giving teachers permission to try new things and slow down; being visible throughout the school; authentically listening to concerns; believing in the teachers and celebrating their success; presenting themselves as learners and taking risks; and not evaluating a teacher when they are trying something new. Given the wide range of leadership practices related to safety that were described by the school leaders, it is clear that safety requires a wholistic approach. It is not one specific practice that leads to a sense of safety, but rather many interconnected practices that work together. As Kate, a school leader, explained:

> But ultimately, it's creating a safe space for them to be learners and take risks. You know, being free to talk about their struggles and work together to progress through them. I don't have all the answers... But certainly, I'm giving them the time, the space and the ability to collaborate and to get messy with it. They need to feel, you know, that they're not being judged or evaluated when they're taking those risks and being a learner.

Overall, the school leaders believed that it was a combination of the above strategies that created a safe environment for the teachers to take risks and implement the Thinking Classrooms framework.

Safety was also very important to the teachers. While the professional learning sessions left the teachers inspired and knowledgeable of what a Thinking Classroom should look and feel like, implementing the framework back at school required them to continue learning while trying new approaches and making changes to their practice. From the teachers' perspectives,

starting to build a Thinking Classroom involved a sizeable amount of risk-taking on their part. As Beth (teacher) put it, “It's a matter of taking those risks and trying to implement those practices.” This was echoed by another teacher, Cam, who said, “At first, I was just, like, let's try it and see what happens.” Risk-taking continued to be an important part of their journeys with Thinking Classrooms from the beginning until now; most teachers indicated that they are still regularly taking risks and trying new things. This was true even for teachers who have been using the framework for many years. Diane, who was part of the very first Thinking Classrooms cohort, remarked, “This year I'm still trying a lot of new things. It still blows my mind, especially when it goes awesome. Even when it doesn't go well, it's still not a disaster.” Overall, the teachers reported a need to take risks and try new things in nearly all aspects of their practice, including: instructional methods, classroom environment, classroom management, and assessment. They were able to take these risks because of the practices that their school leaders had used to create a safe environment for risk-taking.

Compared to the school leaders, the teachers generally spoke in more detail about the need for the students in their classes to take risks as well. This makes sense because it was the teachers who would see firsthand the students’ reactions to the framework’s new way of learning and assessment on a daily basis. For some students in high school, this meant a significant change after learning math for generally the same way over the past decade of their lives. But the teachers believed that it was important for their students to take risks and see value in risk-taking. Faye, a teacher, explained:

> So, the risks are really important to move the learning forward. It lets those who are already good become masters and those who are weaker move up to where they need

> to be. Risk-taking is really important in my classroom. Everyone tastes risks and makes mistakes, including me.

The teachers believed that in order for their students to take risks, they also needed to feel safe. Alex (teacher) pointed out, “As a teacher, you know, you want your students to feel safe to make mistakes and learn.” And like the others, Faye believed that trust was an important aspect of feeling safe, stating, “You have to be vulnerable and learn with them. It's important. If you don't have a good relationship with them, they won't trust you to do problems on the whiteboards and they won't trust you to take risks.” In addition to trust, safety also came from the classroom environment established by the teachers. But the need to feel safe did not just apply to the students, it was equally important to the teachers themselves.

The teachers described a need to feel safe when trying new things, taking risks and making changes to their practice. Similar to the students, this sense of safety came from the school environment and trusting their teacher colleagues and school leader(s). One teacher, Alex, described the parallels between student and teacher risk-taking very succinctly, stating:

> I think that's huge. I think, in terms of the culture at a school, feeling like it's okay not to know something. And that's not a reflection of, you know, being a bad teacher or something like that. As a teacher, you know, you want your students to feel safe to make mistakes and learn. And I feel that my principal has made that very obvious to us as teachers, that it's also okay for us teachers to try new things and learn from mistakes. And yeah, it's okay to stumble because that's how you learn. So yeah, just having a really safe environment to try new things has been, I think a big part of my willingness to take the risk of this whole journey.

Like the other teachers, Diane felt safety in the mutual trust that she had developed with a teacher colleague. She shared:

> We trust each other and trust in the process. So much so that I could say to her, I just did this and it was awesome. You should try it. And she would just do it. She wouldn't need to prepare. She would just trust me and do it. And vice versa.

Faye (teacher) echoed the importance of trust and safety amongst teachers, stating, "If a teacher comes into my room, they can ask any question. They wouldn't feel like it was a silly question or worry that they might look stupid asking it." Another teacher, Beth, valued the sense of safety that came from establishing trust with colleagues. But she also described how safety could come from seeing the school leader take risks with a group of students. Beth recalled:

> … it also helps to see somebody else try and fail, or not be perfect. So, that helps teachers take a bigger risk as well and stick with it. I'd say that's been one of the main things, to have someone just come in and try it. And see that it's not perfect.

Feeling safe to take risks was clearly important to the teachers. And while they appreciated having a school environment that was conducive to risk taking, the teachers generally did not describe, with much detail, the efforts of their school leaders to create one.

From the teachers' perspectives, creating a safe environment seemed to happen mostly behind the scenes. This is an interesting nuance in the perspectives of the school leaders and teachers. While both the school leaders and teachers believed that it was necessary to have a feeling of safety in order to take risks, the school leaders seemed to have a far greater understanding of the purposeful actions that went into making it happen. That is not to say

that the teachers did not appreciate the feeling of safety that resulted from their school leaders' actions; safety was of equally great importance to the teachers. It seemed, however, that the teachers valued and had a greater awareness of the outcome (a feeling of safety) of their leaders' practices than the practices themselves. In other words, just because the teachers did not seem to always appreciate their school leaders' actions to create a safe environment did not mean that they did not value feeling safe. As it can be frustrating for a school leader to feel like their efforts are going unnoticed, this is helpful for them to understand so that they do not feel defeated when supporting the framework.

Giving and Receiving Feedback

In addition to safety and risk-taking, both the school leaders and teachers recalled a need for feedback when implementing the Thinking Classrooms framework. It is important to note that feedback is a form of verbal persuasion and a source of collective teacher efficacy (Hoy & Miskel, 2013). Overall, every school leader believed that feedback was important to the successful implementation of the Thinking Classrooms framework. Most utilized classroom visits, walkthroughs and conversations as a means of providing it. Hannah (school leader), for example, made focused walkthroughs a priority. She explained:

> I was able to give instant feedback or talk to them about it. Whereas, often walkthroughs... don't tend to be focused. I guess they can be. They knew that it was important to me. I was going to ignore everything else and only look and talk about Thinking Classrooms. It helped them to understand that it was a priority.

Jen, a school leader, conducted walkthroughs too, but she also used them as an opportunity to spark a learning conversation with the teacher later. She recalled:

> I pop in and walk through the classrooms to see what the students are learning. I started to keep a little notebook. You know, today I visited the Grade 7 class, this is what they were learning. This is what I observed. Then I might have a question to follow up with the teacher.

Hannah and Jen's practice of conducting focused classroom walkthroughs further exemplifies the findings of Wahlstrom et al. (2010), who note:

> … a clear difference in principal behavior between those who "popped in" or were "visible", as compared with principals who were very intentional about each classroom visit and conversation, with the explicit purpose of engaging with teachers about well-defined instructional ideas and issues. (p. 13)

It is important for school leaders to be purposeful when providing feedback to support the implementation of the Thinking Classrooms framework.

Another school leader, Ian, believed that it was important for teachers to seek out feedback. He said, "I'm looking for them to invite me in with the goal of seeking feedback. As opposed to me assigning myself, based on my position, a role in their classroom." This was possible, Ian believed, once the teacher trusted Ian and felt safe having him in the room. Across the board, every school leader believed that providing feedback was an important part of their role.

Additionally, the school leaders largely viewed feedback as a two-way street; it was also vital for them to find opportunities to seek out feedback when supporting implementation of the framework. By gathering feedback from their teachers, the school leaders were able to assess the teachers' progress at implementing the framework, determine the impact on

student learning, gain an awareness of any challenges the teachers were facing, plan next steps, and ultimately evaluate the effectiveness of their own support. Like other school leaders, Kate described how she used feedback to keep a pulse on the teachers' progress and plan forward. She explained, "So, we're really listening to the teachers' voices, of course. We're listening to their feedback. We're listening to what they say they need." Another school leader, Gina, echoed the same sentiments. She described regularly meeting with the mathematics teachers to better understand their needs. Gina recalled, "Meeting with the department, attending the department meeting, listening to where they're at, listening to what they need in terms of next steps." Collectively, the school leaders believed that giving and receiving feedback was an important part of successfully supporting the Thinking Classrooms framework.

While the teachers valued feedback from their school leaders, they primarily described it as a key role of the school leader(s) and one-way (from the school leader to the teacher). Feedback occurred regularly as a part of classroom visits and walkthroughs; it also took place during ongoing conversations that happened both at school and during the professional learning sessions. The teachers broadly agreed with the school leaders in that feedback was both helpful and important. Alex (teacher) mentioned one of the ways his school leader would provide feedback. He said:

> We've had lots of conversations. As she makes her rounds, she might see me doing a Thinking Classroom lesson and ask me about it later. Or maybe not ask me about it later, but tell me, I loved when you did this, or I love that I saw this. So, providing feedback or positive reinforcement.

Another teacher, Beth, explained how some school leaders incorporated teacher voice into the feedback process. She recalled, "They ask, *why am I walking into your classrooms?* ... the teachers get to set out a goal that they purposely want to be given feedback on." This gave the teachers an opportunity to focus on a specific area of their practice for reflection, analysis, or improvement.

Like the other teachers, Erin also commented on the importance of the receiving feedback from her school leader. But she also pointed out a need for timely feedback. Erin noted, "Often, we got her feedback on the spot. She'd ask, *how do you think this is going right now?*" This instant feedback was helpful as it allowed her to reflect and make changes in the moment, instead of trying to recall something that had happened after the fact. This illustrates a small nuance in the participants' perspectives. While some school leaders and teachers preferred to give and receive feedback at a later time (especially if there were students present), others believed that it should occur immediately. While one timing was not necessarily determined to be better than the other for supporting the Thinking Classrooms framework, it is important for school leaders to be aware of the possibilities so that they can determine which method the teachers they are working with find most valuable.

One teacher, Cam, had a unique experience from the others in that he received very little feedback or support from the school leaders and other teachers at a previous school. Instead, it often came from the divisional mathematics consultants or other members of the professional support services team. While he acknowledged this external source of feedback was beneficial to his practice and helped move his learning forward, he was frustrated by the perceived indifference of his school leaders. He explained:

> But no one ever paid attention to what I was actually doing, except for the administrators. But honestly, I think that was only because they were hearing about it from others who weren't even in the school... it kind of just ended with me. So, that's why I left the school.

Feedback and support were clearly important to Cam. He eventually decided to transfer out of the school because he was not receiving either from his school leaders or teacher colleagues. This important for school leaders to be aware of because it demonstrates what can happen if a teacher does not receive the necessary feedback and support.

