Perceptions of Elementary Mathematics Coaching

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ABSTRACT

This study investigated elementary mathematics coaching from the point of view of two coaches, five elementary classroom teachers, and two principals in an urban school board in Ontario. Case studies were conducted of the two coaches and their work with their respective teachers. Qualitative data was collected through a series of ongoing observations of both teachers and coaches. Additionally, interviews were conducted near the beginning and end of the study with each coach, teacher, and principal.

The teaching experience of the teachers in the study ranged from three to seventeen years and from kindergarten through grade five. The coaching program in the school board was in its fourth year of implementation. One coach had been working as a coach since the inception of the program and the other was in her third year of coaching. Evidence from the study leads to six major findings: (1) all participants indicated that engaging in coaching brought about change in the teachers’ classroom practices; (2) all participants were unable to clearly define a change in student learning due to coaching; (3) trusting and collaborative relationship between teachers and coaches is important to teacher engagement in coaching; (4) co-teaching and model lessons are the coaching structure with most impact; (5) time is the major barrier to coaching; (6) high quality professional development designed to meet the coaches’ learning needs and the existence
of a coaching network to offer support are fundamental to sustaining a coaching program over time.

Implications from this study suggest that coaching programs that include an emphasis on collaboration through reflective discussion and co-teaching are likely to bring about identifiable changes in teacher practice. School boards will need to find ways to ease the challenges that time presents to working with a coach in order for the changes to spread across the district. This study suggests that it is imperative that school boards identify and provide quality professional development to their coaches in order to sustain the changes that occur in practice. Suggestions for stakeholders implementing coaching programs and future research on coaching are included at the end of the study.
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# TABLE OF CONTENTS

## CHAPTER ONE: INTRODUCTION

1.1 Introduction 1
1.2 Research Context 2
1.3 Purpose of the Study 6
1.4 Statement of the Problem 6
1.5 Significance of the Study 7
1.6 Researcher: Personal Background 7
1.7 Limitations of the Study 11
1.8 Plan of the Thesis 11

## CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction 13
2.2 Professional Development
   2.2.1 Traditional and reform professional development 13
   2.2.2 Professional development for teachers of elementary school mathematics 15
2.3 Coaching
   2.3.1 Structural supports 19
   2.3.2 Effective coaching skills 21
   2.3.3 Challenges and barriers 23
   2.3.4 Mathematics coaching 25
2.4 Teacher Change
   2.4.1 History of educational change 30
   2.4.2 Aspects of teacher change 31
   2.4.3 Collaboration 33
   2.4.4 Dialogue 35
   2.4.5 Model lessons 36
   2.4.6 Professional development to foster change 37
   2.4.7 Internal and external factors impacting change 38
2.5 The Ten Dimensions of Mathematics Education 39
2.6 Summary 40
CHAPTER THREE: METHOD

3.1 Introduction 42
3.2 Research Approach and Design 42
3.3 Research Study 44
   3.3.1 Participants 44
   3.3.2 Data collection 45
   3.3.3 Data analysis 48
3.4 Internal Validity 48
3.5 External Validity 49
3.6 Ethical Considerations 50
3.7 Conclusion 50

CHAPTER FOUR: CASE STUDIES 51

4.1 Introduction 51
4.2 Oakside School 51
4.3 The Case of Lynette 53
   4.3.1 Background information 53
   4.3.2 Lynette’s teachers: Background information 55
   4.3.3 Defining her role 60
   4.3.4 Coaching goals 62
   4.3.5 Defining success 65
   4.3.6 Challenges confronting her work 71
   4.3.7 Aspirations 74
4.4 Reflections of Lynette’s Teachers: Sarah, Nick, and Ellen 76
   4.4.1 Views on coaching 76
   4.4.2 Goals 78
   4.4.3 Impact on practice 80
   4.4.4 Impact on student learning 85
   4.4.5 Challenges 86
   4.4.6 Looking forward 88
4.5 Principal Reflections: Suzanne 90
4.6 Summary of Coaching at Oakside School 93
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.7</td>
<td>Maple Downs School</td>
<td>95</td>
</tr>
<tr>
<td>4.8</td>
<td>The Case of Natalia</td>
<td>97</td>
</tr>
<tr>
<td>4.8.1</td>
<td>Background information</td>
<td>97</td>
</tr>
<tr>
<td>4.8.2</td>
<td>Natalia’s teachers: Background information</td>
<td>99</td>
</tr>
<tr>
<td>4.8.3</td>
<td>Defining her role</td>
<td>102</td>
</tr>
<tr>
<td>4.8.4</td>
<td>Coaching goals</td>
<td>105</td>
</tr>
<tr>
<td>4.8.5</td>
<td>Defining success</td>
<td>107</td>
</tr>
<tr>
<td>4.8.6</td>
<td>Challenges confronting her work</td>
<td>113</td>
</tr>
<tr>
<td>4.8.7</td>
<td>Aspirations</td>
<td>115</td>
</tr>
<tr>
<td>4.9</td>
<td>Reflections of Natalia’s Teachers: David and Kim</td>
<td>116</td>
</tr>
<tr>
<td>4.9.1</td>
<td>Views on coaching</td>
<td>116</td>
</tr>
<tr>
<td>4.9.2</td>
<td>Goals</td>
<td>118</td>
</tr>
<tr>
<td>4.9.3</td>
<td>Impact on practice</td>
<td>119</td>
</tr>
<tr>
<td>4.9.4</td>
<td>Impact on student learning</td>
<td>123</td>
</tr>
<tr>
<td>4.9.5</td>
<td>Challenges</td>
<td>124</td>
</tr>
<tr>
<td>4.9.6</td>
<td>Looking forward</td>
<td>125</td>
</tr>
<tr>
<td>4.10</td>
<td>Principal Reflections: Heather</td>
<td>127</td>
</tr>
<tr>
<td>4.11</td>
<td>Summary of Coaching at Maple Downs</td>
<td>130</td>
</tr>
</tbody>
</table>

CHAPTER FIVE: CROSS CASE ANALYSIS, INTERPRETATION, AND DISCUSSION

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Introduction</td>
<td>132</td>
</tr>
<tr>
<td>5.2</td>
<td>Research Questions</td>
<td>132</td>
</tr>
<tr>
<td>5.2.1</td>
<td>Research questions</td>
<td>133</td>
</tr>
<tr>
<td>5.3</td>
<td>Major Findings</td>
<td>153</td>
</tr>
<tr>
<td>5.4</td>
<td>Implications of Findings for Future Research</td>
<td>154</td>
</tr>
<tr>
<td>5.5</td>
<td>Suggestions for Stakeholders in Elementary Mathematics Coaching Programs</td>
<td>157</td>
</tr>
<tr>
<td>5.6</td>
<td>Summary</td>
<td>160</td>
</tr>
</tbody>
</table>

REFERENCES                                                                 | 162  |
FIGURES

Figure 1: Direction of Coaching Impact 30

TABLES

Table 1: Classroom Observations 46
Table 2: Attitudes and Practices for Teaching Mathematics: Oakside School 60
Table 3: Attitudes and Practices for Teaching Mathematics: Maple Downs School 102
Chapter One: Introduction

1.1 Introduction

The purpose of this research is to investigate how an elementary school mathematics coaching process is experienced by elementary teachers, coaches, and school principals. Mathematics coaching is a growing model of embedded professional development in North America, yet there currently exists limited evidence about the way it is perceived by those involved. This topic was chosen due to both my professional experiences and my personal beliefs.

As a former elementary mathematics coach, I think that coaching is a promising form of professional development; one that can help to bring the successful implementation of recent mathematical reforms into elementary classrooms. However, my experience as a coach also leads me to believe that the changes necessary to bring about this successful implementation do not always occur. Despite spending a great deal of time working with teachers both in and out of the classroom, I was always left wondering what, if any, impact my work was having on the teachers’ understanding of and beliefs about mathematics as well as on their classroom practices. I had no evidence that my work made an impact one way or another. The desire to better understand the effects of my own personal work, combined with the limited literature related to mathematics coaching has led me to my topic and my initial research questions.

This thesis will outline the context of my research, my personal background, research questions, conceptual framework, the existing literature relevant to teacher change, teacher professional development and coaching, and my proposed research methodology. The data will be presented as case studies of two coaches and their work with a total of five teachers. The case
studies will be analyzed in relation to the research questions and literature. Finally, implications of the findings and suggestions for future research will be discussed.

1.2 Research Context

For over two decades, the National Council of Teachers of Mathematics (NCTM) has been advocating for a change in the way mathematics in North America is taught and learned. Among the reforms that the NCTM calls for in the document “Principles and Standards of School Mathematics” (2000) are high expectations for every child at every grade level, teachers who understand mathematical content deeply, who know what their students need to learn, who can effectively challenge their students, and students who learn mathematics with depth, who can connect content to prior knowledge, and who are able to gain knowledge actively, through experience. The NCTM envisions reform mathematics classrooms in North America as dynamic, interactive, challenging, and based on constructing deep meaning.

Disappointing student results on international mathematics assessments such as the Trends in International Mathematics and Science Study (TIMSS) (International Association for the Evaluation of Educational Achievement, n.d.) and Programme for International Student Assessment (PISA) (Organisation for Economic Co-Operation and Development, n.d.) particularly in the United States contribute to the calls to change mathematics education and highlight weaknesses in the mathematics instructional process.

Stigler and Hiebert (1999b) studied videos of teaching in Japan, Germany, and the United States as part of the 1995 TIMSS. The authors found that there were vast differences in the mathematics classrooms that were observed. However, they also believed that teachers in each of the three countries did a very good job of teaching mathematics according to their cultural scripts of teaching and learning mathematics. A cultural teaching script is, “a commonly accepted and
A predictable way of structuring a classroom session and sequencing the instructional activities” (Stigler & Hiebert, 1999a, p. 127). The scripts are implicit ideas about what teaching and learning is supposed to look like that teachers keep in mind when teaching (Jacobs & Morita, 2002). The poor performance of North American students in mathematics is not due to poor teaching. The American teachers, in fact, were quite capable of teaching in a way that matches their script. The difficulty is that the North American cultural script for teaching mathematics is not sufficient to promote high levels of mathematical understanding and thus it needs to change.

The deficiency of the cultural script that is used in North America has direct results on the students’ academic futures. Within the United States, mathematics has become the primary “gatekeeper” course to higher education and high-status professions (Lubienski, 2007; Singham, 2003). According to Singham (2003), the strongest effect on post-secondary degree completion is the highest level of mathematics completed. She states that students who are able to take a class beyond Algebra 2 have more than double the odds of completing a bachelor’s degree than those who do not. However, the National Research Council found that the number of students who continue to study mathematics is cut in half each year from high school through graduate school (Schoenfeld, 2002a) and that “when mathematics acts as a filter, it not only filters students out of careers, but frequently out of school itself” (Schoenfeld, 2002a, p. 14).

For too long, success in elementary mathematics has been defined as the ability to memorize and apply procedures. Lubienski (2007) indicates that, “students who approach mathematics by merely memorizing rules are less likely to retain what they have learned than are students who have deep understandings of mathematical concepts and relationships” (p. 3). However, altering long held, implicit beliefs about teaching is difficult. This challenge in effecting change is exacerbated by the fact that many American teachers have poor content
knowledge of mathematics. Ma’s (1999) study of elementary school teachers’ profound understanding of fundamental mathematics found that American teachers lack significant depth of mathematical knowledge and understanding, despite the extensive schooling they receive. In order to improve student learning, teachers need to change their cultural script or practice of teaching mathematics. This involves both improving teachers’ mathematical content knowledge and making changes to long held pedagogical beliefs.

Teachers’ classroom practices impact their students’ achievement. The NCTM (2000) links teaching in a reform-oriented classroom to children learning mathematics more deeply. For teachers to use the reform methods of teaching called for by the NCTM successfully, they will have to feel comfortable with the content that they are teaching, and have a positive disposition towards both the teaching and the learning of mathematics. Since many of today’s teachers participated in math classes that were far different from the type described by the NCTM, one way to educate teachers on content and new pedagogy is through professional development.