And while the school leaders and teachers primarily discussed feedback that happens between the two groups, some of the teachers noted that feedback could also occur solely between teachers. This was especially true when a teacher had an additional role, like support teacher or department head, in the school. Faye (teacher) believed that it was her responsibility as a department head to provide feedback and encouragement to her colleagues. She recalled:

> So, my role was to try to slowly encourage them all to try it and see how it worked. Then give them encouragement and praise, really. I would give feedback and ask questions. Like, *how do you feel? Did this work? How do you know?*

And as the teachers' understanding of the Thinking Classrooms framework grew, so too did their ability to provide feedback and support to other teachers. As Diane (teacher) stated, "It's kind of like I'm a resource person for our department." This sentiment was shared by other teachers, like Alex, who said, "my next steps are hoping to now be able to mentor colleagues, new staff, to the ways of Thinking Classrooms." This shows that while the school leaders played

an important role in providing feedback to teachers, the teachers were also a source of feedback for each other. This is a source of feedback that school leaders who support the Thinking Classrooms framework should seek to leverage in the future.

Having the Right Resources

Both the school leaders and teachers agreed that the teachers needed to have the right resources in order to successfully implement the Thinking Classrooms framework. Collectively, the school leaders recalled needing: vertical non-permanent surfaces (specifically whiteboards), dry erase markers, playing cards, mathematics manipulatives, a collection of good problems, Liljedahl's (2021) book, budget money, professional development and time. The need for high quality professional development was discussed at length in the previous theme; time, too, was of such importance to the participants that it will be examined separately in a subsequent section. What follows is the participants' perspectives on the importance of the remaining resources.

Having a sufficient number of whiteboards (and accompanying dry erase markers) in the classroom was widely described by the participants as a non-negotiable requirement to implementing the Thinking Classrooms framework. This was agreed upon by both the school leaders and the teachers. Gina, a school leader, noted, "In all three buildings, the ease and convenience and quality of the vertical non-permanent surface has impacted how much the Thinking Classroom model has been used. So, the classrooms were outfitted nicely with wall mounted whiteboards." This belief was shared by the teachers, like Alex, who justified why the whiteboards were so significant, remarking, "Whiteboard space was the most important because that's where student learning happens." And like all of the other participants, Faye

(teacher) believed that investing in permanently installed whiteboards was vital. She pointed out:

> Like, there's no use going to the PD if you don't have the whiteboards to do it in your classroom. And you need real whiteboards. You know, the disposable whiteboards are basically useless. They get dirty, you can't clean them. Without one, it doesn't work. If you don't have the ability to practice it properly, it's tough. I use every physical space. Every wall in my classroom is full of whiteboards and I use all my windows... If you don't have that, you won't be able to do it. So, I don't think you can do one without the other. If you go to the PD, but no one's actually outfitted your room properly, it's useless.

More than any other physical resource, permanently installed whiteboards were touted as the number one requirement for implementing Thinking Classrooms. Without them, the teachers' motivation and willingness to implement the framework drastically decreased. It is important to note that this finding is contrary to the work of Liljedahl (2021), who found that other vertical non-permanent surfaces can also be used effectively. He suggests that teachers can use windows, blackboards and other more affordable options.

While the school leaders and teachers agreed that it was the school leaders' responsibility to purchase resources and arrange for installation (if needed), this was not always an easy task. One school leader, Kate, summarized the process for getting whiteboards put into a classroom. She explained, "… in the division, whiteboards take a long time to get approved. You have to have the budget. You have to have workplace safety and health come. You have to have a carpenter available to do the work." Another school leader, Hannah, expressed frustration with the whole process. She said:

> So, as of right now, I haven't been able to provide the whiteboards that the teachers want. Because, one, the budget, and two, we actually don't have the carpenters to install anything right now in our division. Nothing is getting done.

Although bureaucratic obstacles sometimes slowed down the purchase and installation of whiteboards for teachers, the school leaders reported that they were eventually able to overcome these problems.

The whiteboards were so important that when his school leader was unwilling or unable to purchase them, one teacher, Cam, put a lot of effort into acquiring them for his classroom. He shared:

> So, a year goes by and finally I get fed up. I started looking around in other rooms in the school to see where there's whiteboards not being utilized. I took my drill to school and I just took the whiteboards out of the room. And I literally drilled them in my own and put them in myself. Then I was able to do a full-fledged Thinking Classroom. In a big long one, you can actually see the dent in the middle where me and the other guy were running through the doors to try to not get caught and it bent on the turn [laughs].

Given Cam's willingness to break numerous divisional policies and risk disciplinary action, it was clearly important that he had enough whiteboards in his room to implement Thinking Classrooms. This serves as a cautionary tale for school leaders of the great lengths that teachers might go to acquire the resources they need for the framework. And while they did not need to go to the same extremes, the other teachers and school leaders shared Cam's sentiments.

Other resources like playing cards, mathematics manipulatives and Liljedahl's (2021) book were easier for the school leaders to provide because they were significantly cheaper and did not require the involvement of a third party. Liljedahl's (2021) book served as a reference or third point for the learning the participants had done at the professional development sessions and was perceived to be valuable by the school leaders and teachers alike. Gina (school leader) recalled:

> People loved the books, there's no question. I would say of all the professional development books we've shared, those have been some of the most used. People's copies are, you know, you can tell when a book is well used, it's got tabs all over it, or the edges are curled, or it has highlighting all over it, and they're out on people's desks.

Overall, Liljedahl's book was easy to come by and was perceived as particularly valuable. The teachers broadly appreciated their school leaders' purchase of Liljedahl's (2021) book and other supplies and found them to be useful; none of the participants described challenges getting these items in their classrooms. They did however, note that a plan to use the resource and it's timing was important. Beth, a teacher, remarked, "If the principal dishes something out to teachers, without any explanation, without a plan. That's unhelpful." This is important for school leaders to be aware of when purchasing resources for supporting the framework.

Unlike playing cards, mathematics manipulatives and Liljedahl's (2021) book, both the teachers and school leaders reported difficulty assembling a collection of good problems to use with the students. This was especially true in the early days of the Thinking Classrooms framework when it was relatively new, as Luke, a school leader, remarked, "But creating problems that were accessible to kids, that was more of a barrier. You know, they needed to

have a lower floor so that all students could enter in and then move up in difficulty." And while finding instructional resources, like mathematics problems, may not normally be perceived as part of a school leader's role, many school leaders spoke in detail about their efforts to help the teachers find good problems. As an example, Ian (school leader) recalled, "I provided resources, like, actual professional resources in the form of problems and tasks that were appropriate." Another school leader, Hannah, also spoke about helping her teachers find good problems and other instructional resources. She noted that this became easier as time went by. Hannah said, "But I would say by year two, there was such a bank online, because there was momentum all across Canada, that people were sharing problems." The sharing of good problems, both within the school and from online sources, contributed to a growing collection that was amassed by the teachers and school leaders. Other sources of good problems and instructional resources included mathematics textbooks, provincial and divisional support documents, professional support services personnel, and Liljedahl himself.

Release Time to Learn More About the Framework

Although time is a resource, it was mentioned with such frequency and depth by both the school leaders and teachers that it was prudent to examine it separately from other types of resources. Time was incredibly important to all of the participants. It was described much like safety in that it required a wholistic approach and many actions to achieve it. In fact, non-instructional time was reported as being just as important to implementing the Thinking Classrooms framework as having whiteboards. This point was clearly articulated by Gina, a school leader, who hypothesized:

> So, there's no question that nothing would have happened without the release time. So maybe I should put that as number one, because coming back from the PD sessions and having release time to debrief, plan and collaborate together was huge. So maybe, you know, maybe nothing would have even been attempted and people probably wouldn't have even been advocating for their surfaces.

Alex, a teacher, also emphasized the importance of time. He stated, “Time is, is super, super important.” This was echoed by the other participants, including Faye (teacher) who added some context by describing the busy pace and multidimensional aspects of a teacher’s typical day:

> Well, I mean, I get here at 8:10 a.m. most days and still work through lunch. So, time is really precious. There's so much going on, especially in a large high school. We've got over 1 200 kids and a million different activities. A lot of teachers on our math team are involved in lots of those activities. So, it's important to have some built in time for us to work together.

There is no doubt that the teachers having time away from their regular classroom duties was important to the participants. They all agreed that teachers need large amounts of non-instructional time in order to successfully implement the Thinking Classrooms framework.

Both the school leaders and teachers recalled the non-instructional time being used for a variety of purposes and taking many forms. Most frequently, it was required to: learn and practice the framework; prepare lessons and unit plans; find good problems and instructional resources; collaborate with colleagues; have critical conversations and engage in feedback; meet as a mathematics department or grade level team; participate in a professional learning

community; visit other classrooms and schools; and attend professional development sessions. This list further demonstrates how time is an important component of many leadership practices. It should also be noted that all of this was above and beyond the union-mandated preparatory time given to all teachers.

Additionally, the school leaders and teachers agreed that it was primarily the role of the school leader(s) to find non-instructional time for the teachers. They accomplished this in many ways, including: class coverage by a colleague or substitute teacher; release time from the school budget; educational leaves granted by the school division; grade level, department and professional learning community meetings scheduled into the teachers' timetables; and arranging optional lunch and learns over the midday break that teachers could choose to attend. But because non-instructional time almost always has a cost, some school leaders found it challenging to pay for. As Hannah (school leader) explained, "We did some creative timetabling, support, PLCs, lunch and learns, that kind of thing to make it work. But that definitely is a challenge... it comes to time and money for me." Another school leader, Luke, shared the same sentiments. He remarked, "It wasn't that we couldn't provide it, but it was the hardest part of it all to provide." In particular, providing non-instructional time was most challenging in smaller schools, where the school leader(s) oversaw a smaller budget and were provided with less money for release time than larger schools. Nonetheless, it was important for the school leaders to somehow create some non-instructional time to support the framework's implementation.

The teachers generally felt that their school leader(s) had put a good effort into providing non-instructional time for them. They also believed, however, that there never

seemed to be enough time. Like other teachers, Diane commented on the need for her to dedicate time at lunch and after school to implementing the Thinking Classrooms framework. She wondered if her school leader could have found more time by removing the non-instructional duties from her timetable and replacing them with opportunities to meet with her colleagues. She said:

> I'm thinking about all of the extra duties and things we have, right? I walk the halls and I sit in the ALC [Academic Learning Centre]. That's three times a cycle that I'm doing that. I have library duty at lunch. That's three more hours a week where we could be meeting. Even if it was just for one of those hours each week… so that you're not doing it on your own time. I always do it on my own time. Like, I've given up on that. But I think that's the problem, right? It's what we do. So, then things never change.

But from the school leaders' perspective, teachers could always use more non-instructional time. As Gina, a school leader, noted "People will always want more time, so we give that as much as we can." Time was not, however, a limitless resource. It was a fickle beast, no matter how much the school leaders provided, the teachers always wanted more. It is important for school leaders to be aware of the need to provide non-instructional time to support the framework's implementation, but to not give away the farm. They need to balance the allocation of money and time across the many needs and initiatives of the school.

Structures and Opportunities for Collaboration

Both the school leaders and teachers believed that collaboration was an important component of successfully implementing the Thinking Classrooms framework. And while many participants spoke about the importance of teacher collaboration, it is important to note that

the school leaders were often contributing members of the different collaborative teams. From the participants' perspectives, opportunities for collaboration were vital for sharing successes, overcoming hurdles, improving teacher practice and increasing their impact on student learning. Gina, a school leader, stressed that two heads (or more) were always better than one. She observed, "Sharing is big. We've got to do more sharing." This was echoed by the other participants, like Faye (teacher), who described the importance of working together, noting, "… we can figure out what works and what doesn't work. The more people in the group, the more ideas we have. We can also share resources. It's good to work together." Another teacher, Beth, also summarized the benefit of collaboration on student learning. She stated:

> I think teachers have a tendency sometimes to teach in a silo. They have a tendency, sometimes, to close their door and do what they want to do. And it's an island. And you can't... the teachers who are actually collaborating and meeting and talking about these important things are noticing a higher impact on students. I think part of it is because you're coming to a common understanding with research-based practices. You're coming to a common understanding of these things and of what to look for.

Overall, the school leaders and teachers were in agreement that collaboration was clearly important to the framework's implementation.

Although the participants were unified in their belief that collaboration was important, they described many different opportunities and structures for it to happen. Some of these were formally arranged by the school leader, including: professional learning communities (PLCs), grade group meetings, department meetings, co-teaching, mentorship, fishbowling, common preparatory time and classroom/school visits. Other opportunities for collaboration

happened informally. These included: collegial conversations, sharing resources, informal meetings, offering a colleague guidance and support, creating good problems and co-planning lessons/units. Whether formal or informal, both the school leaders and teachers recalled that collaboration increased the collective efficacy of the school staff. Like others, Alex (teacher) stressed how important collaboration was to implementing the Thinking Classrooms framework. It made the task of implementing the new framework both manageable and enjoyable. He proposed, "… the number one thing I believe that my principal's done to foster Thinking Classrooms at our school has been collective efficacy. She's made it really obvious that, as a school, this is something that we're doing together…." This supports the idea that collective teacher efficacy can influence the affective state of both individual staff and the school (Hoy & Miskel, 2013).

The school leaders spoke at length about their efforts to purposefully create opportunities and structures for collaboration. They understood that it was not something that would just happen on its own. Like other school leaders, Kate spoke about the need to be intentional. She remarked, "… you need to ensure that you're creating opportunities for it to continue to grow and flourish. Things like PLCs, things like providing release time, things like common PD… are all really important in fostering and developing collective efficacy." Another school leader, Hannah, quickly saw what can happen when collaboration is not nurtured when she arrived at a new school. She observed:

> So, according to data and research, we know that when a group of teachers collectively work together to bring in a new strategy or something like that, you get higher results. I definitely was able to see that at that school because they hadn't had a collective in

> their math department, they were very disjointed. They weren't discussing what they were doing in their classrooms. They weren't sharing resources and materials.

This had an impact on the students' achievement, the teachers' collective efficacy and the affective state of the math department as a whole. In order to support her teachers' successful implementation of the Thinking Classrooms framework, Hannah created structures and opportunities for them to collaborate. This had a noticeable and almost immediate impact on both the mathematics teachers' practice and students' learning.

Interestingly, while both the teachers and school leaders stressed the importance of collaboration, the two groups had differing perspectives on the impetus behind it. The teachers spoke about collaboration as if it was innate to all schools. That is not to say that they did not appreciate it; they were very appreciative of any opportunity to collaborate, but did not always acknowledge the work of their school leaders to provide them. The teachers seemed to think that collaboration would just happen in a school. Like the school leaders' actions to create a feeling a safety described above, the teachers did not seem to appreciate the intentional practices of their school leaders to create opportunities for collaboration. But, again, this did not mean that they did not value the outcome; the teachers believed that collaboration was very important. As having one's work go unnoticed can be frustrating, this is helpful for school leaders to understand so that they do not feel defeated when supporting the implementation of the Thinking Classrooms framework.

The Role of Professional Support

Closely related to the topic of collaboration, both the school leaders and teachers discussed the role of professional support staff in implementing the Thinking Classrooms

framework. These in-school or divisional support staff were experienced specialist teachers whose primary function was to support teacher instruction and professional development. While each had a similar purpose, they had an array of different titles: learning support teacher, numeracy support teacher, early years support teacher, professional support services teacher, professional support services program lead, mathematics consultant, and math mentor coach. All of the participants valued the support provided by these specialized staff; they also believed that they played an important role in moving teacher practice and student learning forward.

The school leaders appreciated the availability of professional support staff for two reasons. First, a majority of the school leaders were not mathematics content experts. They relied upon the expertise of the specialists to help engage their teachers in conversations about the Thinking Classrooms framework and the connection between teacher practice and student learning. One school leader, Hannah, remarked:

> The only time I got momentum was when I brought in some kind of third point. Like a person, like Peter [Liljedahl], who basically said the exact same thing that I said, but had some kind of expertise or experience in it. Then all of a sudden, it was like, okay, this is worthwhile.

The support staff were held in high regard and respected by the teachers for their content knowledge and pedagogy. As a result, the teachers were willing to collaborate with them because of what they could bring to the table. This was especially true when the school leaders did not come from a mathematics teaching background.

Second, the school leaders relied on professional support staff to bolster teacher capacity, bring new ideas into the school and sustain momentum with the framework's

implementation. In some cases, the school leaders decided to allocate some of their staffing towards the creation of an internal support position, as Kate described, "… we chose to have a full-time dedicated learning support teacher who supports the literacy and numeracy initiatives in the building." Other times, an external team was called in when there were no internal options left. Ian, a school leader, recalled this scenario:

> I'm someone that likes to use the professional resources that exist in the school. But at that point, the professional resources that existed in the school didn't feel like they had additional strategies to support the students. They had exhausted their strategies for trying to support the kids. So, I think they were seeking support from an external support or service. That's why Professional Support Services, in this case, was requested specifically to support math with the Grade 9 students.

Whether from within or outside of the school, having the assistance of a specialist was important because it ensured that the teachers were focused on implementing the Thinking Classrooms framework and adequately supported.

The teachers appreciated the assistance provided by the professional support staff and believed that it helped move their implementation of the framework forward. One teacher, Alex, remarked, "We have a learning support teacher at our school… I think some of the best learning that's happened for me has been during the in-class support where me and him are just focused on a unit or a topic." This was echoed by other teachers who utilized the assistance of the professional support staff in various ways, as Beth (teacher) recalled, "… they're there in class coaching, co-planning and co-teaching sometimes." The professional

support staff also played a role in situating the Thinking Classrooms framework amongst other mathematics pedagogies, as explained by Cam (teacher):

> … with a math mentor coach, it's a lot of making connections between the Thinking Classrooms framework and the NCTM's eight effective teaching practices or our provincial curriculum documents. Quite often teachers don't want just one more thing. So, we like to make the connections, find the commonality. So, you know? Jo Boaler, great. Or, Cathy Fosnot. Or, you know, Marian Small, or whoever. But to find those commonalities, it has been really important because then you realize, okay, it's not that daunting because all these things have things in common that we know are best for student learning.

Making connections between instructional approaches was important because it reassured the teachers that they did not need to start from scratch when implementing the Thinking Classrooms framework. Instead, they could keep some of their current practices, while learning new ones and refining others. This made the change seem manageable and encouraged them to use their agency to do so. Because professional support staff come at a high cost (as much or more than a teacher's salary), it is good for school leaders who are supporting implementation of the framework to know that the teachers valued their support as much as the school leaders did.

Arranging for professional support was the sole responsibility of the school leaders. However, every school leader indicated that having their teachers collaborate with professional support staff was more valuable than books or other pedagogical resources. Because of their multiple roles and high level of expertise, the professional support staff enhanced the school

leaders' leadership practices and overall support of the framework; they also reinforced the school leaders' direction, provided on the job professional learning, enhanced the structure and culture of the school, and improved instruction. As one school leader, Jen, explained, "… just give them a book, it could sit and get dusty on their bookshelf. But if a physical person comes into your room that helps sustain it. The book can't prompt you, motivate you or ask you questions." This strong return on investment encouraged the school leaders to dedicate their own time, energy and resources into creating support positions within the school or seeking divisional assistance.

Summary

The second theme, teacher learning at school, examined how school leaders supported adult learning at school outside of the professional development sessions. Overall, both groups shared the same views on the structures and supports that teachers needed to effectively learn about and implement the Thinking Classrooms framework in their classrooms—the school leaders' and teachers' perspectives were unified in their answers to this study's two subquestions. First, there needed to be a safe and collaborative school environment for the teachers to take risks in their practice and start to implement the framework. Second, receiving timely feedback was an important part of the implementation process for both the teachers and school leaders. Third, the teachers benefited from having resources (especially whiteboards), time and structures for collaboration at school, and the assistance of professional support staff.

Just as in the first theme, all of the leadership practices described by the school leaders and teachers in this second theme align with one or more of the sixteen core leadership

practices suggested by Leithwood (2011). As collaboration was described by the participants as a key component of teacher learning at school, it is no surprise that many connections can be made to core practices of *building collaborative cultures* and *modifying organizational structures to nurture collaboration,* including: establishing a safe environment for risk taking; school leaders and teachers giving and providing feedback; and, creating opportunities and structures for collaboration on the Thinking Classrooms framework's implementation. And while feedback can be seen as a component of collaboration, it is also a way of gathering information about the framework's implementation; this aligns with Leithwood's (2011) core practice of *monitoring progress of students, teachers, and the school*. Beyond collaboration, this theme also revealed many of the resources necessary for implementing the framework. These included physical resources, financial resources and time; in addition, many school leaders spoke in detail about their efforts to help the teachers find good problems. Leithwood (2011) recognizes the importance of resource allocation in the core practices of *providing instructional support* and *aligning resources.* Finally, providing time and professional support staff supported the school leaders' practices across all four categories of Leithwood's (2011) framework; both were described as having a wide-ranging and wholistic effect by both groups of participants. Combined, all of these connections support the notion that Leithwood's (2011) framework continues to provide a solid foundation for this thesis paper. This theme also identifies, like the theme before it, the specific knowledge that school leaders need to apply Leithwood's (2011) practices when supporting Thinking Classrooms. This is significant because Leithwood (2011) does not provide specific actions, like purchase whiteboards, for school leaders to follow.

And while this second theme examined the leadership practices and supports that were necessary for the teachers to continue their learning while implementing the framework at school, the third theme proposes a requirement for school leaders to be learners as well.

School Leaders Are Learners

The third theme, school leaders are learners, provides two more answers to the main research question. Based on the findings, the fifth and sixth optimal practices for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools are:

5. Attend and be actively involved in teacher professional learning.
6. Form trusting relationships by modeling risk taking, being vulnerable and embodying learning.

This theme also examines the requirement for school leaders to be active participants in learning alongside their teachers. It includes the need for school leaders to: actively participate in teacher learning; present themselves as learners; and, as a result, form close bonds with staff. In total, three closely connected topics form this theme:

1. Involvement in teacher learning.
2. A need to embody learning.
3. The value of trusting relationships.

And like the previous themes, a specific order is not implied. The topics were discussed by the participants in an interconnected, recurring and often simultaneous manner.

Involvement in Teacher Learning

While the school leaders were invited to participate in the Thinking Classrooms professional development sessions, it was not a requirement of the William Norrie School Division. However, every single participant, whether teacher or school leader, stressed the importance of at least one school leader attending the professional development sessions and being involved in the teacher learning happening both inside and outside of the school. From the participants' perspectives, the school leaders' involvement was significant for three reasons.