However, traditionally poor pre-service teaching and ineffective professional development opportunities only serve to make problems with mathematics education worse. Ball, Sleep, Boerst and Bass (2009) discuss a number of issues that plague pre-service teacher education. Among them is the lack of shared curriculum for pre-service teachers of mathematics, and a lack of agreement about the knowledge and skills to be gained in such a course. This results in a diversity of experiences in which teacher-candidates learn from their co-operating teacher in their field placement and from their professor. There is no control for the content or quality of teaching to which a pre-service teacher will be exposed. Furthermore, the authors highlight the focus in pre-service courses on analyzing and reflecting on teaching and not on actual methods of teaching. They argue that more time needs to be actually spent on the practice
of teaching mathematics and on learning the pedagogical content knowledge for teaching mathematics.

Once pre-service teachers enter the classroom, there is typically minimal opportunity for them to engage in high quality professional development. Dorph and Holtz (2000) indicate that only 2% of professional development has the 4 criteria necessary to be deemed high quality: i) connected to content knowledge, ii) designed with clear and focused audience in mind, iii) sustained over time with a coherent plan, and iv) opportunities to reflect, analyze, and work on practice are given. Dessimone and Porter (2002) support the findings of Dorph and Holtz. They found that less than one quarter of teachers in their study had experienced high quality professional development and that most district-supported professional development did not meet the definition of high quality.

It is within this context, one in which the need for a change in instruction in order to improve student achievement and increase the retention of students in mathematics’ classrooms is becoming critical, that mathematics coaching has emerged. Teachers continue to struggle with both the content and the pedagogical content currently required of them and traditional, low-quality professional development opportunities are not leading to effective, sustained implementation of reform-oriented pedagogies. Coaching meets the definition of high quality professional development due to the fact that it is designed to meet both the pedagogical and content needs of each particular teacher, is ongoing, and is built around opportunities for trying out different practices and reflective discussion of those attempts. However, as coaching continues to gain popularity, and is increasingly being adopted in school districts as a way to improve both teaching and learning, there remains very little research on its efficacy. More research is needed on the impact of coaching in order for the mathematics community to better
understand how, when, and why coaching does and does not affect instruction and how those effects later translate to student achievement.

1.3 Purpose of the Study

The purpose of this study is to investigate the way in which the mathematics coaching process is experienced and perceived by elementary mathematics teachers, coaches, and school principals.

1.4 Statement of the Problem

The problem that I explored in my research is to determine the perceptions that are formed by teachers, coaches, and principals who are engaged in mathematics coaching.

In order to investigate this problem, I conducted observations of two elementary mathematics coaches and their work with five classroom teachers. My observations occurred during pre- and post-lesson meetings between the coach and the teacher, during lessons that were modeled by the coach, during lessons that were co-taught by both the teacher and the coach, during lessons taught by the teacher while the coach was in the room, and during lessons taught by the teacher without the coach’s presence. I conducted semi-structured interviews with each coach, teacher, and the principal at each teacher’s school toward the beginning of the study and again after the observations were complete. In addition, I conducted one interview with a former mathematics instructional leader from the school district in which the study occurred.

The research questions that I investigated were:

1. What are the mathematics teachers’ perceptions of the impact of coaching on their practice?
2. What are the mathematics coaches’ perceptions of the impact of coaching on teachers’ practices?
3. How do the teachers experience the coaching process?

4. How does coaching affect elementary mathematics teachers’ beliefs about the teaching and learning of mathematics?

5. What are the challenges that impede and the elements that enable a coaching program?

By focusing on these questions over three months of observations and interviews, I was be able to document changes made in each teacher’s practice in the areas above both in the coach’s presence and when the teacher was instructing alone.

1.5 Significance of the Study

This study is expected to contribute to the demonstrated need for research in the emerging field of mathematics coaching and will therefore benefit the mathematics research community. As the results of this study will provide information about the practice of coaching and its perceived effects on teacher development and teacher change, it will have direct implications for a number of practitioners. These practitioners include school board members, administrators, both those already employing coaches and those considering adopting a mathematics coaching program, elementary mathematics coaches, and the teachers with whom they work.

1.6 Researcher: Personal Background

My interest in the effects of elementary mathematics coaching stems from my experience as a fifth grade classroom teacher in an American school district that was implementing a standards-based (reform) mathematics curriculum and later from my role as the elementary mathematics coach for the district.
As a young child, I always received good marks in mathematics classes. However, toward the end of my high school experience, I began to struggle with the more difficult concepts that were presented in classes such as calculus. This experience left me feeling certain that I was not “good” at math, and I thus opted out of taking additional math classes once I entered university.

During my teacher-training experience, I was introduced to a more reform-oriented style of teaching mathematics. I was surprised to find myself making sense of mathematics for the first time. I finally understood that there were reasons underlying all of the mathematical procedures I had memorized, and found that I made more sense of mathematics once I had a stronger conceptual understanding of it. I wondered why I had not had the opportunity to learn mathematics in this fashion as a child, and how learning mathematics with an emphasis on conceptual understanding might have changed my year of calculus and the choices I made for my courses in university.

As I became more interested in and curious about the methods that were being advocated for in mathematics education, I grew more excited to begin my career teaching mathematics using an approach that was different from the one I had experienced as a child. It was my belief that, if young students could make sense of mathematics, and not simply memorize it, they would begin to enjoy it, and would have the necessary tools to understand more advanced mathematics, such as calculus. I was, therefore, disappointed with the traditional approach that was being used in my district when I was first hired and volunteered to pilot a new standards-based mathematics curriculum.

As a part of the support offered to the small number of teachers piloting the curriculum, I had an outside consultant come into my mathematics class once a week to help me plan, to
observe, and to give me feedback on my lessons. I felt that this support greatly helped me to reflect upon and to modify my practice, and noticed my practice changing. I found myself changing the types of questions I was asking so that I could generate multiple responses, changing the way I responded to the students’ comments so that they would have to support and validate their ideas without my telling them if they were right or wrong, encouraging multiple and varied solutions to mathematics problems, and supporting the use of tools such as manipulatives more frequently.

However, when the curriculum was implemented across the district the following year, the in-class support was removed and professional development became much more traditional. We had a one day workshop approximately every other month. These workshops focused primarily on the materials we would need, on ways to organize our students, and on the structure of the teacher guides. This was the sort of professional development that the teachers expected and asked for. When the Mathematics and Science Curriculum Director attempted to bring in an outside consultant to observe instruction and provide feedback in the third year of implementation, she was met with a great deal of resistance from the teachers. Ultimately, the outside mathematics consultant who was hired came to each school only once during the year, and worked with only two teachers at each school. The ten teachers who worked with the outside mathematics consultant had either piloted the curriculum, were on the district’s mathematics leadership team, or were in their first year of teaching.

After three years of full implementation of the standards-based mathematics program, the district’s scores on the state standardized mathematics test (taken in every grade from third through tenth) had not improved. The district administration decided to hire an internal mathematics coach to work with the teachers at the five elementary schools with the goal of
raising mathematics proficiency scores. I was hired and it was my responsibility to work with over 100 teachers across the district to improve student learning.

My experience as a mathematics coach was varied. There were many teachers who were not open to my presence. I spent the bulk of my time trying to gain trust and access with these teachers. Our work focused primarily on acquiring and creating materials and on the broad planning of units.

There were other teachers who were neutral to working with me. I felt that they understood and accepted the fact that we were required to work together, and they were always willing to work with me. They expressed interest in having me model a standards-based lesson and would gamely try a new approach if I suggested it. Yet, I did not feel as though these teachers harboured a desire to make any changes to their practice. In fact, many disliked the standards-based program and spoke openly of their preference for a more traditional approach to mathematics education. These teachers were able to adapt the standards-based curriculum in order to teach it in a more traditional way, and continued to emphasize procedural and rote knowledge over conceptual understanding.

There were many other teachers who were very receptive to my role with whom I worked collaboratively to plan and implement lessons. These teachers would seek out my advice and assistance, were eager for feedback, and showed a genuine curiosity about ways to align their practice more closely to reform methods.

No matter how willing a teacher may have been to work with me, though, I had no evidence about the impact of my work. I certainly observed changes in practice over time with a small number of teachers, and attempts at changing practice with others. I could not be certain, though, that these changes were sustained after I left the classroom or the school. While
standardized test scores did begin to improve in the district, there was no proof that these improvements were based on my work, and were not a result of growing teacher and/or student comfort and familiarity with the mathematics program.

1.7 Limitations of the Study

This study examined two coaches and their work with five teachers. Mathematics coaching is still an emerging field, and coaches’ job descriptions and responsibilities vary from district-to-district, school-to-school, and even from teacher-to-teacher. Thus, due to the small sample size, it will be difficult to make generalizations beyond cases with similar characteristics as those that were studied. While large generalizations will be hard to make, this study will illuminate whether teachers, coaches, and principals perceive coaching as having an impact on their practice and beliefs in five different cases. It will be difficult to assert that coaching will bring about specific classroom-based changes universally, for example to a specific teacher response or questioning style. However, the information will highlight whether classroom-based changes are indeed made by those teachers who engage in coaching. Additionally, participants involved in this study will be able to provide information about the aspects of coaching that are useful for supporting change and the aspects that impede it. This information will provide more evidence about the efficacy of coaching as a form of professional development.

1.8 Plan of the Thesis

The thesis is arranged into five chapters. The first chapter provides introductory information about the research problem, the questions that were investigated, the researcher’s background, and situates the research in the larger context of curriculum studies and teacher development.
The second chapter provides a review of the literature related to teacher professional development in elementary mathematics and coaching. Particular attention is given to the rising field of mathematics coaching and includes information and analysis of the studies that have been conducted on coaching thus far. The chapter includes information about the teacher change process and the Ten Dimensions of Mathematics Education and its use in identifying aspects of practice that are impacted by engaging in mathematics coaching as a form of professional development.

The third chapter describes the methods that I used to conduct my study. This chapter includes the rationale for the study, the protocol for observation, and the interview questions. Methods of data collection, recording, and analysis are also discussed thoroughly. Chapter three describes the study participants and how they were recruited for the project. Finally, this chapter describes ethical considerations such as the masking of identities, and the protection of data.

Chapter four presents the findings of the research study. The data is presented through case studies of the coaches and their work with five elementary classroom teachers.

The final chapter, chapter five, presents a discussion of the data in relation to the original research questions. The findings are also linked to the literature about teacher change, professional development for elementary mathematics teachers, and elementary mathematics coaching. The implications of these findings and suggestions for future research are shared.
Chapter Two: Literature Review

2.1 Introduction

Professional development in mathematics for elementary school teachers is often designed as a one day workshop during which an expert from outside of the school district provides an overview of a particular teaching strategy, curriculum, or content. This more traditional form of professional development rarely includes assistance with implementation of the new skill, follow up support, or an opportunity for teachers to evaluate and reflect upon the work they are engaged in. This literature review examines new paradigms for professional development for elementary mathematics teaching, with particular attention given to coaching. The relationship between elementary mathematics coaching and the development of reform-based teaching practices will then be explored as will the implications of this type of professional development in relation to teacher change.

2.2 Professional Development

2.2.1 Traditional and reform professional development

Traditionally, professional development and staff development occurred in workshops that were disconnected from the classroom and curriculum, lacked intellectual depth, and were fragmented occurrences (Lowenberg Ball & Cohen, 1999). Despite a low level of transfer into the classroom from these experiences (Showers & Joyce, 1996), Lowenberg Ball and Cohen (1999) indicate that this form of professional development is still common in most schools. However, a growing understanding about what students need to know and how teachers should teach has led to the realization that teachers cannot simply be told what to do in a classroom one day and be expected to successfully implement it the next (Lampert & Lowenberg Ball, 1999). Teachers need knowledge for teaching, and need to acquire new skills, behaviours,
attitudes, and depth of content knowledge (Loucks-Horsley, Love, Stiles, Mundry, & Hewson, 2003). Hawley and Valli (1999) call this “[a]n almost unprecedented consensus [...] among researchers, professional development specialists, and key policymakers on ways to increase the knowledge and skills of educators substantially” (p. 127). The new conceptualization of professional development links school change to quality professional development, and highlights collaboration and the opportunity for teachers to solve problems that emerge in their practice (Hawley & Valli, 1999). The goal of professional development is to improve student achievement through change in teacher practice (Loucks-Horsley, et al., 2003).

In order for this change to take place, schools need to break away from the traditional factory model and become a model that allows room to function as a learning group, or a professional learning community (PLC) (Dufour & Eaker, 1998). Professional learning communities enable collective inquiry that increases awareness. That, in turn, leads to changes in attitudes and beliefs and then to changes in the teaching and learning processes in the school (Dufour & Eaker, 1998). In addition to time being provided for collaboration during the school day, the new vision of professional development includes the presentation and explanation of theories that underlie practice, demonstration of pedagogies, the opportunity for guided practice, and the chance to receive prompt feedback (Showers, Joyce & Bennett, 1987 in Dufour & Eaker, 1998).