First, it ensured that the school leaders understood the Thinking Classrooms framework, allowing them to support the work required to implement it and fully recognize its potential impact on student learning. Like the other school leaders, Kate described how the sessions improved her understanding of the framework and her ability to lead. She remarked, "… understanding strong pedagogy is beneficial as a school leader. It was very supportive for myself, not just from a math lens, but also from a leadership lens, to be able to support teachers." The teachers also recognized the importance of school leaders attending the professional development sessions and the direct effect this had on the quality of support they received in the school. One teacher, Faye described how having a school leader at the session ensured their backing later on. She recalled, "… they were very excited about the process and very supportive. They realized it was important for student learning. It's important to have an admin. at the sessions because that way you have support when you go back to school." Another teacher, Cam, shared the same point of view but went further to describe what can happen when a school leader does not take part in the teachers' learning:

> … sometimes a principal will ask their teachers to do something and they don't know what it is that they're asking them to do. It could be a lot. So, then the teachers go off and do it and realize it's this big thing. It stresses them out. But the administrator doesn't necessarily know that.

This correlates with the work of Ringler et al. (2013) who found that teachers need to see that their school leaders' understanding forms the basis of their support. For school leaders who are supporting the implementation of the Thinking Classrooms framework, this is an important point to consider when deciding whether or not to attend the professional development sessions.

Second, the school leaders' involvement was important because it imparted value on what the teachers were learning. The school leaders understood the message that their presence sent; they hoped that by dedicating their time to learning about it, the Thinking Classrooms framework would be seen as a priority in the school. This was best explained by Hannah (school leader), who said:

> I truly believe, from the feedback I've heard from the staff, is that the school leader has to be present at the professional learning. If you're not, and you don't make it the priority, then the teachers aren't going to make whatever it is they're learning a priority either. I know I've said that before, but I really, really, do believe that as a leader. Whatever I want to get going, I better be there with them.

Other school leaders, including Ian, echoed the same ideas. He said, "I think that one of the ways that a leader shows what's important is through their presence." While these deliberate attempts by the school leaders to place value on the framework were well received by all of the

teachers, some pointed out that being physically in the room was different from being actively involved. Unfortunately, the teachers recalled instances of school leaders being at the professional learning, but otherwise preoccupied with emails, phone calls or other distractions. One teacher, Beth, described this important nuance, remarking, “I can't even count the number of teachers who have said, like to have a principal actually sit with us in a workshop and not go out and do other work is huge.”

In fairness to the school leaders who could not always be present or actively engaged in learning with their teachers, it should be noted that the school leaders had many responsibilities. Like others, Jen (school leader) was pulled in multiple directions. She claimed, “It can be hard to balance all of the initiatives, though, because there are so many initiatives that happen in a school.” This sometimes left the school leaders to choose between learning alongside their teachers and their other obligations. One school leader, Hannah, described how simultaneous demands for her time meant navigating a difficult situation with a superior at the school division office. She recalled:

> ... the date of the afternoon that it [the Thinking Classrooms PD] happened to be on was also the date of a divisional committee meeting. I sent my regrets, saying that I no longer could attend the divisional meeting as I was attending PD with my staff. And, umm... someone very high up phoned me, directly, to tell me I had responsibilities related to divisional committees and that I needed to rethink my decision. And I said, no, I'm going to attend the PD. So... [long pause].

While Hannah was comfortable standing up to her superior, not every school leader would do the same. This does show, however, how important it was for Hannah to be involved in the

professional learning of her teachers—school leaders who want to support the implementation of the Thinking Classrooms framework have to make their involvement in teacher learning a priority. This sentiment was shared by all of the participants and supports the work of Hilton et al. (2015) who found positive outcomes for both parties when school leaders attended professional development with teachers.

Third, the school leaders' involvement allowed them to offer moral support, be part of learning conversations, and supervise the teachers' learning. Gina, a school leader, recalled, "I listened to a lot of conversations. Sometimes I would guide them a little bit. But in listening to those conversations, that gave me some really good ideas of where we needed to go next." Being there also allowed the school leaders to supervise their staff, as Luke explained:

> … the teachers I was working with always needed some guidance during the professional learning sessions. That's saying it nicely. They needed someone there to allow them to listen to the message. So, there was that, the supervisory part. I needed to do that at times with them.

This kept the teachers' attention focused on the session and reiterated the school leaders' expectations for professional learning. Like other teachers, Faye appreciated her school leader's involvement and described how their presence created opportunities for encouragement that moved the teachers' learning forwards. She said, "… they encouraged us. If they weren't there, we wouldn't have started Thinking Classrooms as early as we did. Their support was so important." And while the school leaders recognized the importance of providing encouragement during their conversations with teachers, they also viewed the conversations as an opportunity to provide direction and plan for the future.

A Need to Embody Learning

In addition to being involved in the teachers' learning, both groups of participants believed that it was important for the school leaders to present themselves as learners. The school leaders clearly understood the importance of modeling learning for their staff. Like other school leaders, Hannah, described going into a classroom to apply her learning about the framework with students. She recalled, "I was excited to even go and attempt it in somebody else's class. I think that also created a bit of excitement with the teachers. That we were kind of struggling together, and I was in it with them." This served as motivation for the teachers to continue on their own learning journey with the Thinking Classrooms framework. From the teachers' perspective, it was essential for the school leader(s) to embody learning. Faye, like other teachers, remarked, "… they need to be a learner. I think that's important. But I also think that most of our admin. want to be learners or else they wouldn't be in that role. Learning is so important." When their school leaders personified learning, it provided the teachers with a role model. This made implementation of the Thinking Classrooms framework easier because the school leader(s) inspired them. Echoing the sentiments of the other teachers, Erin explained, "It makes everything so much easier. Her being a learner, she's a model for us. Just like we modeled to our students what to do, she's modeling to us to have an interest in learning."

Beyond providing inspiration, school leaders who embodied learning displayed a willingness to take risks that was highly regarded and appreciated by the teachers. It also encouraged the teachers to continue taking risks in their own practice, which was essential to implementing the Thinking Classrooms framework. The school leaders believed that it was

important for them to take learning risks with their teachers and were deliberate in doing so. Like others, Kate (school leader) declared, “If you're asking classroom teachers to take risks and try something new in their classroom, then you need to model that as a leader.” Another school leader, Jen, concurred and went on to explain how her credibility increased when she put herself out there. She stated, “We take that risk together so that they know that I walk the walk and talk the talk.” This did not go unnoticed by the teachers. Similar to the other teachers’ experiences, Beth recalled the benefit of seeing her school leader take risks. She noted, “… it also helps to see somebody else try and fail, or not be perfect. So, that helps teachers take a bigger risk as well and stick with it.” As a whole, modeling risk-taking for the teachers provided vicarious experience and social persuasion, both sources of collective teacher efficacy identified by Hoy and Miskel (2013).

Perhaps most important, it was necessary for the school leaders to embody learning because it put their own vulnerability on display. This made the teachers feel less intimidated and increased their level of respect for their school leaders, which in turn provided motivation to implement the Thinking Classrooms framework. The school leaders recognized the need for them to be vulnerable, and like risk taking, they were mindful of their actions to demonstrate their own vulnerability. One school leader, Luke, elegantly summarized the feelings of the school leaders:

> You need to expose your learning and be vulnerable. If you can't, it's hard. That's a battle, again, when we talk it about it from a leadership perspective. It can be a battle with your ego sometimes. But if you can't get around that you're not going to be able to work with the people you need to be in it with.

This was echoed by another school leader, Gina, who reasoned that actions speak much louder than words. She stated, "Your staff seeing you do, you try, you participate, you being vulnerable, has much more impact than you just sharing a bunch of knowledge." The school leaders understood that by showing their staff it was okay to be vulnerable, the teachers would be more willing to learn about and implement the Thinking Classrooms framework as this required an element of vulnerability in itself.

The importance of vulnerability was not lost on the teachers. One teacher, Erin, described how her school leader's vulnerability eased the teachers' minds. She mused, "I think it makes you feel less intimidated because she's putting herself out there. She's being vulnerable and not the person who knows everything. She's a person who's learning and wants to know more." This feeling was shared by the other teachers who were also more willing to implement the framework when they saw their school leader being vulnerable too. Beth (teacher) drove this point home, lamenting about "… a principal who pretends to know everything, because God forbid, he or she doesn't… When a principal's willing to be vulnerable, it's just so much easier to respect." This is important for school leaders to remember when supporting the implementation of the Thinking Classrooms framework; they need to put themselves out there, be authentic and expose their own learning vulnerabilities for the teachers and students to see.

The Value of Trusting Relationships

The school leaders and the teachers believed that trusting relationships were essential to implementing the Thinking Classrooms framework. Both groups of participants spoke at length about the need for trust between the teachers and school leaders. As a whole, the

school leaders were well aware of the need for trust when implementing any school initiative. Additionally, all of the school leaders recognized that learning about the framework with the teachers and embodying learning resulted in stronger relationships. As Luke, a school leader, reflected, "I think they saw our relationship became more collegial than just principal and teacher. That was really important. I had to be in the learning with them." Another school leader, Ian, hypothesized a link between the success of an initiative and the relationship that exists between teachers and school leaders:

> I think that we are able to create more sustainability in the initiatives that we implement if the relationship is trusting. I think that it allows for a back-and-forth dialogue between the administrator and the teacher to discuss the strengths and weaknesses of the initiative in a way that those groups can work together to do something that will last.

This perspective was shared by the other school leaders, including Jen, who noted, "I think if you don't have the respect of your teachers, you're not going to make much of an impact." Trust between the school leaders and teachers was clearly important to implementing the Thinking Classrooms framework. So, too, was the time and effort that it took to build that trust.

From the teachers' perspective, trust was something that had to be earned, not demanded. One teacher, Alex, described the importance of feeling like his school leader was there for him. He contended, "You have to believe that your leader has your back and that, you know, they value risk taking, and they're going to support you to your end goal. Probably that support piece, feeling supported, is the most important part." And while the other teachers

agreed, Beth (teacher) went further and offered a warning to school leaders who are not willing to put the time and effort into learning with their staff:

> It's hard to respect a leader like that. Even when I had principals who would come and tell me what a great job I was doing, I couldn't care less because I knew that they didn't know what I was actually doing. So, even paying a compliment meant nothing to me if you don't know what I'm doing, and what you should actually be looking for in my classroom. So yeah, as far as actually caring, I just think it's easy to spot the ones where it's all lip service.

Overall, the degree of trust that existed between the two groups was closely connected to the respect that the school leaders had earned from being involved in the teachers' learning, the support they provided based on their knowledge of the framework, and their embodiment of learning at school.

Just as trusting relationships between the two groups of participants were important to implementing the framework, so too were the many combinations of relationships that existed between the school leaders, teachers, students, and families. As important elements of teacher relationships with other teachers have already been covered in collaboration and professional support above, a focus on trust between school and home follows. This was also identified by the participants as a part of supporting the framework's implementation.

The school leaders saw a need for strong relationships with students and families. At Gina's school, some parents were concerned about the new assessment practices that came with the implementation of Thinking Classrooms. Gina supported her teachers and alleviated the families' fears by having phone conversations and in person discussions with parents. She

noted, “I think it's having those conversations with families as well, because I think some of the fear comes from parents questioning marks.” Ian, too, pointed out the need for mutually trusting relationships between the school and home. He observed that “families and teachers trusting each other that they're all doing the best they can to support kids' learning” are essential for success. The teachers agreed, noting that for many students, learning mathematics using the Thinking Classrooms framework was completely different from what they were used to. For the teachers to successfully implement the framework, the students and their parents needed to put their trust in the teacher that a new approach would be effective. Many of the teachers seemed cognizant of this fact and discussed how the relationships they had with their students allowed for an easier transition. As one teacher, Faye, explained:

> I didn't find it difficult. But my students, I think I have a good rapport with them. I'm very honest with them as well, right? I was upfront. I told them what Thinking Classrooms was about right away. I sent out information to parents ahead of time saying, you know, this is what my classroom looks like. If you have questions make sure to call.

This exemplifies the need for trust and open communication when implementing or supporting the Thinking Classrooms framework. Both school leaders and teachers need to be transparent about the framework’s use with students and families; this includes helping parents understand why math is taught differently now and addressing any misconceptions.

Summary

The third theme, school leaders are learners, examined the need for school leaders to be active participants in learning alongside their teachers and the trusting relationships that can result. Like the first two themes, the teachers and school leaders generally agreed upon the practices and supports that teachers need to successfully implement the Thinking Classrooms framework in this area. This provides additional answers to this study's two subquestions. First, at least one leader from each school needs to be involved in the teachers' learning that happens both inside and outside of the school. Second, the school leaders need to develop trusting relationships with teachers by modeling risk taking, being vulnerable and presenting themselves as learners. The need for trusting relationships extends beyond school leaders and teachers to also include students and families.

Leithwood's (2011) framework continues to provide a good roadmap of the leadership practices that were found throughout this theme. All three core practices provided by his developing people category align with the actions identified by the participants as important when school leaders are involved as learners, including: taking time to learn about the Thinking Classrooms framework in order to offer the right support; being actively present during teacher learning to impart value through one's presence; offering moral support; guiding learning conversations; and, supervising the teachers' learning. Leithwood (2011) also supports the school leaders' efforts to model learning by going into classrooms to implement the framework, taking risks, and exposing their own vulnerabilities as a part of his core leadership practice of *modeling appropriate values and practices*. These practices help to build trust with teachers, which in turn forms a part of his core leadership practice of *building collaborative cultures*. Finally, both the school leaders and teachers understood that trust needs to extend to students

and families as well; this is in line with Leithwood's (2011) core leadership practice of *connecting the school to the wider community*. Even though the findings continue to agree with Leithwood's (2011) general framework, this theme also identifies, like the two previous themes, specific actions that school leaders can take to support the implementation of the Thinking Classrooms framework.

And while the third theme advocated for school leaders to be learners too, the fourth theme examines how school leaders set direction in the school.

School Leaders Set Direction

The fourth theme, school leaders set direction, provides the final two answers to the main research question. Based on the findings, the seventh and eighth optimal practices for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools are:

7. Communicate a clear vision and school goals while cultivating teacher leadership to support both.
8. Use quantitative and qualitative data from numerous sources to celebrate success, monitor, plan and reflect.

This theme also explores the ways in which school leaders guide a school towards its goal of implementing the Thinking Classrooms framework. This includes how school leaders: communicate their vision for the framework, give leadership opportunities to teachers, and use data to measure impact and celebrate success. In total, three closely connected topics form this theme:

1. Communicating a clear vision.

2. Developing teacher leadership.
3. Using data effectively.

Like the previous themes, the participants discussed the above topics in an interconnected, recurring and often simultaneous manner. A specific order is not implied.

Communicating a Clear Vision

A clear vision for implementing the Thinking Classrooms framework across the school was important to the school leaders and teachers. Having one provided consistency in the focus, pedagogical approaches and expectations for students and staff. Both groups agreed that it was the role of the school leaders to foster a vision for the framework in the school. Like others, Gina (school leader) recognized the power of the school leader to bring a vision to life. She explained, "I think a lot of it comes down to my beliefs and what I talk about and what I value and what I support." In the schools where this happened, the participants reported increased collective teacher efficacy and a substantial impact on student learning. This is unsurprising as a clear vision can persuade teachers and impact the affective state of the school, both of which support collective teacher efficacy (Hoy & Miskel, 2013).

The school leaders described in detail their sustained efforts to bring the school around their shared vision: planting seeds for the framework's growth; focusing the teachers' attention on student learning goals; setting clear expectations for implementation; and, communicating using consistent language. This work happened both formally and informally over extended periods of time. Like his school leader colleagues, Ian explained:

> … there was significant work behind the scenes. Planting seeds, getting teachers to understand that likely a change was required and building trust so that we could

> actually implement this and have open conversations about what was happening in classrooms. That all takes time.

It was clear that the school leaders understood the power of having the Thinking Classrooms framework as a part of their vision for the school and many were deliberate in their actions to bring the teachers around it.

When there was a clear vision, the impact on students was substantial. One teacher, Erin, described the benefits of everyone working in the same direction:

> … every single classroom was doing it. So, no matter which class students go to next year, like, if these five students go to a different teacher, and these 10 students go to a different teacher, and the rest stay, they're all doing the same thing. There is the same expectations school wide. It doesn't matter. So, there's no regression. There's no, oh, in this classroom it looks like this, but in this classroom, it looks like that. That's big…
>
> Students know what to expect. I really think that's why it's so successful at our school.

This exemplifies why it is important for school leaders to have a clear vision for the Thinking Classrooms framework across the school.

While all of the participants agreed that a clear vision for the framework was advantageous, there was wide disagreement on the effectiveness of the school leaders' abilities to communicate and execute their vision. Even within the two groups, the participants did not always agree. All of the school leaders expressed confidence in their ability to set the direction of the school and support the Thinking Classrooms framework. Some of the school leaders did, however, find it challenging to connect the many, sometimes new and contrary, learning initiatives that happen in a school. This was compounded by external pressures from the

school division and/or department of education and made it difficult to maintain consistency over time. Jen (school leader) offered this perspective:

> The province comes up with new initiatives all the time. Then they filter down to schools and twist. Recently, it's not just them making recommendations, it's mandates that are coming through. They don't always consider the needs of the school division or consider the needs of the school. So, there's a bit of juggling that goes with that. We need to do the shoulds in the mandates that we're being told, together with what we know is most effective for our learners.

It is understandable, then, why the teachers did not always feel like there was connection and consistency in the school leaders' vision. This was often caused by forces beyond the school leaders' control.

And while the school leaders wanted to maintain a consistent vision for their schools, many of them (especially the vice-principals) reported being reassigned to other schools on a regular basis. The school leaders were cognizant of this fact and tried to mitigate the effects of their own movement by developing teacher leaders in the school to carry on their vision. This strategy was described by Ian (school leader), who said:

> I only needed to learn one time that if I was leading it, it would get dropped when I left. Whereas if I can leave someone at the school, like a teacher leader that is passionate about it, at least it will carry on.

This provided a bridge of support for the Thinking Classrooms framework in the school until the new leader could include it as a part of his/her own vision (or not).

The teachers' responses in this area were particularly helpful as they added some nuance and insight for school leaders who want to support the implementation of the framework. Some teachers, like Alex, believed that their school leader had done a remarkable job of bringing the whole school around their vision for the framework. He argued:

> I believe that you can't just tell people this is what we're doing and have them buy in. You need to create a sense of buy in, and you need to do that strategically… essentially, they need to believe in your vision as a school, as a school leader. They have to believe that you're doing things for the right reasons, which I hope for everyone is student learning.

Like some of the other teachers, Alex passionately believed that his school leaders' vision had a positive impact on the school.

At the same time, other teachers revealed that their school leaders were ineffective at bringing the school together around a shared vision. They believed that some school leaders did not know enough about the framework to provide adequate direction; this resulted in teachers struggling with its implementation. Beth, a teacher, described this situation:

> It ends up being that you don't understand the use of it or the value of it [the Thinking Classrooms framework]. The principal clearly hasn't articulated anything… the administrators don't understand the value because they haven't put the work in themselves.

This provides another reason why it is important for school leaders to be involved in the teachers' professional learning and be learners themselves. Without enough knowledge about

the framework, it would be difficult to have a vision for its implementation, never mind communicate that vision and bring people around it.

Additionally, some of the teachers reported feelings of confusion and discouragement when their school leaders did not connect the Thinking Classrooms framework to other parts of their vision for the school. This was especially the case in larger schools where many learning initiatives were taking place at once. As Cam, a teacher, bemoaned:

> … schools try to do too much. Rather than doing one or two things well, we're doing 10 things. Is it possible to do less? I don't know. But it would be easier for the leader to manage and the teachers to keep the targets in view, instead of losing them all of the time.

This sentiment was shared by other teachers, like Diane, who also pointed out the need for consistency within the school leader's vision:

> I think that there's an agenda all of the time. It just ebbs and flows, right? One day we have to do learning sprints and then we have to do something else. Oh, the learning sprints are gone now. But now we're doing, I don't even know what it is, right? There's always a new wave of something that someone is saying is cool or is good.

The teachers' responses show that school leaders who want to support the implementation of the Thinking Classrooms framework need to connect it to the many initiatives of the school and be consistent over time. This will not always be an easy task given ever changing government mandates and school division priorities. School leaders need to play the long game by planting seeds, developing teacher leadership, and firmly embedding the Thinking Classrooms framework into the vision of the school by explicitly connecting it to other initiatives.

Developing Teacher Leadership

Both the school leaders and teachers believed that it was important to develop teacher leaders who could support implementation of the Thinking Classrooms framework in the school. Beyond being an important part of succession planning, as described previously by Ian, developing teacher leaders ensured that other teachers had a peer that they could turn to as a role model and support within the school; oftentimes these people were the teacher champions of the framework and highly regarded by others for their knowledge and expertise. Like the other school leaders, Kate described the importance of fostering teacher leadership:

> I do feel like we have a couple of expert teachers on our staff. Anybody could learn a ton from observing their classroom. So, I'll be continuing to foster their leadership and help them be leaders on staff. I'll ensure that people have the opportunity to come and visit them. I'll give them opportunities to continue to facilitate PD. It's really important, I think, for teachers to hear another classroom teacher talk about successes in their room. It empowers them to be leaders. So, I'll continue to provide them with those opportunities.

Without a doubt, teacher leaders were essential components of the ongoing collaboration that happened in the schools.

Leadership development to support the framework was both informal and formal. Sometimes the school leaders recognized a teacher's passion for the Thinking Classrooms framework and would purposely step back to stay out of the way; this allowed the teacher to exercise their agency, take the reins and fly. This created vicarious experiences for other

teachers, a source of collective teacher efficacy (Hoy & Miskel, 2013), as described by Ian (school leader):

> …having a teacher leader is essential. We need to have the first person where the seed starts and where the flower starts growing. Then other people see the flower and think well, that's really nice flower. Then it starts spreading across the school. I've seen that, definitely.

Other times the school leaders would informally encourage a teacher to step forward and mentor others, like Alex (teacher) recalled, "I've also just been nudged by my principal. Like, hey, this is a new staff, would you mind if they fishbowl or you know, come in and watch the lesson?" The school leaders reported that these kinds of informal arrangements were the easiest to organize as they did not require release time or dedicated support periods in the teachers' timetables.

Developing formal leadership structures and roles required more effort on the part of the school leaders, but both groups of participants believed that they were important to have in the school. While some of the formal teacher leadership structures that supported the Thinking Classrooms framework were longstanding in the schools, like department heads councils, mathematics committees and academic leadership groups, specific roles were created by many of the school leaders to specifically support the framework. These roles had different names, like adult learning teacher, Thinking Classrooms support teacher and classroom support teacher, but their primary purpose was the same; they were to mentor, coach and support other teachers with the implementation of the framework.