In describing quality professional development, Loucks-Horsley et al. (2003) indicate that it needs to be designed around an image of effective classroom learning, be research-based, use practices that will also be used with students, be based on student learning data, allow opportunities for teachers to build pedagogical content knowledge, content knowledge, and knowledge about practice, and provide opportunities for collaboration with colleagues. An
important aspect of this type of professional development is that there is time for reflection on both past and current actions. It should not be seen as additive, with more being added for teachers to do and learn, but instead as transformative (Loucks-Horsley, et al., 2003). The Annenberg Institute for School Reform (n.d.) reports that recent research has found that professional development is most effective when it is based in schools, collaborative, embedded in practice, inquiry-based, and designed to address the needs identified by teachers and to increase teachers’ theoretical understanding.

2.2.2 Professional development for teachers of elementary school mathematics

The National Council of Teachers of Mathematics advocates for reform mathematics teaching and learning. Reform mathematics is focused not only on computational and procedural skills, but also on mathematical thinking and reasoning, and diverse strategies for solving problems. In addition to number and operations, algebra, geometry, measurement, and data analysis, the NCTM includes standards for problem solving, reasoning and proof, communication, connections, and representation (Principles and Standards of School Mathematics, 2000). Teachers guide the learning process of students and must therefore attain the mathematical and pedagogical skills required to do this effectively. The NCTM encourages teachers to engage in collaborative work with colleagues and engage in high quality professional development around mathematics. The NCTM also calls for teachers to make time to reflect and analyze their teaching individually and collaboratively in order to improve their instruction (Principles and Standards for School Mathematics, 2000).

Thus, many teachers are being asked to teach mathematics in a way that is wholly anathema to what they experienced as students. This presents a great challenge and impediment to instructional change as teachers often revert back to the way they were socialized into
understanding the teaching and learning process as children (Lowenberg Ball & Cohen, 1999).

To ensure the sustainability of reform efforts, Lowenberg Ball and Cohen (1999) argue that teachers’ learning needs to occur in the types of practice that are advocated for by reform mathematicians.

Lowenberg Ball, Hill and Bass (2005) argue that efforts in reform mathematics will fail if the mathematical knowledge of teachers is not improved. Mathematical knowledge for teaching is more than simply knowing how to carry out an algorithm or whether an answer is correct or incorrect. It includes anticipating and understanding errors students make in procedures, how to explain mathematical ideas, the ability to listen to and make sense of student thinking, knowing which examples, models, and assessments are appropriate for specific content and skills, and understanding which type of mathematical language is appropriate in different situations. Lowenberg Ball, Hill and Bass (2005) found that teachers who score higher in measures of mathematical knowledge for teaching produce more gains in student achievement than those with a lower level of mathematical knowledge for teaching. In fact, the effect of having a teacher within the highest quartile of mathematical knowledge for teaching is comparable to the effect of socio-economic status on student test scores.

However, adult mathematical knowledge for teaching is typically low (Lowenberg Ball, Hill & Bass, 2005). In order to improve student learning, the authors argue that professional development cannot consist simply of changing standards or curriculum, and instead must also aim to improve teachers’ mathematical knowledge for teaching.

2.3 Coaching

Showers and Joyce are widely credited with introducing the idea of peer coaching in the 1980s (Black, Molseed, & Sayler, 2003; Hargreaves & Dawe, 1990; McGatha, 2008). In their
article tracing the changes in coaching practices over time, Showers and Joyce (1996) indicate that they first purposed the idea of coaching because studies done in the 1970s showed that typical professional development did not lead to teacher change or to the implementation and spread of new ideas. The authors state that the assumption that teachers would take what they had learned during professional development training and implement it in their own classrooms without support was proven false and point to the fact that less than 10% of teachers were implementing what they had learned in their workshops. Showers and Joyce (1996) did not believe that this was the fault of the teachers, but that it was a result of a poorly designed training system and advocated for a new model of professional development. They described peer coaching as a form of training that included modeling and practice, was non-evaluative, and had focus on curriculum and innovation.

The work that was done on coaching in the 1980s focused primarily on individuals and small groups of teachers (Showers & Joyce, 1996). In the 1990s, the scope of coaching shifted toward using peer coaching as a collaborative endeavour that required the participation of the entire school faculty (Showers & Joyce, 1996). In 2009, Knight pointed to the continued growth of coaching over the last decade as being a result of the ongoing recognition that traditional professional development did not lead to teacher change.

Coaching is alternatively described as a job-embedded form of professional development with the purpose of directly improving student learning (Brady, 2007; Sweeney, 2007), or with the purpose of improving professional practice (Knight, 2007, Loucks-Horsley, et al., 2003). Saphier and West (2009) highlight the connection between these two goals by indicating that the primary purpose of a coach is to focus on improving instruction that will improve learning. Within a school, only coaches work side by side with teachers towards this aim, without
engaging in evaluation (Saphier & West, 2009). Regardless of its expressed purpose, coaching is grounded in the principles of effective professional development (Annenberg Institute for School Reform, n.d.) and the commonly held view is that coaching works to end isolation and individualization that often defines teacher practice (Bruce & Ross, 2008; Dufour, 1998; Hargreaves & Dawes, 1990).

While Killion (2006) states that quality instruction is the core of a coach’s work, the roles and responsibilities of a coach are vast and there exists little agreement as to exactly what defines the job of a coach. Various authors point to different tasks including: leading professional development, answering questions about teaching and learning, mentoring new teachers, forming relationships with parents and community members, working with the central office on school goals, advocating for policies and resources, implementing new instructional approaches (Pankake & Moller, 2007), building content leadership, ensuring instruction meets student needs, aligning curriculum with state standards (Sweeney, 2007), modeling lessons, co-planning, improving teachers’ capacity for reflection and analysis of lessons (Brady, 2007), and sharing knowledge (Loucks-Horsley, et al., 2003). While it is evident that a clear vision of what defines a coach is lacking, school-based coaching does meet many of the National Staff Development Council’s (NSDC) “Standards for Staff Development” (Russo, 2004). Among the criteria included by the NSDC for effective professional development that align with the role of a coach, are the organization of learning communities, resources and support provided for adult learning, collaboration, and a focus on both content and pedagogical knowledge (National Staff Development Council, n.d.).

Five different types of coaching are prevalent in schools (Black, Molseed, & Sayler, 2003). The first, peer coaching, involves two or more teachers observing each other with a focus
on instructional skills. The second, collegial coaching, again involves two or more teachers who are this time focusing on improving an area of instruction that has been chosen by the observed teacher. The third, challenge coaching, has the goal of solving a persistent problem. Cognitive coaching is designed to support teachers in reflecting on their own practice, and technical coaching is aimed at supporting the transfer of ideas from professional development workshops into the classroom (Black, Molseed & Sayler, 2003).

Despite the numerous types of coaching and responsibilities of a coach, Knight (2009) points to a number of common features including the fact that coaching is job-embedded, requires an equal partnership between the coach and the teacher, is a long lasting, intensive relationship, engages in dialogue and reflection, is confidential and non-evaluative, and requires thoughtful communication. Loucks-Horsley, et al. (2003) indicate that the key features of coaching are that it involves a focus on improvement, with a pre-determined goal, and that it follows a cycle of pre-conference, observation, and debriefing.

2.3.1 Structural supports

Instructional coaching is viewed as an alternative to traditional professional development, which has proven continually unsuccessful in bringing about teacher change (Showers & Joyce, 1996; Knight, 2009). Among the benefits to coaching is the fact that it is on-site (Knight, 2007), ongoing (Knight, 2009), and is adaptable in order to meet the needs of different teachers and students (Confer, 2006; Knight, 2007; West & Staub, 2003). Brady (2007) and Bruce and Ross (2008) indicate that coaching should be a part of a whole school reform effort. Furthermore, Bruce and Ross (2008) point to coaching as being an effective tool for overcoming privatization in teaching and building a school community during reform efforts. Simply hiring a coach will
not guarantee a change in school climate or in teacher practice. Specific structural supports are necessary in order to enable coaches to do their jobs.

A well designed coaching program is one in which the teachers and coach are equal partners and the teachers have choice about what and how they learn (Knight, 2007). Coaches are often are hired from within the teaching staff at a school (Sweeney, 2007). In order to ensure that an equal status relationship occurs, principals must understand the confidentiality of the teacher-coach relationship (Brady, 2007) and work to foster and protect those peer relationships (Pankake & Moller, 2007). Given the extensive options for coaching responsibilities, it is important for the administration to work with the coach to form an action plan that includes short and long term goals, and outlines the coach’s responsibilities (Pankake & Moller, 2007; Wong & Nicotera, 2003).

School administrators also need to be available to meet with their coaches, provide the resources that are necessary to reach their goals, avoid assigning administrative or other non-coaching roles to the coach, and provide their coaches with any important information about the teachers and students with whom the coaches will be working (Pankake & Moller, 2007; Wong & Nicotera, 2003). Most importantly, administrators need to ensure that they provide adequate time for coaches to meet with their teachers before and after observations (Knight, 2009). This time is necessary for dialogue and reflection to occur.

In addition to structural and administrative support, coaches also need access to ongoing training and professional development designed specifically for coaches (Brady, 2007; Pankake & Moller, 2007; Wong & Nicotera, 2003). As indicated earlier, many coaches come directly from a classroom environment. Working with students is not the same as working with teachers and coaches need training on skills related to understanding adult learners (Brady, 2007).
Coaches are regarded as leaders in their districts and need support and training in leadership skills (Pankake & Moller, 2007) and communication skills (Brady, 2007). Coaches are subject area specialists and need to have deep and current content knowledge as well as pedagogical knowledge (Brady, 2007). Finally, coaches need to have training on how to gather, analyze, and use a variety of types of data, including student work and local assessments (Brady, 2007), in order to understand where student learning is weak and strong and to locate areas in need of improvement.

Brady (2007) also recommends that coaches build a network of coaches from outside of their schools. Brady (2007) argues that access to external consultants enables coaches to discuss conflicts that arise. Due to the confidential nature of coaching, these issues are difficult to discuss with administration or peers so an outside forum in which to engage in problem solving and reflection is a useful support for coaches.

### 2.3.2 Effective coaching skills

Coaches work in a structure in which they are neither teacher, nor administrator. This balancing act is evident in many of the skills that coaches need in order to be successful. They must be seen as working collaboratively with their peers while at the same time, working closely with the principal to ensure that they are meeting the goals and expectations of the administration (Knight, 2007). In order to do this, coaches need to be effective communicators with strong social skills (West & Staub, 2003). They need to be open and honest, non-confrontational, and non-offending in their work with colleagues at all levels (Brady, 2007). In addition to discussions of pedagogy, coaching conversations should focus on assessment, content, and teaching strategies (West & Staub, 2003).
Coaches are expected to be committed to a process of ongoing learning and to recognize that, like the teachers with whom they work, coaches are continuing to improve their teaching practice (West & Staub, 2003). An effective coach needs to be confident and persistent (Brady, 2007) in order to build and maintain relationships. Knight (2007) also indicates that a coach needs to be humble and ambitious in order to foster positive relationships. However, while coaches need to be engaged in the work they are doing and connect with their peers, they must also be able to detach themselves personally from their work in order to not be offended by the resistance with which they are met (Knight, 2007).

Due to the fact that a coach walks a fine line between teacher and administrator, and works closely with both, West and Staub (2003) indicate that coaches are in a “uniquely powerful position” (p. 140) in the development of professional learning communities within a school. West and Staub (2003) state that it is the coach’s role to create an environment in which risks can be taken and reflected upon through modeling lessons and through facilitating constructively critical conversations around their own practice as well as the practice of the teachers.

Coaches must be able to offer strategies that are easy for teachers to adopt, while doing everything possible to help their teachers implement these new strategies (Knight, 2007). West and Staub (2003) indicate that coaches must be able to identify the needs of a teacher and understand the culture and relationships that exist within a school in order for instructional change to occur. Additionally, the coach must make the alternative practices appealing to the teacher and remove any barriers that may exist for a teacher (Knight, 2007). This may involve clarifying texts, preparing materials, copies, and handouts, giving feedback, and modeling lessons (Knight, 2007). West and Staub (2003) recommend that coaches have a variety of
strategies available to them so that they can appropriately differentiate their approaches depending on the needs of the teachers with whom they are working.

Furthermore, coaches must be organized, while also able to maintain an open mind and sense of flexibility in order to meet the needs and interests of different teachers (Knight, 2007). Because a coach is, in many ways, a part of both the administrative team and the teaching staff, yet at the same time is not fully a member of either, a coach needs to be able to build honest and trusting relationships with everyone with whom he or she works (West & Staub, 2003) and have a clear, focused (Knight, 2009), and shared goal with all of his or her colleagues. West and Staub (2003) recommend that coaches document teacher change and progress as they work together over the course of the year. The authors highlight the fact that change might look different across teachers, times of the year, and areas being addressed and suggest that a coach “become a detective for progress” (West & Staub, 2003, p. 36).

2.3.3 Challenges and barriers

While structural and administrative supports can help enable a coaching program, a variety of challenges still exist for coaches. Knight (2007) points to school systems underestimating the complexity of change and not planning well for the implementation of a coaching program as a significant barrier to effective coaching. When a coaching system is implemented simplistically and without thought, it is likely that the culture of a school will not be ready to support coaches (Sweeney, 2007). A coach that does not have the cultural support of the school system will have difficulties forming positive relationships with peers (Russo, 2004). West and Staub (2003) caution that principals and coaches may have different purposes for the coach in the school. Specifically, the authors point to the fact a principal may wish to have the coach work primarily with teachers the principal believes are struggling. West and Staub (2003)
recommend that coaches and principals find time to discuss the various demands and
perspectives that they are bringing into the coaching arrangement. Because coaching requires a
change in the norms of isolation of teaching (Dufour & Eaker, 2004), coaches working in a
system without a clearly defined and accepted vision may find that teachers are unwilling to
open their classroom to them (Loucks-Horsley, et al., 2003). The vision of the role of the coach
must be understood by all stakeholders involved in the coaching program.

Furthermore, when a coach’s new role is left undefined, relationships between teachers
and coaches may be strained (Pankake & Moller, 2007; Russo, 2004). The lack of a clearly
defined goal for coaches and ambiguity in their work is cited frequently as an obstacle for
coaches to overcome. In her case studies of two coaches, McGatha (2008) found that it took four
months for the teachers and coaches to be able to understand and define their roles in the
coaching relationship, and in his study Knight (2009) found that coaches spent less than 25% of
their time actually coaching.

Even when a well thought out and defined coaching program is implemented, a coach is
likely to face many barriers. Bruce and Ross (2008) and Murray, Ma, and Mazur (2008)
highlight the difficulty of scheduling for coaches, and particularly of finding time for teachers
and coaches to meet to debrief a lesson. Professionally, many coaches have not worked with
adults before (Sweeney, 2007). This shift in focus means that coaches will need training in adult
learning and support in their roles, yet this training is not always available (Sweeney, 2007).
Brady (2007) highlights numerous additional challenges facing coaches professionally including
supporting the different needs of new and veteran teachers, maintaining positive relationships,
managing time and multiple priorities, staying current on pedagogy, and finding a way through a
job that has no formal authority.
Russo (2004) indicates that there are many challenges that might face a school district while implementing a coaching program. These include the additional cost, underestimating what is needed in order to do the coaching work effectively while overestimating the impact a coach can have, and logistical challenges such as finding and training enough coaches without taking all of the best teachers out of the classroom.

Hargreaves and Dawes (1990) suggest an even larger challenge a coach may face. The authors indicate that coaching may have the impact of ending teacher isolation and promoting a change in practice. They also highlight the fact that a coaching model is a change from a deficit model of teaching toward one that works with teachers by recognizing their own professional knowledge. However, they argue that coaching, and particularly technical coaching (which focuses on implementing professional development training into the classroom), can foster disempowerment and de-professionalization amongst teachers.

A coaching program alone does not address organizational or structural problems within a school, and only broaches the specific topics of skills for teaching and learning (Hargreaves & Dawes, 1990). Nor does the implementation of coaching deal with resistance to change amongst teachers. According to the authors, coaching does not allow for moral or intellectual disagreements amongst teachers, coaches, and administrators. Instead, they argue, coaching is a bureaucratic model, which fosters a top-down, standardized approach to education. In effect, the coach is responsible for encouraging teachers to teach according to the “best practices” decided upon by administrators.

2.3.4 Mathematics coaching

In a 2006 president’s message to members of the National Council of Teachers of Mathematics, Fennel called for elementary mathematics specialists to be placed in schools
immediately. He argues that elementary teachers are generalists who have only taken 2 – 3
courses in mathematics education during their pre-service training. Fennel further indicates that
there is typically a strong focus on literacy in elementary schools, which means that the need for
specialists with strong mathematical content and pedagogical knowledge in elementary schools
is even more necessary. However, Fennel also indicates that very little is currently known about
the impact of coaching in relation to mathematics specifically (personal communication, May 1,
2010).

Much of the research done to date on coaching is related to creating and sustaining a
coaching program and thus, there are a limited number of studies done on the effectiveness of
mathematics coaching, and they have produced mixed results. Although their research is not
about mathematics coaching in particular, authors such as Knight (2007), Black, Molseed, and
Sayler (2003), Showers and Joyce (1996), and Costa and Garmston (1994) found that
participation in coaching programs led to changes in teacher practice. For example, Knight’s
(2007) research reports that teachers who work with coaches are four times more likely to
implement new practices learned during professional development as those who do not work
with coaches. This outcome matches Showers and Joyce’s (1996) studies done in the 1980s in
which implementation rates rose consistently amongst teachers using coaching. Black, Molseed
and Sayler (2003) indicate that teachers who engage in coaching report a deeper knowledge
about how they might improve their own practice. After completing four studies on classroom
instruction, Costa and Garmston (1994) found substantial improvements in teaching repertoires,
improved lesson planning, increased teacher confidence, moderate improvements in student
learning, and an increase in self-questioning, reflection, and analysis.
These findings are echoed in studies focused on mathematics coaching. Bruce and Ross (2008) found that coaching fosters more risk taking amongst teachers, increased student-to-student interaction and more open-ended tasks in the classroom, more reflection about teaching, and an increased efficacy about teaching practice. Bruce and Ross (2008) also found that, with time, the quality of conversations in coaching relationships improved. The results of McGatha’s (2008) two case studies are similar. In McGatha’s study, both of the mathematics coaches she observed moved into more complex types of coaching, which resulted in dialogue aimed more directly at encouraging teacher self-reflection.

Blount and Singleton (2008) interviewed 12 policy division leaders of Virginia schools engaged in a National Science Foundation (NSF) funded project studying the impact of elementary mathematics specialists. After two years of implementation, the division leaders all believed in the effectiveness of elementary mathematics specialists and reported improved teacher instruction, an increase in teacher content knowledge, and student achievement gains. In Virginian schools with coaches, the pass rates for students on the state standardized tests increased by 14 points, while in schools without specialists the increase was only 1 point. In a 2010 report of the NSF funded study, the Virginia Mathematics and Science Coalition examined the state test scores of 24,500 grade 3, 4, and 5 students at thirty-six schools in Virginia with math specialists over three years. Statistically significant positive impact was found in all three grades. The scores for third-graders in schools with specialists increased an average of 10 points during the specialists’ second year and 16 points in the specialists’ third year. Fourth grade scores were an average of 15 points higher in the second year and 19 points higher in the third year, while fifth graders gained an average of 19 points in the second year and 20 points in the specialists’ third year.
Miles-Grant and Davenport (2009) report similar gains in student achievement in Boston schools after nine years of elementary mathematics coaching. The percent of 4th grade students passing the state test rose from 56% to 77%, and the number of 4th grade students scoring at the proficient or advanced level increased from 15% to 30%.

Brady’s (2007) study of a coaching program in Kansas evaluated its effectiveness by examining student results on a standardized test over four years. This student achievement data showed an increase in the percentage of students scoring at proficient plus (the highest level). Prior to the implementation of the program only 21.5% of students were proficient plus in mathematics. After 3 years of implementation, 40.8% of the students scored proficient plus. Because the implementation of the coaching program did not happen in isolation, but as a part of a larger reform effort, it is difficult to know how much of the gains were due to coaching. However, Brady (2007) reports that an independent evaluation found coaching to be a significant factor in the change.

Not all studies of coaching have found evidence of teacher change or student growth. Olson and Barrett (2004) conducted case studies with three first grade teachers in a high poverty urban district. These teachers were a part of a school improvement program that included summer workshops, professional development sessions, and coaching once a month over the course of three years. Despite the long duration of the program, Olson and Barrett found that the teachers often deflected conversations that would lead to deeper reflection of teaching and learning, and dismissed reform teaching styles as taking too long and being inefficient.

Murray, Ma, and Mazur (2008) studied the effects of peer coaching on student achievement. The teachers were working on implementing a reform-based curriculum in Appalachia. They were required to meet with their self-selected peer coach a minimum of twice
a year. While the teachers reported that they liked the opportunity to share ideas, techniques, and strategies, the qualitative study of their work found little depth, reflection, or critique in their conversations. Like Olson and Barrett, Murray, Ma, and Mazur’s results indicated that conversations tended to avoid reflection and instead focused on issues such as management, content, and the organization of learning. Participants were more likely to make statements than pose questions, which led to minimal critique of lessons. Pre- and post-tests were also conducted with the students in the classrooms of teachers engaged in coaching using questions from the Programme for International Student Assessment. Murray, Ma, and Mazur found that participation in the coaching program had no effect on student achievement.

McGatha (2009) wrote a review of the research on mathematics specialists and coaches for the National Council of Teachers of Mathematics. In her brief, she emphasizes the lack of research that has been done on mathematics coaching. She included both published studies and paper presentations completed since 1990 and found only seven focused on mathematics coaching. These seven studies could be further broken down into a focus on one of three areas: improving instructional practice, designing coaching programs, and improving student learning. Reviews of the seven studies, some of which are still ongoing indicate that, “[t]he empirical and anecdotal evidence suggest that coaching is a promising professional development that can lead to improved teaching and learning. However, we need to continue to pursue research that can support these initial findings.” (McGatha, 2009, p. 2). Likewise, the final report produced by the National Mathematics Advisory Panel in 2008 recommends more research be done on mathematics specialists in elementary classrooms, especially in light of the fact that coaches are becoming more common in schools. Despite reviewing 114 pieces of literature, the Panel
indicates that there is no high quality research to show that the use of mathematics specialists improves student learning.

2.4 Teacher Change

Because there is limited high quality research to link mathematics coaching to improved student outcomes, current research is now focusing directly on student learning as it relates to mathematics coaching. While this is undoubtedly a critical indicator of the success or failure of a coaching program, it bypasses the teacher entirely. As shown in Figure 1, mathematics coaches work directly with classroom teachers, who in turn work directly with their students. Thus it could be expected that a change in student learning as a result of coaching will occur only if there is also a change in teacher practice. While there are many calls being made to connect the impact of mathematics coaching to student achievement, little research exists to show how a coach’s work is connected directly to teaching practice.

Figure 1. Current research is aimed at connecting the impact of mathematics coaching to student achievement. However, the direction of a coach’s work flows from a coach to a teacher and then to students.

2.4.1 History of educational change

Hargreaves and Shirley (2009) trace the shifts in educational change policy since the end of the Second World War. The first method of change they call “Innovation and Inconsistency,” which focussed on innovative educational changes, but was hampered by a lack of coherence across educational institutions. This wave was followed by “Markets and Standardization.” The authors indicate that while this increased competition in education by raising expectations
teachers lost their motivation and autonomy and the increased emphasis on standardization negatively impacted student learning. Hargreaves and Shirley (2009) describe the third way, “Performance and Partnership” as a way to combine the best aspects of the two prior attempts at change. This third way did not occur in the United States as fully as it did in countries such as Canada. However, while the intention was to successfully combine “state support and market competition” (p. 12) the result was vague calls reform without strong leadership to guide the changes.

Hargreaves and Shirley (2009) put forth a call for a fourth path of educational change. In this model of educational change, reforms will come from quality leadership and professional learning that will lead to high levels of student engagement. Important in their vision for change are principles such as “professional cultures of trust, cooperation, and responsibility,” “professional networking of peers and with mentors,” “cultures of improvement where the strong help the weak,” and “learning and achievement priorities” that are intended to meet the vision of schools.