While both the school leaders and teachers viewed these leadership roles as beneficial, they required significant resource allocation, specifically time, to create and maintain. This was necessary because formal roles needed to be included as a part of the teacher's assigned timetable. From the teachers' perspective, they appreciated having dedicated time to support the Thinking Classrooms framework because it meant that they did not have to give up their own time before school, at lunch or after school. It also recognized the value of their contributions and was seen as a vouch of support from their school leaders. One teacher, Diane, remarked, "Admin. is supporting that implementation in the school by putting it into my timetable." This perspective was shared by the other teachers, all of whom, just like the school leaders, believed that teacher leadership was an important component of supporting the implementation of the Thinking Classrooms framework.

Using Data Effectively

The school leaders and teachers agreed that collecting and analyzing data was an important part of implementing the Thinking Classrooms framework. Both groups of participants spoke about the need to collect and analyze quantitative and qualitative data from teachers, students and records systems. While the data was reported to have come from various sources and took many forms, it was primarily used to: determine the impact of the framework on student learning, engagement and attendance; monitor the teachers' implementation of the framework and plan for further professional learning; create a school plan and allocate resources to support school goals; and, identify areas of concern and celebrate success.

All of the participants strongly believed that the Thinking Classrooms framework had a positive impact on the students' learning and engagement in mathematics. The school leaders identified many advantages to using the framework and all of them indicated that their strong support was influenced by their own analysis of school data that showed it was effective. In fact, all of the school leaders believed that the framework had a positive impact on teaching and learning in the school as a whole, beyond what was happening in mathematics classrooms. This impact was noticed by the teachers as well. Like others, Faye (teacher) had examined her students' data and commented on the significant change in achievement. She boasted, "It made a huge difference when I look at our marks and our success rate. They have skyrocketed. So, we know Thinking Classrooms works." Perhaps just as important, the participants also believed it was important to collect data on the students' attitude towards mathematics. Beth explained her process:

> I pulled random students to get student voice for how it made them feel. That was enough to convince anybody. That data, the kids' feedback, was just unbelievable. How it increased their confidence, their engagement, their understanding of math, all of those things.

It is important to note that while both the school leaders and teachers analyzed data on a regular basis, the school leaders were usually the impetus behind this process. The teachers used data as a tool for teaching partially because it was an expectation of their school leaders. This is an important observation for school leaders who want to use data to support the implementation of the Thinking Classrooms framework in the future.

The school leaders also collected data to monitor the teachers' implementation of the framework and plan for professional development. This data was described as qualitative feedback that the school leaders gathered through conversations with their teachers and reflection questions. Like other school leaders, Kate believed that it was important for her and the teachers to know where they were at with the framework's implementation so that they could continue to move it forward. She said, "At the end of the year, they reflected upon where they were within the wheels and set goals for the following year. That would help drive our PD." These sentiments were shared by other school leaders, who saw value in using both student and teacher data to plan for further learning.

The participants agreed, too, that it was important to collect, analyze and use data to form their school's continuous improvement plan and report. This document was mandatory for all schools in the William Norrie School Division. It required teachers and school leaders to come together throughout the school year to reflect upon the current year and plan for the following year; it had to be submitted to the school division by June 30 and it also served as the basis for the school plan. Like her colleagues, Jen (school leader) described how the Thinking Classrooms framework was included as a strategy in their continuous improvement plan and report:

> We have quarterly meetings with our teams. I'm looking at how what we've done in the classroom relates to the continuous improvement plan. Through that, our goals are to increase engagement and to increase our data in mathematics. One of our strategies was looking at Thinking Classrooms pedagogy.

Beyond listing the framework as a strategy to meet school goals, the school leaders used data from the continuous improvement plan and report to make decisions about resource allocation for the upcoming year. As Gina, a school leader, explained, "… obviously our school budget should be a reflection of our continuous improvement plan and our school goals. So, we allocated funds within our school budget specifically towards supporting the Thinking Classroom model." This demonstrated the role of data as a part of the planning and decision-making process.

Finally, both the teachers and school leaders reported using data to identify areas of concern and celebrate success. Although the teachers focused on student data from their classroom, grade group or department, the school leaders took more of a balcony view. They often considered the school as a whole before narrowing their focus to specific areas, always keeping in mind their school vision and goals. While this allowed all of the participants to identify areas of concern, it also illuminated the positive impact that the Thinking Classrooms framework was having on students. This offered many opportunities to celebrate the teachers' successes. All of the participants believed that it was important to celebrate success and the school leaders took advantage of this opportunity often. One school leader, Kate, praised her teachers on a weekly basis. She exclaimed, "I celebrate with the staff every week. I do a weekly update and share some of the learning that I've seen around the school." The importance of being deliberate with recognition was echoed by the other school leaders. They believed that celebrating evidence of the teachers' impact created a recursive cycle that fueled the collective teacher efficacy of the school. This aligns with the findings of Hoy and Miskel (2013) and led to the teachers having even further success with the Thinking Classrooms

framework. Thus, it is an important observation for other school leaders who want to support the framework to remember.

Summary

The fourth theme, school leaders set direction, looked at how school leaders communicate their vision, provide leadership opportunities and use data to guide their school towards its goals. As has been the case throughout this thesis, the teachers' and school leaders' answers to the study's two subquestions were in harmony. That is, they agreed on the practices and supports that teachers need to successfully implement the Thinking Classrooms framework in this area. First, school leaders need to communicate a clear vision for implementation of the Thinking Classrooms framework across the school. This ensures consistency in approach, teacher collaboration, coordination of resources and a common language throughout the school. Second, school leaders need to foster both informal and formal opportunities for teacher leadership. They also need to dedicate the appropriate resources, especially time, that are needed for teachers to lead. Finally, both teachers and school leaders need to use quantitative and qualitative data to monitor, plan and reflect. Importantly, data should also be used to celebrate success, which in turn builds collective teacher efficacy.

Once again, Leithwood's (2011) framework provides a firm bedrock of the leadership practices described by the teachers and school leaders in this theme. Specifically, communicating a clear, consistent vision for the Thinking Classroom's framework aligns with the four core leadership practices in Leithwood's (2011) setting directions category. And while leadership development is covered by the three core leadership practices in Leithwood's (2011)

category developing people, for implementation of the Thinking Classrooms framework it is also a vital component of *building collaborative cultures* and *modifying organizational structures to nurture collaboration*. Finally, the use of data is an important part of setting directions and improving the instructional program, two categories of Leithwood's (2011) core leadership practices. What this theme adds, however, is context and specific steps for school leaders who want to support the implementation of the Thinking Classrooms framework. This is above and beyond the general framework of core leadership practices described by Leithwood (2011).

Chapter Summary

Chapter Five examined seventeen topics spread across four themes: high quality professional development, teacher learning at school, school leaders are learners, and school leaders set direction. As a whole, the findings confirm that the study was well positioned amongst the three areas of study previously identified in the literature review: school leaders' involvement in teacher professional development, agency, and collective teacher efficacy. This is evident by the many links to the literature that were found and discussed throughout the chapter. The findings and resulting optimal practices also align with many of the core leadership practices identified by Leithwood (2011), further validating his work. Overall, his theoretical lens was helpful to identify and better understand the relationships between the seventeen topics found across the four themes, making it a good fit for the data used to write this chapter.

In summary, this chapter answered the study's research question by providing eight optimal practices for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools:

1. Ensure teachers are aware of, and have the opportunity to attend, high quality professional development about the framework.
2. Establish a safe and collaborative school environment where teachers are able to take risks in their practice.
3. Give and seek out timely feedback on the framework's implementation.
4. Provide physical resources (especially whiteboards), time and structures for collaboration, and the assistance of professional support staff.
5. Attend and be actively involved in teacher professional learning.
6. Form trusting relationships by modeling risk taking, being vulnerable and embodying learning.
7. Communicate a clear vision and school goals while cultivating teacher leadership to support both.
8. Use quantitative and qualitative data from numerous sources to celebrate success, monitor, plan and reflect.

Each of which is based on the lived experiences of the research project's participants.

Chapter Six: Conclusion

Introduction

The purpose of this interview-based qualitative study was to determine optimal practices for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools. To ensure that the perspectives of both school leaders and teachers were included in the results, the study was guided by two subquestions; each looked at effective leadership practices and supports from one of the two viewpoints. This study was necessary because no research has been previously done in this area. While the Thinking Classrooms framework suggests optimal practices for teachers and has been widely adopted in classrooms across Canada and around the world, no one has studied how school leaders can best support its implementation.

In this chapter, I will summarize my research findings and demonstrate how they connect to other similar areas of literature. I will also make recommendations for future research and discuss the implications of this study on the practice of school leaders. Finally, I will end this thesis with some closing remarks.

Summary of Findings

This study revealed that school leaders and teachers widely agree upon the effective practices and supports that are necessary to implement the Thinking Classrooms framework. That is, the practices and supports that the school leaders provided because they believed that they were effective were largely the same as the ones identified by the teachers as being valuable. While each group's viewpoint resolved the project's two subquestions, their shared perspectives provided the answer to the study's main research question. A total of eight

optimal practices for school leaders who want to support the mathematics instruction of teachers who are establishing Thinking Classrooms in K-12 schools were identified:

1. Ensure teachers are aware of, and have the opportunity to attend, high quality professional development about the framework.
2. Establish a safe and collaborative school environment where teachers are able to take risks in their practice.
3. Give and seek out timely feedback on the framework's implementation.
4. Provide physical resources (especially whiteboards), time and structures for collaboration, and the assistance of professional support staff.
5. Attend and be actively involved in teacher professional learning.
6. Form trusting relationships by modeling risk taking, being vulnerable and embodying learning.
7. Communicate a clear vision and school goals while cultivating teacher leadership to support both.
8. Use quantitative and qualitative data from numerous sources to celebrate success, monitor, plan and reflect.

Each of these optimal practices came from the shared experiences and perspectives of the study's participants. Combined with previously existing literature, they provide an important roadmap for school leaders who want to have a positive impact on the framework's implementation at their school. The connections between the findings of this study and pre-existing literature are discussed in the following section.

Connections to Previous Research

As has been demonstrated at length in the previous chapter, the results of this thesis align closely to the three areas of literature that this research project was positioned amongst: school leaders' involvement in teacher professional development, agency and collective teacher efficacy. They also fit well with the theoretical lens that was selected for this study, suggesting that Leithwood's (2011) framework provides an effective understanding of the underlying core practices that effective school leaders employ. What follows is a brief summary of the connections found between this thesis and these previous areas of research.

First, this thesis emphasized the importance of the school leaders' involvement in effective teacher professional development and illuminated many positive outcomes that resulted from it. The results supported the work of Hilton et al. (2015) who found many benefits to school leaders attending professional development with teachers. It also reinforced the findings of Ringler et al. (2013) who suggested that teachers see their school leaders' attendance at professional learning as a sign that it is important and had a greater respect for the school leaders who took time to learn about the framework alongside them. Further, this thesis highlighted that collaborative teacher professional learning can take many forms both within a single school and across schools. This aligned with the findings of Vangrieken et al. (2017) who proposed that teacher learning communities do not have a common structure. Finally, it demonstrated that while school leaders have an important role in providing structures and opportunities for teacher learning, the teachers themselves play an important role in learning about the Thinking Classrooms framework. Bredeson and Johansson (2000) had a similar result, stressing the importance of fostering teacher autonomy.