The educational change process is not easy, particularly sustaining and spreading the change (Hargreaves & Shirley, 2009). Therefore the authors indicate that change needs to be driven by people coming together working towards a shared, coherent vision that is focused on student learning and achievement. This needs to be guided by “sustainable leadership” (p. 95) that allows for flexibility to adapt to the change process as needed.

2.4.2 Aspects of teacher change

Teacher change is related to an internal motivation to inquire and learn more about one’s practice. According to both Attard (2007) and Day (1999), this commitment to ongoing investigation is a value that should be inherent in all teachers. It is when teachers engage in the
expected reflection and questioning about their practice that change can occur (Attard, 2007; Day, 1999). Attard (2007) indicates that, in order for teachers to engage in the change process, they need to first identify a problem in their practice. This is similar to Day’s (1999) suggestion that teachers reflect deeply about their beliefs and how they match or do not match their own actions. Day (1999) points out that sometimes teacher actions do not match their stated theories about teaching. It is through investigating what one says and what one does that dissonance and recognition of the need for change will occur. Attard (2007) points out that not all aspects of practice can be changed at once. Therefore, the reflection and change process is ongoing: once a new practice is established it can be opened up to investigation and inquiry (Attard, 2007) or work can begin on a new task.

Without this type of reflection, Day (1999) cautions that teachers will not see the possibilities for change. Likewise, Attard (2007) suggests that teachers often adapt habits of practice that quickly become routine. This originally occurs as a matter of survival during the first few years of teaching (Attard, 2007; Day, 1999). However, if a teacher does not engage in reflection and become motivated to inquire about their own practice, mediocre teaching results as habits do not change and thus improvement does not occur (Attard, 2007).

Day (1999) indicates that when a teacher does not feel ownership over the change process that is occurring and the decisions that are driving it, change is unlikely to be sustained. Similarly, Sikes (1992) suggests that if teachers are not valued for their ideas and expertise then they can avoid implementing changes behind their classroom doors. There is a danger in implementing top-down change mandates as it suggests a deficiency in the teacher and removes autonomy from a teacher’s own practice (Sikes, 1992). Thus, when schools engage in change initiatives it is important to provide a voice to teachers. Change comes when teachers alter their
own beliefs, emotions, attitudes, and values (Day, 1999; Sikes, 1992). It is by including teachers, the experiences, and the knowledge that they bring with them in the process of change that they will feel they are trusted as an agent of change.

Engaging in a change in practice requires intense vulnerability, discomfort, and risk taking (Attard, 2007; Day, 1999; Reid & Zack, 2010a). It is easier to maintain a routinized practice than to risk an unsuccessful change. However, multiple authors point to collaboration and trust as necessary factors to help mitigate the risk and fear associated with change.

### 2.4.3 Collaboration

Hargreaves and Shirley (2009) state that “collaborative cultures are strongly associated with increased student success and improved retention among new teachers” (p. 92). In considering his own process of change Attard (2007) indicates that, while individual reflection can lead to change, discussion with colleagues also does so by raising new ideas and perspectives for consideration. Opportunities for this type of discussion in schools, however, are rare (Attard, 2007; Grimmett & Crehan, 1992). Collaborative practices cannot simply be forced onto teachers. As Hargreaves and Shirley (2009) indicate, collaboration that is mandated and is either focused on looking purely at data spreadsheets or on topics removed from specific teaching practices ends up as “contrived” interactions that are unproductive. Instead, successful collaboration needs to be focused on teacher inquiry. As Day (1999) points out, when learning is aimed to address teacher needs it is a form of additive or transformative knowledge that will result in growth.

Grimmett and Crehan (1992) indicate that, when successful collaboration occurs, teachers gain both depth and flexibility in their teaching practices and are enabled to try out ideas that they may not have had on their own. Collaborative efforts need the guidance of strong leaders and include teachers as equal members of the change process (Grimmett & Crehan, 1992).
According to the authors, schools with strong cultures both promote and sustain collaborative practices and risk-taking.

It is important for trust to be established in these types of collaborative relationship if teachers are to develop the confidence and courage required to take risks in their practice (Day, 1999; Penlington, 2008; Reid & Zacks, 2010b). Males, Otten, and Herbal-Eisenmann indicate that it can be difficult to create a learning community that supports trusting relationships while also feeling open to pushing deeper reflection through deliberate and critical discussion of teacher practice. However, the authors argue that these types of critical friend relationships are required for change to occur in practice.

Similarly, Day (1999) highlights critical friends as a powerful support for teacher change. Day (1999) indicates that the relationship formed between critical friends needs to be one in which time is provided for trust to be developed between two equals who support each other. Penlington (2008) argues that, for teachers to be able to question each other critically, a strong relationship must be developed. She suggests that discussions with the same person or group over time may be more effective than conversations with different people each time since repeated engagement in discussion with the same group will likely support the development of trust. The critical friend relationship must foster independence so that teachers develop their own autonomy and self-confidence after a short period interdependence. Ultimately, according to Day (1999), the critical friends must be viewed as temporary relationship.

In their study of a new teacher undergoing a change in her mathematics planning, Munoz-Catalan, Carillo Yanez, and Climent Rodriguez (2010) report that the new teacher involved credited her year-long involvement in a collaborative learning community as supporting her change. In the role of critical friends, the experienced teachers with whom the new teacher
worked openly disagreed with some of her practices and statements and used questioning to push the new teacher to consider the rationale for her actions more deeply. While the authors indicate that, at the beginning of the work done in the PLC, the new teacher felt that she was being personally attacked, over time she began to see the critical comments as a part of her own professional learning. Once this occurred, she became more receptive to considering their ideas.

2.4.4 Dialogue

Penlington (2008) reports on teacher dialogue acting as an impetus for change in teacher practice. While Mesler Parise and Spillane (2010) highlight that collaborative discussion is the greatest predictor of teacher change, Penlington (2008) notes that teacher-to-teacher dialogue is already used as an important, or even central, component of teacher professional development. Penlington (2008) offers an analysis of the dialogue process to highlight why it is important to teacher change and specific components of dialogue that are necessary to bring about the change. She indicates that practical reason is a thinking process that leads to decision-making. Practical reason develops through interaction (Penlington, 2008). While we can have internal dialogue with the voice and alternative point of view of an “other,” this type of dialogue does not force us to confront subliminal or hidden ideas, but only to consider the limited number of ideas that are in our conscious thought. When we engage in dialogue with actual others, they are able to push our thinking to consider the hidden subconscious reasons we do (or do not do) something and to present new and alternative perspectives. This type of dialogue results in teachers reflecting more deeply about their actions.

Penlington (2008) indicates that, like the collaborative practices above, this type of dialogue depends on the development of trust in a space that is safe for multiple points of view to be raised. However, if the discussion does not include conflict then deeper reflection cannot
occur. Unfortunately, teachers are rarely prepared for the type of learning that requires debate and dissonance. Instead, educators tend to share stories of what has occurred and build a culture of agreement (Males, Otten, & Herbal-Eisenmann, 2010; Penlington, 2008). Penlington (2008) thus argues that schools need to develop a culture in which conflict and disagreement are not considered personal attacks but necessary to improve practice. It is through this practice of dissonance that assumptions about teaching and learning can be examined, discussed, and changed as needed.

2.4.5 Model lessons

Research also indicates that model lessons can act as a powerful impetus for teacher change. Hargreaves and Shirley (2009) state that demonstration is one way to support teachers through professional development. In their study of demonstration classrooms in an Ontario-based school board, Grierson and Gallagher (2009) found that the teachers who observed an expert teacher model a literacy lesson were pushed to make changes in their own classroom practices. The authors report that some of the teachers considered this form of professional development to be the most effective professional development they had experienced. Because the teachers had the opportunity to observe a real teacher implementing reform pedagogy in a real classroom in their own school board, the teachers left with a more positive feeling about the reasonableness of implementing these changes in their own classrooms. Grierson and Gallagher (2009) found that, after observing the lesson and debriefing with the demonstration teacher, the eight teachers in the study made changes to the physical set up in their classroom, their literacy centre, the way they implemented guided reading, and the way they assessed student learning. The teachers reported increased self-reflection and became motivated to set goals for their own practice.
Grierson and Gallagher (2009) note that aspects of this form of professional development that supported change included the fact that it occurred in a safe environment where risk-taking was encouraged, that the demonstration teacher modeled practices recommended by the Ontario government that they had learned about in other professional development sessions, and that the demonstration teacher provided further support via email after the observations. The teachers involved in the study indicated that, despite their positive feelings about observing a teacher in a demonstration classroom, they would have liked to have had follow up support in their own classroom as they attempted to initiate the change. Two of the teachers reported that they abandoned the changes they were making because they had difficulty managing them and needed more follow up support.

### 2.4.6 Professional development to foster change

Mesler Parise and Spillane’s (2010) study of differing professional development structures and their impact on teacher change also highlight the importance of collaborative opportunities. Mesler Parise and Spillane (2010) found that both formal and informal learning can result in change in teacher practice. Mesler Parise and Spillane collected data from teachers at 30 elementary schools in one urban school district. Teachers completed a questionnaire that included questions about the type and amount of professional development they had engaged in, about perceived changes in their practice, as well as information about their school and themselves. The authors’ definition of informal professional development was related to on the job learning from colleagues. This included professional discussions, asking questions, and providing and receiving feedback. When defining formal professional development the authors included workshops, graduate classes, traditional one day professional development seminars,
and more reform professional development such as study groups and professional learning communities.

Results of Melser Parise and Spillane’s (2010) study indicate that both formal and informal professional development are associated with teacher change. Within these professional development structures, collaborative discussion emerged as the strongest predictor of teacher change. Other factors that predicted teacher change included advice seeking, with a weak correlation and teacher efficacy, with a high correlation. The authors suggest that, since both types of professional development correlate with teacher change, a combination of both may be the best approach to bringing about changes in teacher practice.

While they did not study this explicitly, Mesler Parise and Spillane (2010) point to literature that indicates the more reform type of formal professional development has a stronger link to teacher change, which may be due to its emphasis on discussion. The authors did not include coaching in this study, but suggest that it “may play an important role in facilitating teachers’ on-the-job learning opportunities” (p. 340).

### 2.4.7 Internal and external factors impacting change

When a school or district is attempting to implement educational changes, it is necessary to consider factors that are located both outside and inside of the institutional environment. Community or societal pressure to maintain the status quo can inhibit change from moving forward (Capital Area School Development Association, 1997). Typically, the public tends to embrace a more traditional view of education and thus are resistant to attempts at change (Capital Area School Development Association, 1997). Similarly, factors within a school setting can inhibit change. These include colleagues who hold an opposing view to teaching and learning (Attard, 2007; Capital Area School Development Association, 1997), union pressure,
and an evaluation system that rewards established practices over innovative ideas (Capital Area School Development Association, 1997). Furthermore, when a school setting is not designed to validate and support teachers trying out new practices, to provide time for reflection and open communication, and to work toward a shared vision, then change can be very difficult, if not impossible. Without careful examination of these factors and the way they may impede attempts at change, it may be difficult to sustain the changes that are made.

2.5 The Ten Dimensions of Mathematics Education

McDougall (2004) indicates that as the understanding of what constitutes best mathematical practices shifts toward a more reform-oriented view, the expectations for what occurs within a mathematics classroom also changes. It is commonly accepted that strong mathematics instruction must incorporate more than knowledge of number facts and that mathematical literacy is more than procedural fluency (McDougall, 2004). This shifting vision of teacher practice, thus, inherently means that the role of the classroom teacher must also change in order to meet these new demands. In addition to the NCTM’s Principles for School Mathematics and process standards, McDougall (2004) draws attention to five competencies that are necessary for mathematical literacy: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition.

McDougall (2004) identifies “Ten Dimensions of Mathematics Education”, which highlight aspects of teaching and learning that are evident in a mathematics program. They are:

- Program scope and planning
- Meeting individual needs
- Learning environment
- Student tasks
• Constructing knowledge
• Communicating with parents
• Manipulatives and technology
• Students’ mathematical communication
• Assessment
• Teacher’s attitude and comfort with mathematics

While these dimensions may overlap at times, they provide a framework for observing development in teaching practices. In addition to detailed descriptions of each dimension McDougall provides a survey of “Attitudes and Practices for Teaching Math.” This survey is designed for teachers to help them identify their areas of strength and weakness in mathematics teaching. This data can then inform the individual teacher, a coach, or an administrator about the work that might be done in order to support the teachers’ professional growth and/or highlight areas of practice where change is occurring. The “Attitudes and Practices for Teaching Math Survey” can also be used to gather baseline information about a teacher’s understanding of his or her own practices and beliefs surrounding the teaching and learning of mathematics. Finally, the survey can provide descriptive information about professional development by highlighting dimensions that are or are not addressed, and how those areas match or diverge from teachers’ needs.

2.6 Summary

Recent understanding about effective forms of professional development for teachers shows that collaboration and reflection are necessary ingredients to foster changes in teacher practice. Meanwhile, in order to implement the reform-oriented changes in the way mathematics is taught and learned in elementary schools, teachers need to acquire new pedagogical
knowledge, content knowledge, and pedagogical content knowledge. Together, the changes needed in classroom teaching, coupled with the increased understanding of high leverage practices in professional development are leading to new forms of teacher training in North America.

Mathematics coaching is emerging as a potential new form of professional development for teachers of elementary school mathematics. While research is finding mathematics coaching to be a promising model, much of the literature is focused on how to structure and support a coaching program rather than on the impact that coaching has on mathematics teaching and learning. There remain few empirical studies done on the effectiveness of coaching in its ability to change teacher practice or to improve student achievement.

One framework for observing and identifying both change in teacher practice and areas targeted for professional development is the Ten Dimensions of Mathematics Education. Once a teacher has taken the “Attitudes and Practices for Teaching Math Survey” professional development can be targeted to address the area(s) found to be in need of improvement. Focusing on a teacher’s development in one or more of the Ten Dimensions of Mathematics Education during the time that the teacher is engaged in working with a mathematics coach is one way to understand the effects of elementary mathematics coaching on teacher practice.
Chapter Three: Method

3.1 Introduction

The aim of this study is to examine the ways in which elementary mathematics coaching is experienced by elementary mathematics teachers, coaches, and principals. This chapter will expand upon the research approach and design of the study. After a detailed overview of the qualitative study, this chapter will discuss the participants who will be involved and their recruitment, the data collection and analysis, and finally the ethical considerations of this study.

3.2 Research Approach and Design

This is a qualitative study to address the research question: What are elementary mathematics teachers’ and coaches’ perceptions of coaching? It is expected that this study will contribute to the demonstrated need for research on the efficacy of elementary mathematics coaching. Qualitative research is a set of interpretative practices that make the phenomena under study visible (Denzin & Lincoln, 2005). Through the use a variety of empirical data, such as observation, interviews, and personal experiences, the researcher is able to triangulate the data in order to gain a deep understanding of the research environment. The use of multiple methods adds not only depth, but also complexity, multiple perspectives, and a richer description of the question being studied (Denzin & Lincoln, 2005).

More specifically, this research is a case study of the ways in which key stakeholders experience elementary mathematics coaching. Merriam (1998) states that a case study design is appropriate when the researcher’s goal is to gain “insight, discovery, and interpretation” (p. 28) of a defined object of study. Case studies are useful when the researcher wants to study process and the causal effects of that process (Merriam, 1998). Case studies are unique due to the fact that they focus on a particular phenomenon, are richly descriptive in their final product, and
clarify the reader’s understanding of the phenomenon under study (Merriam, 1998). My case study is a collective case study. Stake (2000) defines a collective case study as one that involves several cases that are used to provide insight of a specific phenomenon. Including more than one case enabled me to gain a better understanding of the coaching phenomenon and strengthens the validity of my interpretations (Merriam, 1998).

I used both observations and interviews to collect my data. Observation that occurs in a natural setting provides a first hand experience of the classroom (Merriam, 1990) and helps the researcher to better understand the case being studied (Stake, 1995). Conducting observations allowed me to gather the data in the moment, as it happened and thus allowed different aspects of classroom experiences to emerge over the course of the study (Merriam, 1990).

In addition to observations, I conducted tape-recorded interviews with each teacher, coach, and principal toward the beginning of the observations and again at the end of the three months of observation. The purpose of these interviews was to understand the participants’ meaning making and understanding in relationship to the research questions (Warren, 2001). Interviews provided me with thick descriptions that were used to help understand the experiences and perspectives of the participants (Warren, 2001). This allowed me to establish common patterns and themes that emerged between and across observations and interviews (Warren, 2001).

As the interview itself is not an experience that happens in isolation, but is connected to and embedded within the entire educational setting that is being observed (Fontana, 2001), it was important for me to be aware of and draw out the inter-related parts of the observations and interviews. While interview questions designed around the research question were developed prior to all interviews, the interviews themselves remained open-ended and flexible in order for
participants to tell their own stories, and to allow for follow-up and clarifying questions (Warren, 2001).

3.3 Research Study

3.3.1 Participants

This study included two elementary mathematics coaches working at elementary schools in a local school board. In order to find coaches to participate in the study, I first spoke with a current graduate student at my university who, prior to enrolling in graduate studies, worked as a mathematics instructional leader in a local district. The graduate student gave me the name and contact information of another mathematics instructional leader in the local school board. This mathematics instructional leader provided me with the names of six coaches who may have been willing to participate in the study. A seventh potential coach was identified through a friend who is a teacher in the local board. I sent an email to each coach to inquire who might be interested in participating in the study and offered to meet with each of them to further discuss the research, to answer questions the coaches may have had, and to determine the job structure and responsibilities of each coach. After this communication, two of the coaches agreed to participate in the study.

The principals of each coach were then contacted to ensure their consent. The teachers who participated in the study were suggested by the coaches. They were already working with the coaches in some manner and agreed to be a part of the study. Once the field of potential participants was narrowed down, each received a written explanation of the study and an informed consent letter to sign before any research began.

The study focused on the work that each of the coaches was doing with two or three teachers, through the use of observation and interview. Additionally, I conducted interviews with
the principals of each teacher involved in the study and with a former instructional leader in the school board in which the study occurred. By working with two different coaches, I was able to understand some of the differences that might result due to varying experience levels, relationships, or job descriptions. Furthermore, by conducting observations of the coach working with more than one teacher, I could begin to distinguish between factors that the coach had influence on as opposed to factors that were a result of teacher characteristics, as well as the interplay between varying teaching and coaching styles.

3.3.2 Data collection

Over the course of three months, I conducted ongoing observations in five elementary mathematics classrooms. The observations included:

- Mathematics lessons conducted by teachers who were working with a coach, both with and without the coach’s presence;
- Model lessons presented by the coach;
- Lessons co-taught by both the coach and the classroom teacher together;
- Professional learning communities, and;
- Pre-conference planning sessions, and post-lesson debriefing sessions between the coach and the teacher.

In the role of observer my activities were known to all participants (Merriam, 1990). This allowed me to make observation the primary focus of classroom visits. While engaging as a full participant may have lead me to gather even more first hand knowledge of activities, the observer role still ensured access to a great deal of information, while allowing participation to remain secondary to the observation (Merriam, 1990).
During all observations, detailed and descriptive notes were recorded of both the coach and the teacher. It was hoped that at least one observation would be conducted of each teacher and his or her work with a coach each week. However, due to scheduling demands of both the teachers and the coaches, this was not always feasible. By the end of the study, I had observed each teacher in various formats between eight and eleven times. Table 1 shows the number of observations that I made of each participant as well as the type of observations. Additionally, I kept a journal as a place to record my own experiences, ideas, questions, and reactions throughout the study (Merriam, 1990).

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Sarah (Oakside)</th>
<th>Nick (Oakside)</th>
<th>Ellen (Oakside)</th>
<th>David (Maple Downs)</th>
<th>Kim (Maple Downs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-Taught</td>
<td>1</td>
<td>4</td>
<td>4 + 1(^a)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Individual</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>PD (PLC)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

\(^a\)One observation of Lynette and Ellen was a session where they planned for their upcoming co-taught lessons.

Two rounds of interviews with each participant also occurred in this study. The first round of interviews conducted with the teachers and principals created a framework of the existing practice within each teachers’ classroom, the beliefs and values that each teacher and principal held in regard to elementary mathematics teaching, learning, and professional
development, and the goals the teacher had for working with the coach. The first round of interviews conducted with the coaches assisted me in understanding the coaches’ knowledge and beliefs about reform-based practice, mathematics teaching and learning, and the goals each coach had for their work with each teacher. The final round of interviews, conducted once the observations were completed, focused on reflection of the coaching process and assessed any changes in beliefs or actions surrounding the development of teacher practice.

Before any observations or interviews occurred, each teacher completed the “Attitudes and Practices for Teaching Mathematics Survey” (Appendix A). These results first served as a guide to help me better understand the teachers’ beliefs about mathematics teaching and learning as the study began. The survey results enabled me to collect an additional piece of background information about the teacher participants to get a fuller picture of each teacher and his or her pre-conceived notions associated with mathematics teaching and learning. This information was not shared with the teachers or coaches as it was not intended to guide the choices they made surrounding their work together. Instead, the information was used to consider what dimensions of mathematics teaching were and were not being addressed through coaching and how these dimensions did or did not match the teachers’ and coaches’ goals for improvement.

Additionally, near the beginning of the study, I conducted an interview with a former instructional leader from the district who was there when the coaching program was initiated. This interview provided me with some history and a stronger understanding of the structure of the coaching initiative in the board. Additionally, because the interviewee had experience in the board, but is currently removed from the site, the researcher was able to receive information about promising developments in the district and challenges that the district faces as a result of
the coaching program that might have been difficult to access from those participants currently working in the board.

3.3.3 Data analysis

Each observation and interview was transcribed. I reviewed the transcriptions and field notes on multiple occasions and recorded analytic notes each time the data was reviewed (Delamont, 2002). The data was coded in order to generate themes and categories. Throughout the coding process, I worked to maintain a flexible stance toward the data as the purpose of the coding was to explore multiple and various patterns that emerged (Coffey & Atkinson, 1996). As the coding took place, I began to explore the data systematically, ask questions of the data, and search for answers (Coffey & Atkinson, 1996; Delamont, 2002). I aimed to be aware of both consistencies and inconsistencies within the data, and focused on finding meaning in those findings (Wiersma & Jurs, 2009). With the emergence of categories and themes that linked the data together, I began to examine the data for super ordinate categories (Coffey & Atkinson, 2002) and began the theorizing process (Delamont, 2002). I used NVivo 9 as a tool to assist the coding and analysis processes.

3.4 Internal Validity

It is recognized that I held some biases during the research processes, especially given my previous experience as an elementary mathematics coach. I also recognize that as familiarity with the research sites and relationships with participants began to develop, the focus of observations began to change (Merriam, 1990). Schoenfeld (2002b) indicates that, “what researchers see in complex real-world settings is not objective reality but a complex function of their beliefs and understandings” (p. 451). As the only researcher of this study, I am solely accountable for ensuring internal validity.
In order to minimize the impact I had on the results of the study, I conducted multiple observations at each site over the course of three months and I conducted interviews on more than one occasion. The use of multiple sources of data enabled me to check for validity of the data and interpretations. Furthermore, I shared interview and observation notes with the participants involved in each in order to be sure of accuracy of both transcription and interpretation.

3.5 External Validity

Because this study examined the work of two different coaches, working in two different sections of a large urban school board with different student populations and a total of five different teachers, generalizations from this study will be able to be made for other coaches and schools in the same district. Further generalizations will be able to be made to school boards with similar demographics as the one being investigated, as well as to school boards with demographics similar to each of the sub-populations at each coach’s site.

Due to the limited amount of research that currently exists on the effects of coaching on teacher practice, it is anticipated that the results of this study might also act as a theoretical base for research being conducted in other sites, even if the profile of the teachers and coaches differ from those in this study. Therefore, while this study provides information about two individual coaches and their work with five distinct teachers, it is believed that those results can be generalized to the larger mathematics education community, particularly those places investigating mathematics coaching and those districts already implementing mathematics coaching or considering its implementation in local elementary schools.
3.6 Ethical Considerations

The proposed methods for this research study underwent an ethics review by the Office of Research Ethics at the University of Toronto. All of the teachers, coaches, and principals were informed of the research project verbally, and with a written explanatory letter before they were asked to agree to participate. Participants signed informed consent documents and were free to withdraw from the study at any time. Transcripts of all interviews and observations were sent to the participants involved, although no participants had access to transcripts of observations or interviews in which they did not participate. All participants had the right to make comments and provide feedback about the observations and interviews and to provide their own input in order to ensure accuracy. At the end of the study, each participant received a copy of the results and the analysis. None of the participants suggested changes to the text of the transcripts. All documents will be kept in a locked, encrypted file on the computer for five years after completion of the study. I did not use the real names of any of the participants, their schools, or their school board. Pseudonyms were employed instead. It is believed that no one was harmed in this study, and that the results will contribute to a growing knowledge base around the impact of elementary mathematics coaching.