Second, this thesis highlighted the role of agency in implementing the Thinking Classrooms framework. While most of the school leaders expressed an expectation that teachers who attended the professional learning sessions needed to at least try to implement the framework in the classroom, every teacher had the ability to decide the extent to which they implemented the framework, the thinking tasks that they used, how they overcame challenges to implementation and any refinements to their practice that were needed. This ability to act and undertake the act of implementing the Thinking Classrooms framework aligned with Imants and Van der Wal's (2020) definition of agency. Further, the findings highlighted various forms of Bandura's (2001) three types of agency: personal, proxy and collective agency. The last of which was closely related to the collective teacher efficacy that developed as the teachers worked to implement the framework with others.

Lastly, this thesis furthered the importance of school leaders fostering collective teacher efficacy in schools. This fact was suggested time and time again by the participants as a vital and important part of implementing the Thinking Classrooms framework. The participants spoke about all four sources of collective teacher efficacy. Specifically, the teachers needed their school leaders to provide: mastery experiences as a part of learning about the framework; opportunities and structures for collaboration to learn vicariously through the successes of others; feedback, a form of verbal persuasion; and, a positive affective state in the school, often described as a safe environment for teachers and students to take risks in their practice and learning. All of which bolsters the work of Hoy and Miskel (2013) who found mastery experience, vicarious experience, verbal persuasion and affective state to be important sources of collective teacher efficacy. Additionally, the teachers and school leaders claimed that the

students' understanding of mathematics improved. This was a result of their implementation of the framework, which was successful partly because of the increased level of collective teacher efficacy in the school. This further supports the work of Goddard and Goddard (2001), Ramos et al. (2014) and Donohoo (2017), all of whom found that student achievement is positively impacted by collective teacher efficacy.

Building on Theory

The eight optimal practices that were identified in this thesis can be seen as derivatives of Leithwood's (2011) sixteen core leadership practices; the numerous connections between Leithwood's (2011) work and the findings of this study have already been discussed at length as a part of the summary for each theme. And although Leithwood's (2011) framework provided a good foundational roadmap for identifying the optimal leadership practices that support the Thinking Classrooms framework, it is too general for school leaders to use on its own. The eight optimal practices recommended in the findings of this thesis are intended to specifically support the implementation of the Thinking Classrooms framework. For this reason, they were sorted into different (although similar) themes based on the participants' experiences. Each of the eight practices could, however, be broken down and reclassified to fit within Leithwood's (2011) framework of core practices and categories with relative ease. This supports the overall validity and usefulness of his work. In an effort to build upon Leithwood's (2011) framework, and provide further clarity for each of the practices identified in this thesis, Table Two provides specific actions that school leaders can take to fully enact each of the eight optimal leadership practices for supporting the Thinking Classrooms framework.

Table 2

Specific actions to support the Thinking Classrooms framework

Optimal practice	What it looks like
1. Ensure teachers are aware of, and have the opportunity to attend, high quality professional development about the framework.	Decide if the Thinking Classrooms professional development sessions are voluntary or mandatory and clearly communicate the reason for this decision. Share benefits of the sessions and registration information with teachers. Negotiate for extra spots and fund substitute teachers. Ensure the sessions: use modeling to provide mastery and vicarious experiences; are collaborative and ongoing over time; offer opportunities for reflection upon and/or changes to practice.
2. Establish a safe and collaborative school environment where teachers are able to take risks in their practice.	Take a wholistic approach to safety by utilizing a combination of leadership practices. Encourage teachers to take risks in their practice while implementing the Thinking Classrooms framework, learn through their mistakes, and slow down. Be visible in the school; go into classrooms and implement the framework alongside teachers. Explain and defend the use of the framework to concerned parents/guardians and community members. Have an open office door, authentically listen to concerns related to the framework's implementation, and offer moral support.
3. Give and seek out timely feedback on the framework's implementation.	Be purposeful when conducting walkthroughs and providing teachers feedback about their implementation of the Thinking Classrooms framework. Determine the best time for feedback (in the moment or later). Seek out feedback from teachers on the framework's implementation to assess progress, determine impact on student learning, gain an awareness of the challenges, plan next steps, and evaluate the effectiveness of one's support. Encourage feedback between teachers and teacher leaders.
4. Provide physical resources (especially whiteboards), time and structures for collaboration, and the assistance of	Purchase and arrange the installation of enough whiteboards in each classroom to support the Thinking Classrooms framework's use. Be aware of timing and communicate a plan for resources that are purchased to support the framework. Provide an appropriate amount of non-instructional time for teachers to: learn more about the framework and plan; visit other

professional support staff.	schools; meet and discuss their implementation; and, participate in professional learning communities to support the framework. Create structures for collaboration with colleagues who are also using the framework, both within the school and out of the school. Arrange for professional support staff to support the teachers' implementation of the framework.
5. Attend and be actively involved in teacher professional learning.	Be actively engaged in teacher learning about the Thinking Classrooms framework. Learn in the moment alongside the teachers; do not get distracted by emails, phone calls and meetings. Show that learning about the framework is a priority through your presence. Learn about the framework in order to adequately support it. Guide learning conversations, offer moral support and provide encouragement.
6. Form trusting relationships by modeling risk taking, being vulnerable and embodying learning.	Embody learning in the school by presenting as a learner and implementing practices from the Thinking Classrooms framework with students. Take risks alongside the teachers and expose your own vulnerabilities while learning about the framework. Do not pretend to know everything about the framework; it is okay for leaders to be learners too. Earn trust by supporting teachers with the framework and developing strong relationships over time. Have the teachers' backs; do not judge when teachers are learning how to implement the framework. Be transparent about the framework's use with students and families. Explain why this new approach is beneficial to student learning.
7. Communicate a clear vision and school goals while cultivating teacher leadership to support both.	Use consistent language to communicate a clear vision for the Thinking Classrooms framework in the school; ensure consistency in focus, pedagogical approach and expectations. Maintain focus on student learning goals. Embed the framework firmly into the vision of the school by explicitly connecting it to other initiatives. Play the long game by identifying potential teacher champions, planting seeds and being patient. Use formal structures and informal processes to develop teacher leadership to support the framework. Create specific roles to mentor, coach and support teachers using the framework (i.e., classroom support teacher).

8. Use quantitative and qualitative data from numerous sources to celebrate success, monitor, plan and reflect.	Determine the impact of the Thinking Classrooms framework on student learning, engagement and attendance at school. Create a school plan that includes the framework and allocates resources to achieving school goals. Collect qualitative feedback about the framework from teachers and students. Use data to monitor instructional effectiveness, identify areas of concern and plan for professional learning on the framework. Look for opportunities to celebrate success often.

Recommendations for Future Research

All of the participants in this study were from schools where the Thinking Classrooms framework was already well established. While not every teacher was implementing all fourteen optimal practices perfectly, each teacher had incorporated a considerable amount of the framework into their practice and was experiencing a substantial amount of success. In addition, the school leaders had experience supporting teachers who were successful. This was helpful because it illuminated the common leadership practices that supported the teachers' success. However, a future study should recruit school leaders and teachers from schools where the implementation was not successful or the teachers had given up. This would paint a more complete picture by putting a spotlight on barriers to using the framework. It may also reveal some leadership practices and supports that are unhelpful or damaging.

It was not a requirement for the teachers and school leaders to be from the same school in order to participate in this study. While this did not prevent this thesis paper from recommending optimal practices for school leaders that were based on the combined perspectives and experiences of the participants as a whole, a future study could require that for a school leader to participate, a teacher from their school must also participate. This would

allow the researchers to compare and contrast responses about specific leadership practices that the school leader was employing. For example, if a school leader spoke about providing release time to collaborate on the framework, the teacher could provide specific feedback on the effectiveness of that support. This might reveal additional nuances in the ways that school leaders carryout the eight optimal practices identified by this study, creating further understanding of how to support the Thinking Classrooms framework's implementation.

The amount of financial support required for successful implementation of the Thinking Classrooms framework was not measured by this study. Future research could ask school leaders to quantify the amount of money that is needed to: provide professional development; hire substitute teachers for release time; purchase resources like whiteboards; and, create professional support roles. This could reveal fiscal roadblocks to supporting the framework. It would also provide school leaders with a better understanding of the amount of money that is needed to implement the framework. This would allow them to decide if they have enough funding before starting the journey of implementing Thinking Classrooms in a school.

Finally, this study was conducted in a large metro school division in Manitoba. As the Thinking Classrooms framework is being used worldwide, future studies should examine effective practices and supports provided by school leaders in other regions. This would reveal the extent to which this study's findings are applicable in other contexts. It is possible that with different cultural expectations, socio-economics, mathematics curriculums, school designs, or in a rural setting, additional or different optimal leadership practices are needed to support the framework.

Implications for Practice

All of the eight optimal practices can be used by school leaders to support teachers who are establishing Thinking Classrooms in K-12 schools. Although each practice has the potential to have an influence, when combined they make a significant impact. For school leaders who have never supported teachers implementing the Thinking Classrooms framework, the eight optimal practices offer important considerations as they begin their journey. For more seasoned school leaders, they provide helpful reminders and perhaps offer additional practices that even an experienced leader could add to their repertoire. In either case, the findings of this study have the potential to make a positive contribution to practice.

It is important to note that while the school leaders described a need to be deliberate in carrying out each of the eight practices, none of the practices were described as brand new or entirely different from what the school leaders already did to support other initiatives in the school. This is an important distinction between the role of the school leaders and the role of the teachers in implementing the Thinking Classrooms framework. While Liljedahl (2021) found that teachers need to break established classroom norms and create a new reality for mathematics classrooms, this study found that school leaders can alter pre-existing strategies to support the teachers in their work—the school leaders do not need to break established leadership norms to support the framework. This assumes, of course, that the school leaders are actually doing what Leithwood (2011) and others have found to be effective leadership practices in the first place.

Closing Remarks

Through this interview-based qualitative research study, I identified four themes composed of seventeen topics; each of which offered insights into the practices of school

leaders who were supporting teachers with the implementation of the Thinking Classrooms framework in K-12 schools. While listening to the perspectives and experiences of both teachers and school leaders, I heard multiple stories that reaffirmed the important role that school leaders play in guiding and supporting the instruction in a school. To help me understand what the participants were describing and make connections to existing literature, I used Leithwood's (2011) framework of core leadership practices to guide my interpretation and analysis. This proved valuable as it allowed me to determine eight optimal practices for school leaders who want to support teachers who are establishing Thinking Classrooms. These practices are well positioned amongst existing literature in three closely related areas: school leaders' involvement in teacher professional development, agency and collective teacher efficacy. Given that this is the first study that looks at the role that school leaders play in supporting Thinking Classrooms, I hope that it provides practical advice for school leaders and serves as a springboard for future research in this area. Lastly, I hope that this thesis inspires someone to make changes in their practice, like Liljedahl's (2016) work inspired me—I have experienced firsthand that all students can and will think if given the opportunity.