3.7 Conclusion

This research study collected qualitative data through the use of semi-structured interviews, classroom observations, and observations of various coach-teacher meetings. The data collected was analyzed, coded, and used to understand the ways in which the mathematics coaching process was experienced by elementary mathematics teachers, coaches, and principals.
Chapter Four: Case Studies

4.1 Introduction

This chapter explores the case studies of two elementary mathematics coaches, Lynette and Natalia, and their work with three teachers and two teachers respectively. Each case study will provide a description of the school and the work around mathematics in which its teachers were engaged, some background information about each coach and teacher, and the perceptions each participant reports in relation to elementary mathematics coaching, its purpose, its effect on classroom practice, student learning, challenges that are faced when engaging in coaching, and wishes for future coaching work. The case studies will also include each principal’s reflections on the coaching process at her school. Each case study will end with a summary of important ideas raised at each school

4.2 Oakside School

Oakside School is a small school with approximately 250 students in grades Junior Kindergarten through 6. It is located in the south-western region of the school district and borders on the neighbouring suburb. Thirty-seven percent of the students have a first language other than English and 5% of the students have been in Canada for less than five years. Prior to the 2010 – 2011 academic school year, teachers at Oakside had spent two years focusing their professional development efforts on literacy. During the 2010 – 2011 year, this focus shifted to mathematics. In the fall of 2010 the staff examined the data they received as a part of a district review. During the first months of 2011, their principal, Suzanne, organized a Professional Learning Community focussed around mathematics with her staff. This PLC was designed in a similar format to the PLC they had used for their work in literacy. The staff were given four half-day release days throughout the winter and spring and met together with the principal and the
other teachers in their division. Thus the primary teachers would meet before lunch and the junior teachers after lunch. Their work was organized around a common text, *Good Questions: Great Ways to Differentiate Instruction* by Marian Small, which had been recommended to Suzanne by some of the teachers. Each half-day meeting also included one classroom observation. Suzanne invited Lynette, the math coach for the Family of Schools, to participate in the PLCs. Three teachers at the school, Nick (grade 4/5), Ellen (JK/SK), and the grade 6 teacher (and math teacher leader in the school) had previously worked with Lynette either in their classrooms and/or as participants in a math Additional Qualification (AQ) courses that she had taught the previous year. For the remaining teachers at the school, this was the first experience working with a mathematics coach in any capacity.

During the first PLC in February, which I did not attend, Lynette spent some time reviewing provincial test data with the teachers and all of the staff observed a lesson that was co-taught by Lynette and the grade 6 teacher leader. During the remaining PLCs, teachers typically spent time engaged in a text-based discussion facilitated by the principal, Lynette, and/or a teacher leader. They then chose a task or question that they wanted to try with their own students before the next PLC meeting, and shared student work samples as evidence from the task chosen at the prior meeting. Finally, most PLCs included an observational component in which Lynette and a teacher co-taught in front of the other teachers and Suzanne. Lynette and the teacher planned the lesson ahead of time and before the observation began they described the lesson to the observing teachers. After the lesson, the staff met together to debrief what they had seen.

My research at Oakside focussed on three teachers: Sarah, a grade 3 teacher who had never worked with Lynette prior to presenting a co-taught lesson for the PLC, Nick a grade 4/5 teacher who had taken the AQ courses that Lynette taught the year before, but had not had her in
his classroom prior to co-teaching a lesson with her for the PLC, and Ellen who had taken Lynette’s AQ course, and had also worked with Lynette in her classroom over the course of the year.

4.3 The Case of Lynette

4.3.1 Background information

This academic school year was Lynette’s fourth and final year as a mathematics coach in her Family of Schools, which includes 25 schools. She became a mathematics coach during the inception of the role in the school board. Prior to that, Lynette spent 10 years as a classroom teacher. She taught a grade 1/2 split for two years, then spent six years teaching grade 6, and then taught grade 3 for two years. Lynette’s path into the role of mathematics coach was unplanned and came about largely due to her own initiative. Lynette describes herself as someone who always liked math and while the school she was working in was focused on literacy initiatives, she did her own reading on mathematics and shared this information with her grade-level colleagues. When mathematics documents arrived at her school, they were given to Lynette who read them, and tried the ideas out in her own classroom. She shared the successful ones with her primary division teaching peers and later with the entire staff. She also presented a workshop for teachers at her school. Lynette indicated that the focus on literacy at her school meant that very little was happening in mathematics and that, “I just thought, you know what? I think people would appreciate having a conversation. And they did” (Interview, April 8, 2011). This led her to present some workshops at the Family of Schools level and when the job opening for an elementary mathematics coach was posted, Lynette decided to apply.

Lynette says that no one really knew what the role was at the time, but it seemed to be “the best of both worlds” (Interview, April 8, 2011) because it gave her the opportunity to
explore working at a more administrative level with teachers. Pursuing a career as a principal is something Lynette has considered and she felt that this would be a chance to see if she might ultimately want to move in that direction. However, there was a guarantee in place for the new coaches. If the job did not work out (as the board was trying it out) or if the coaches did not like the job, they would be able to return to classroom teaching at their home school the following year. During the first year of mathematics coaching in the school board, there were only twelve coaches hired; twelve more were hired the second year, so in her first year Lynette was responsible for two Families of Schools, which she describes as “a bit crazy” (Interview, April 8, 2011). Despite the large number of teachers Lynette worked with, she enjoyed the job, especially when she was able to work with the teachers and students in the classroom because that is where she saw change.

In reflecting on her own mathematical background, Lynette described herself as the student who was always asking why. She always enjoyed math, and did not find it challenging until high school when she became frustrated because she was being asked to consistently replicate procedures without understanding why. Lynette fondly recalled one teacher in high school who took the time to answer those questions for her. However, for most of her mathematics classes as a student, she was asked to memorize and repeat one method for solving a problem. Lynette described this as a challenge for her work as a coach because, “you teach the way you were taught” (Interview, April 8, 2011), and most of the teachers she works with were taught in a similar fashion to her own experience.

Lynette’s own schooling in math impacts her views on how mathematics should be taught in elementary school. Lynette strongly emphasizes understanding of the mathematics:

I always say to students that if you can explain your thinking, then I know you understand. And that is for everybody. You know if you can explain something, then you
Lynette believes strongly in students constructing their own knowledge through inquiry-based activities and that the onus is on the teacher to create rich tasks, ask good questions, and provide students with opportunities to show and explain their thinking. For Lynette, mathematical errors are useful as they tell about the students thinking:

> I do not care about the answer, it is how you got there, it is that process. So, if you show me your thinking, if I see that process, sure you can make an error, we can all make errors, but if you have understood that process, shown your thinking, and you can explain that process to me, you are going to catch that error if you have one. If you do not catch it, it may be when you share your work because you are revising and going over it then, or if not, someone else may bring it up and ask you a question. But I think they are just very telling. You know where the students are. (Interview, April 8, 2011)

### 4.3.2 Lynette’s teachers: Background information

The three teachers from Oakside School who participated in this case study engaged in the coaching work with Lynette in differing ways. Sarah is a grade 3 teacher at the school. She has 17 years of teaching experience, twelve of which have been at Oakside School. At the time of the study, she had been teaching grade 3 for four years, and had taught other grades in the primary division. She is also certified to teach special education. Sarah is considered a literacy teacher leader in the school and has done some work with the Family of Schools’ literacy coach in prior years. She had not, however, had any interaction with Lynette prior to the PLC that her principal organized.

Sarah describes herself has someone who loves teaching math. She explains that math was not easy or fun for her when she was a student and that she feels she can relate well to students who are struggling and is able to break down problems for students to better understand because of her own difficult experiences with math. Sarah’s pedagogical approach to teaching
math is more traditional than reform-based. Sarah’s students worked with partners from time to
time, but most frequently worked alone. The problems they solved were often from the school
textbook and homework assignments also came from the text.

Sarah indicated during her interview that she did not care which strategies her students
used to solve a problem as long as they could explain and justify their thinking, but also stated
that there was only one method for solving addition, subtraction, multiplication, and division
problems. Sarah made manipulatives available to her students occasionally by placing them on a
rug at the side of the room for students who felt they needed them and spoke about the
importance of using concrete tools, particularly for students who struggle. As a grade 3 teacher,
Sarah feels immense pressure to cover the required content for the provincial standardized test
and the factor of time repeatedly comes up for Sarah when discussing mathematics teaching and
learning.

In her “Attitudes and Practices for Teaching Mathematics Survey,” Sarah’s overall
average score (from 1 – 6) was 4.47. The average scores on this survey identify how current a
teacher’s beliefs are with reform-oriented ideas around mathematics education. The higher the
score, the more aligned the teacher’s beliefs are with standards-based pedagogies. Sarah’s lowest
average score, a four, came in the dimensions of “Communicating with Parents” and “Program
Scope and Planning.” Her highest score, a five, was in the “Learning Environments” dimension.

Sarah’s work with Lynette was limited during the research period. During the second
PLC meeting that occurred in March, Sarah and Lynette co-taught a lesson in front of the other
primary division teachers. This lesson came about when Suzanne, the principal, told Sarah that
she would be presenting the lesson. This was a situation that Lynette described as, “not ideal”
(Interview, April 8, 2011). The lesson that was presented was planned by Sarah and Lynette
primarily over email. They spoke about it together for the first time during the morning of the PLC. The lesson was debriefed with the whole primary division. Other than this one lesson, Lynette did not work one-on-one with Sarah again, nor was she invited back into the classroom. The remainder of Sarah’s work with Lynette occurred at the PLC sessions with the rest of the primary division teachers. While this situation is atypical for the work observed with the coaches and teachers in my study, it is the typical coaching experience that the majority of teachers at Oakside School received during the spring of 2011.

Nick is the grade 4/5 teacher at Oakside School. The 2010 – 2011 school year was his fifth year of teaching, all of which had been at the junior division level. He describes himself as someone who has always liked math and has always been good at it. He talks about the fact that, like Lynette, he was taught primarily how to follow a rote procedure to solve problems, but that he was never satisfied with this. Nick says that he spent a great deal of his own time in high school trying to figure out how and why mathematical solutions worked and that this was something he wanted his students to understand.

Nick emphasizes process over product and encouraged his students to try multiple strategies to solve problems and to share those strategies with one another. Nick’s students frequently worked in partners or small groups, and were always provided with discussion time during class. Manipulatives were present around the classroom and students were encouraged to seek out and use whichever manipulatives they wanted whenever they wanted them.

Nick received and overall average score of 5.3 on the “Attitudes and Practices for Teaching Math” survey. Like Sarah, his lowest score was a four in “Communicating with Parents.” There were only two other dimensions in which Nick’s average was below a five: “Program Scope and Planning” with a 4.3 and “Assessment”, with a 4.5. His highest score was a
six for “Manipulatives and Technology.” This dimension was closely followed by “Meeting Individual Needs”, in which Nick scored a 5.8.

Nick’s work with Lynette began during the previous academic year when he took a math professional development course that was facilitated by Lynette and the Instructional Leader for the Family of Schools. After this professional development course, Nick did not seek out Lynette for any support or invite her into his classroom. However, he credits that work for changing the way he taught his math class, particularly the fact that he became less reliant on the text book as a result of the course. Nick volunteered to be a model classroom for Oakside’s PLC and he co-taught a lesson with Lynette in March that was observed by the junior division teachers at his school. This was the first time he had Lynette work with him directly in his classroom. Like Sarah, Nick and Lynette planned much of the lesson via email. Once the co-teaching session was over, Nick agreed to continue working on a one-on-one basis with Lynette throughout the remainder of the year. During his final interview, Nick suggested that this was partly due to my presence and research at his school, as it gave him the incentive to seek Lynette out, and said that he wished he had done so earlier.

This research study occurred during Ellen’s third year of teaching JK/SK, although this was her first time teaching in one school all day. Oakside was one of the schools in the board that began implementing full day Kindergarten in 2010 – 2011. Prior to the 2010-2011 academic year, she split her time between Oakside School and another school within the Family of Schools. Ellen describes herself as someone who had a very bad experience with math as a student. She remembers not understanding what she was being asked to do, and passing a high school course only because of good attendance. She says that she wanted to teach Kindergarten partly because she was anxious about teaching mathematics in higher grades. However, after
seeking out the math professional development with Lynette, Ellen’s feelings about teaching math have changed. She now reports that she loves it and believes that math should be inquiry-based, hands on, and related to the students’ real world experiences. Ellen consistently had math centres available at which her students could “play math” and she engaged the class in discussions about mathematics throughout the day, integrating it into other subjects such as literacy and science. Manipulatives were readily available for students around the room and students were encouraged to use them whenever and however they wanted.