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Appendix A

Semi-Structured Interview Questions for Teachers

1. How did you first hear about Thinking Classrooms? What about it interested you? Why did you decide to attend the professional development sessions on it?
2. What were the professional development sessions like?
    a. What did the session look/sound like?
    b. What was the facilitator's role? What did they say and do?
    c. What was your role? What did you do? How did you feel?
    d. Did anyone go to the sessions with you? What did they do? Did you collaborate in any way?
3. After the professional development sessions, how did you start to implement the Thinking Classrooms framework?
    a. What was easy to implement?
    b. What was challenging? How did you overcome these challenges? Did anyone help you? How did they help?
4. What resources (financial, time, more professional development, etc.) did you need to implement the framework? How did you get these resources? Who helped you get them?
    a. Which of these resources was most important to implement the Thinking Classrooms framework? Why?
    b. Were there any resources that weren't helpful? Why?
    c. Were there any resources that you needed, but couldn't get? Why?

5. Has your school leader(s) helped you implement Thinking Classrooms?
    a. Has this been effective? Why or why not?
    b. What is the same or different about their support of this initiative, compared to other initiatives in the school? Why?
6. What would take your implementation of Thinking Classrooms to the next level? What are your next steps?
7. Is there anything else you would like to tell me about your experience implementing Thinking Classrooms?

Possible Prompts for All Questions:

- Can you expand on that?
- Tell me more about that…
- Can you give me an example?
- How did that happen?
- How did that make you feel?
- What did that look like?
- What were other people doing?
- What was significant about that?
- Why does that stand out in your memory?
- Why do you think you noticed that?
- If I was there, what would I see?

Appendix B

Semi-Structured Interview Questions for School Leaders

1. How did you first hear about Thinking Classrooms? What about it interested you? Why did you agree to have teachers attend the professional development sessions on it?
2. Did you attend the professional development sessions with the teachers? Why or why not? What were the professional development sessions like?
    a. What did the session look/sound like?
    b. What was the facilitator's role? What did they say and do?
    c. What was your role? What did you do? How did you feel?
    d. Did anyone go to the sessions with you? What did they do? Did you collaborate in any way?
3. After the professional development sessions, how did teachers at your school start to implement the Thinking Classrooms framework?
    a. What was easy to implement?
    b. What was challenging?
    c. How did they overcome these challenges? Did you help them? How did you help?
4. What resources (financial, time, more professional development, etc.) did you need to provide to implement the framework? How did you get these resources? Who helped you get them?
    a. Which of these resources was most important to implement the Thinking Classrooms framework? Why?

   b. Were there any resources you couldn't provide? Why?

5. Have you helped teachers at your school implement Thinking Classrooms?
   a. Has this been effective? Why or why not?
   b. What is the same or different about your support of this initiative, compared to other initiatives in the school? Why?
6. What would take your school's implementation of Thinking Classrooms to the next level? What are your next steps?
7. Is there anything else you would like to tell me about your experiences supporting the implementation of Thinking Classrooms?

Possible Prompts for All Questions:

- Can you expand on that?
- Tell me more about that…
- Can you give me an example?
- How did that happen?
- How did that make you feel?
- What did that look like?
- What were other people doing?
- What was significant about that?
- Why does that stand out in your memory?
- Why do you think you noticed that?
- If I was there, what would I see?

Appendix C

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RESEARCH PARTICIPANT INFORMATION AND CONSENT FORM
Individual Interview

Title of Study: Effective School Leadership to Support Innovative Teaching: Mathematics Education Using the Thinking Classrooms Framework

Principal Investigator: Thomas Locke, Master's Student, University of Manitoba [redacted]

Advisor: Dr. Ee-Seul Yoon, Associate Professor, University of Manitoba [redacted]

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

You are being asked to participate in a research study involving an individual interview. Please take your time to review this consent form and discuss any questions you may have with the principal investigator, advisor, your family, or friends before you make your decision. This consent form may contain words that you do not understand. Please ask the principal investigator to explain any words or information that you clearly do not understand.

This research study is being conducted as part of a Master's Thesis in Educational Administration at the University of Manitoba. The thesis advisor is listed above.

This research has been approved by the Research Ethics Board at the University of Manitoba, Fort Garry campus.

Purpose of this Study
This research study is being conducted to understand how school leaders can support the implementation of the Thinking Classrooms framework in Kindergarten to Grade 12 schools.

Participants Selection
You are being asked to participate in this study because:

- you are a teacher who has attended a Thinking Classrooms professional learning cohort and are implementing the Thinking Classrooms framework, or
- you are a school leader who supports teachers that have participated in a Thinking Classrooms professional learning cohort and are implementing the Thinking Classrooms framework.

No one from [redacted] School may participate in this study.

A total of 12 to 20 participants (6 to 10 teachers and 6 to 10 school leaders) will be asked to participate.

Study Procedures

- The method of data collection for this study will be one individual interview per participant.
- The interview is expected to last approximately one hour.
- When arranging a date and time for the interview, participants will be given the option for an in-person interview or an interview via Zoom.
- Teachers will be asked questions relating to their implementation of the Thinking Classrooms framework. Some questions will refer to their own experiences at the Thinking Classrooms professional learning sessions; others will focus on their implementation of the framework and the support received from their school leader(s). These questions will help us to better understand how teachers perceive different supports provided by school leaders.
- School leaders will be asked questions relating to their support of the Thinking Classrooms framework. Some questions will refer to their own experiences/involvement at the teacher professional learning sessions; others will focus on their support of the framework's implementation by teachers. These questions will help us to better understand how school leaders attempt to support the implementation of the Thinking Classrooms framework.
- The interview will be audio recorded using a smart phone and transcribed by the principal investigator to ensure accurate reporting of the information you provide. Transcription will be completed using a software application called Otter.
- Approximately two weeks after your interview, you will be emailed a copy of your transcript as an opportunity to review it for accuracy. If you do not reply to the email with changes within two weeks, it will be assumed that the transcript is accurate or that you do not wish to review it.
- At the completion of the study, you will be provided with a summary of the results via email or regular mail. It is anticipated that you will receive the summary around January 2025.

Risks and Discomforts

There are minimal risks. However, you may find talking about your experiences implementing or supporting the Thinking Classrooms framework to be upsetting or emotional. You do not have to answer any question that makes you uncomfortable or that you find too upsetting. You may choose to end the interview at any time.

Benefits

Participating in the research study may not offer you any direct benefits. However, you may find it interesting to participate in the study and reflect upon your experiences implementing or supporting the Thinking Classrooms framework. The study results may help researchers, educators and school leaders gain a better understanding of how school leaders can better support the implementation of the Thinking Classrooms framework in Kindergarten to Grade 12 schools.

Costs

There is no cost for you to participate in the interview.

Payment for Participation

You will receive no payment or reimbursement for any expenses related to taking part in this study. As a token of appreciation for your time, the principal investigator will offer you a beverage and light snack before starting the interview.

Confidentiality

I will do everything possible to keep your personal information confidential. Your name will not be used at all in the study report. Instead, pseudonyms (for example, "Linda", "Robert", "Gurpreet", "Buffy", etc.) will be used to remove all directly identifying information from the transcription and report. The study report will generalize responses across participants and will include individual quotations. Please note that while you will not be identified as the speaker, quotations will be used to highlight specific points. For example: Linda recalled, "With each lesson the students became more engaged."

All audio recordings will be permanently deleted after being transcribed.

All consent forms will be stored in a folder inside of a locked filing cabinet in the Principal Investigator's home office. All other research data will be stored electronically in UM OneDrive folders; UM OneDrive is protected by two-factor authentication.

The principal investigator is a graduate student at the University of Manitoba. Because this research study is being conducted as part of a Master's Thesis in Educational Administration, the thesis advisor, Dr. Ee-Seul Yoon, will have access to all data. She has a professional responsibility to protect your privacy.

Some people or groups may need to check the study records to make sure all of the information is correct and the study has been conducted properly. This includes the Research Ethics Board at the University of Manitoba. All of these people have a professional responsibility to protect your privacy.

The results of this study will be included in a Master's Thesis that will be posted on the University of Manitoba's public repository for scholarly works, MSpace. They may also be published as part of a journal article, conference presentation, or other publications.

Some data and information from this study may be sent outside of the University of Manitoba to other researchers, organizations, or made publicly available. This is for further analysis, testing, as part of the research study, or a requirement by a granting agency or journal. Any information sent out of the University of Manitoba will not show your name or address, or any other identifiable personal information about you. However, despite efforts to keep your personal information confidential, absolute confidentiality cannot be guaranteed. Your personal information may be disclosed if required by law.

All confidential data will be permanently deleted by January 2026.

Voluntary Participation/Withdrawal from the Study

Your decision to take part in this study is voluntary. You may refuse to participate or you may withdraw from the study at any time. You can choose to not answer any questions that make you feel uncomfortable, and can choose to end the interview at any time. There are no negative repercussions for choosing to skip a question or ending the interview. If during the interview you decide that you would like to withdraw from the study, please tell the principal investigator. The principal investigator will then stop audio-recording, thank you for your time and permanently delete your data with no consequences to you. After the interview, please notify the principal investigator by email if you wish to withdraw from the study. You may choose to withdraw your data from the study until the data analysis portion of the study begins, which will occur in September 2023.

Questions

If any questions come up before, during or after the study, contact the principal investigator or thesis advisor.

For questions about your rights as a research participant, you may contact the University of Manitoba, Fort Garry Campus Research Ethics Board Office at (204) 474-7122.

Consent Signatures

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for

clarification or new information throughout your participation.

The University of Manitoba may look at your research records to see that the research is being done in a safe and proper way.

This research has been approved by the Research Ethics Board at the University of Manitoba, Fort Garry campus. If you have any concerns or complaints about this project you may contact any of the above-named persons or the Human Ethics Officer at 204-474-7122 or HumanEthics@umanitoba.ca. A copy of this consent form has been given to you to keep for your records and reference.

Participant signature: _____ **Date:** _____

Participant printed name: _____

Participant email address for summary of results: _____

OR, Participant mailing address for summary of results:

Address:_____ **City:**_____ **Postal Code:**_____

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has knowingly given their consent.

Signature: _____ **Date:** _____

Printed name: _____

Role in the study: _____

Appendix D

University of Manitoba | Research Ethics and Compliance

Human Ethics - Fort Garry
208-194 Dafoe Road
Winnipeg, MB R3T 2N2
T: 204 474 8872
humanethics@umanitoba.ca

PROTOCOL APPROVAL

Effective: January 4, 2023 Expiry: January 3, 2024

Principal Investigator:	Thomas Locke
Advisor:	Ee-Seul Yoon
Protocol Number:	HE2022-0346
Protocol Title:	*Effective School Leadership to Support Innovative Teaching: Mathematics Education Using the Thinking Classrooms Framework*

Andrea L Szwajcer, Chair, REB2

Research Ethics Board 2 has reviewed and approved the above research. The Human Ethics Office (HEO) is constituted and operates in accordance with the current *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans*- TCPS 2 (2018).

This approval is subject to the following conditions:

i. Approval is granted for the research and purposes described in the protocol only.

ii. Any changes to the protocol or research materials must be approved by the HEO before implementation.

iii. Any deviations to the research or adverse events must be reported to the HEO immediately through an REB Event.

iv. This approval is valid for one year only. A Renewal Request must be submitted and approved prior to the above expiry date.

v. A Protocol Closure must be submitted to the HEO when the research is complete or if the research is terminated.

vi. The University of Manitoba may request to audit your research documentation to confirm compliance with this approved protocol, and with the UM *Ethics of Research Involving Humans*Ethics of Research Involving Humans policies and procedures.