Ellen had the highest overall average score at Oakside on the “Attitudes and Beliefs for Teacher Practice” Survey at 5.54. Like her colleagues, her lowest score, a five, came in “Communicating with Parents.” Her next lowest score was in “Student Tasks” with an average score of 5.2. Ellen scored a six in two dimensions: “Students’ Mathematical Communication” and “Learning Environment.” The average score that each teacher from Oakside School received for each dimension and their overall average score on the “Attitudes and Beliefs for Teacher Practice” Survey is shown in Table 2.

Like Nick, Ellen’s first contact with Lynette was during the professional development AQ course offered the previous academic year. Also like Nick, Ellen credits this experience with changing some of the ways she taught in her kindergarten classroom, with enabling her to take more risks, and with giving her more confidence as a mathematics teacher. Unlike Nick, however, Ellen sought out Lynette for classroom support after the professional development seminars and had already been working with Lynette in her classroom before I began my research. By the time I began my study, Ellen and Lynette had already formed a close relationship and Ellen’s classroom was being used as a demonstration classroom within the Family of Schools with Lynette’s support.
Table 2

*Attitudes and Practices for Teaching Mathematics: Oakside School*

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Sarah</th>
<th>Nick</th>
<th>Ellen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Scope and Planning</td>
<td>4</td>
<td>4.3</td>
<td>5.67</td>
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<tr>
<td>Meeting Individual Needs</td>
<td>4.8</td>
<td>5.8</td>
<td>5.4</td>
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<tr>
<td>Learning Environment</td>
<td>5</td>
<td>5.3</td>
<td>6</td>
</tr>
<tr>
<td>Student Tasks</td>
<td>4.4</td>
<td>5.6</td>
<td>5.2</td>
</tr>
<tr>
<td>Constructing Knowledge</td>
<td>4.4</td>
<td>5.4</td>
<td>5.4</td>
</tr>
<tr>
<td>Communicating With Parents</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Manipulatives and Technology</td>
<td>4.5</td>
<td>6</td>
<td>5.5</td>
</tr>
<tr>
<td>Students’ Mathematical Communication</td>
<td>4.75</td>
<td>5.5</td>
<td>6</td>
</tr>
<tr>
<td>Assessment</td>
<td>4.25</td>
<td>4.5</td>
<td>5.67</td>
</tr>
<tr>
<td>Teachers Attitude and Comfort with Mathematics</td>
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<td>5.4</td>
<td>5.4</td>
</tr>
<tr>
<td>OVERALL SCORE</td>
<td>4.47</td>
<td>5.3</td>
<td>5.54</td>
</tr>
</tbody>
</table>

4.3.3 Defining her role

When asked to describe what a mathematics coach is, Lynette spoke about two distinctly different aspects of her job. The first was the structure of her job:

In terms of what I do? What don’t I do? I guess it is kind of two sided. There is the side that is more of the system stuff, where it is presentations. It could be to the whole Family of Schools. We have done that approach. It could be to individual schools. It just depends on the need. […]But, the bigger part, and I still do sessions all the time, but the bigger part of my job, or that I see as my job is the coaching aspect, where you are actually in the classroom, in the schools, because that is where you’re going to actually effect any change. (Interview, April 8, 2011)

She also spoke about the conditions necessary for her to do her job. This aspect of her job appears to be significantly more important to her as the ideas were raised repeatedly in both interviews. In particular, she spoke in great detail about the need to create strong relationships with the teachers with whom she worked, the desire to be seen as another teacher and not as an expert, and the fact that teachers must not view her as evaluative.

When talking about her work with teachers, Lynette emphasizes the fact that when she begins working with a teacher she tells them that she is a teacher too and that she is also learning.
She takes the attitude that, in her role as mathematics coach she has been afforded the opportunity to focus on one particular strand of the elementary school curriculum, but that she does not know more about teaching, learning, and the students than the classroom teacher.

Because she has this depth of knowledge in one area, she approaches her role as one in which she would like to sit with the teachers and talk about what they know together. She feels that the best thing she can do is have good conversations with teachers to get them to consider new and different ideas. In this way, Lynette believes that changes in practice may occur:

I think it is just my job to have that sort of coaching experience where...it is just basically you are building relationships with people, with teachers, and having conversations and you want those conversations to spark thinking in them. Not necessarily changing their thinking, but a lot of times we are so isolated in teaching that, we all mean very well, we want to get together, but there is no time. So when I get the time to sit down and talk to the teacher about something, they are little things. They are little things that you never thought about and it is both ways. A lot of times I come in and they think I am the all-knowing person and I have everything... I can pull out a problem here, there, and everywhere. And, I have to let them know that that is not what this is about. My role is not coming in here and doing it for you, because what is that going to do? I am going to leave and what is going to happen, right? But if we have had a chance to sit down and talk about what we have been doing, whether it is in person, whether it is on email, and if I have been able to get you to think a little bit more, then I think I have done my job. If you want to experiment a little bit more and try something new, I think I have done my job. I guess it is just creating that relationship where they feel open enough to have a conversation. (Interview, April 8, 2011)

Lynette spoke about the fact that some coaches in the school board believe that they have a higher position than classroom teachers and indicates that she works very hard to dispel this perception. It is her opinion that once a power imbalance is created then effective coaching cannot happen. “The minute you create that difference, like I am better than you and the power thing, well forget it. It is not happening. I have seen it happen with other people and it is not so nice” (Interview, April 8, 2011).

The fact that different coaches within the same board take different approaches to the role may be attributed to the fact that each of the 24 coaches is supervised by the Superintendent for
his or her own Family of Schools. Lynette spoke openly about the fact that coaches in different parts of the board structured their work differently and were responsible for different types of activities and initiatives across the district. She indicated that what a coach does in another part of the board might be completely different from what she does. She says the coaches’ work is dictated by the Superintendent’s vision and his or her understanding of math.

Lynette points out that both aspects of her role, structural and relational have evolved over the course of her four years of work. When Lynette began her work in the district, she typically did large scale presentations and workshops at the Family of Schools level. Together with her Superintendent, Lynette determined that, while they were “nice that one day” (Interview, April 8, 2011), these were not effective at building capacity. As time has passed, Lynette has shifted away from the large scale workshops to focus her professional development toward a school level, and to spend more time in the classroom with teachers. When considering the first year of coaching, Lynette indicates that, at first, most of the teachers thought of her role as an evaluative one. It was through repeated conversation with teachers in which she placed her self as someone to talk to, to try things out with, and to bounce ideas off of that Lynette began to develop the close and trusting relationships she believes are necessary for her work.

Ultimately, Lynette described the purpose of her position as improving student learning. Like everything else, it is student achievement. […]. That is how I feel about teaching generally. It is about the students. So, it is just about the students to me. And I think that the best people to get to the students are the teachers, the biggest impact on the students. So, if we work with teachers and get them thinking, things are going to happen. Yeah it will just happen, unfold that way and then the kids will probably benefit. (Interview, June 16, 2011)

4.3.4 Coaching goals

Lynette’s large scale goal is to improve student achievement by connecting her work as a coach to the classroom practice of the teachers with whom she works. In speaking of her goals as
a coach, her reflection turns again to the importance of creating a strong and trusting relationship with the teachers. By forming the relationships, Lynette feels that she can have the types of deep conversations that might effect change in classroom practice and thus improve student learning. She talks about the amount of time it takes to create this type of relationship, but believes strongly that the time investment is important for the deep and honest relationships that she needs to have with teachers in order to bring about change. Lynette approaches her teachers with respect and recognizes the difficulty they may have in admitting that they are struggling to understand mathematics content. She feels that her teachers will not be able to open up and discuss these misunderstandings until they feel comfortable and safe with her:

It is about relationships. This is my fourth year in the role and, it has taken time. It takes time because it is very sensitive as an adult for you to say, ‘I do not understand’ or ‘I do not get it.’ It is scary as a child to do that, but as and adult, you do not want to admit that you do not know something. And so, to admit that I have been doing this wrong...not wrong, but not maybe the best method that I could have all these years, that is a little hard. There is ego in there and it is in having conversations with people. The way you have the conversations, you build those relationships and then you feel like you can have the conversation and then that, when you break those walls down, then you can get into really good stuff with teachers in the classroom, but it takes time...it takes time. (Interview, April 8, 2011)

Lynette holds more specific, smaller scale goals for the work she does with each teacher. These appear to be determined both by teacher need as assessed by Lynette and by the relationship that she holds with each teacher. Lynette had already spent time with Ellen and had created a strong relationship with her. In talking about her goals for Ellen, Lynette discusses both what she believes Ellen wants to gain from their work together (new ideas and some experience with problem solving) and what she herself wants for Ellen. Because Lynette feels that Ellen is already “fantastic at what she does” and is “already there in terms of content and making it relevant for her students” she defines her personal goals for Ellen as “little things” (Interview, April 8, 2011). Lynette believes that the co-teaching experience will support Ellen with these
ideals as she will be able to have conversations about her work in the actual moment of her teaching as well as afterwards.

Lynette also hoped to work with Ellen on creating math problems that were more open-ended in nature. During the PLC on the morning of April 6th, 2011 Ellen shared with the group a problem she had given her students. The problem was “Susie ran a race and she didn’t come first and didn’t come last, draw a picture of the race.” This problem came from the grade K – 2 section of the text that the school was using for their PLC. Ellen reflected that the students were given a piece of paper but no manipulatives to solve the problem. She felt that it was asking a great deal of the students and that the problem was aimed at a higher grade level. She later revisited the concept from this problem with a revised question, “Nemo and his five friends were running a race to the plants. Nemo didn’t come first and didn’t come last. Draw a picture of the race and tell us what you know about the math.” Ellen felt that the students had much better success after the teachers “closed the problem a little bit.” However, in her interview on April 8th, Lynette reported that she had been in the room when the students were working on the original race problem. She felt the students were successful with the problem and she felt a challenge for Ellen in her work as a classroom teacher would be to feel more comfortable including more open types of problems in her curriculum.

Lynette’s relationship with Nick was still at the early stages when she was asked to describe her goal for him. She spoke about her goal being “just building that relationship” about “getting to know him” and to “have some conversations so there is comfort” (Interview, April 8, 2011). Lynette identified the topic area she believed they would begin with, fractions, and identified what she felt were strengths and challenges in his teaching. After spending one session in Nick’s classroom co-teaching for the school’s PLC Lynette spoke highly of Nick’s content
knowledge, careful planning, and of the mathematical conversations that his students were having. She wanted to work with Nick on ensuring that the consolidation part of his lesson engaged all of his students in mathematical reflection and to ensure that no students, even those who were struggling, disengaged from the work.

While Lynette spent only one day working with Sarah in her classroom, she was able to define a clearer mathematical goal for Sarah than for Nick. This may be due to the fact that she did not feel that she needed to work on first forming a solid relationship with Sarah as their individual work together lasted only one morning. Lynette stated that she hoped Sarah would understand that she did not need to be like the math teacher leader in the school, and that she needed to be herself in the classroom. She wanted Sarah to be open to having some ideas sparked by conversations that might enable her to change her mind about mathematics and/or her practice. Lynette did qualify this by saying, “Maybe not, maybe what [she is] doing is absolutely fine. I have no idea because I am not in [her] classroom” (Interview, April 8, 2011). Lynette highlighted Sarah’s strengths of wanting her students to do well and of being open to try new things in order to help her students. She felt the biggest challenge with Sarah would be the possibility of Sarah returning to her old way of doing things despite her openness and willingness to try.

4.3.5 Defining success

When considering the various structures that she uses with her teachers, Lynette believes that “well run” PLCs can have an impact on teachers’ work. In defining a well run PLC, Lynette says that all teachers have to want to be there, believe in the work they are doing, and invest themselves in it. For Lynette, this means that they don’t necessarily have to all participate orally, but they must all be open to the conversations that occur and feel comfortable in the
environment. Lynette believes that Oakside’s PLC was well run and she points to the growing number of participants involved in the conversations and the fact that teachers she considered to be less confident also spoke up as evidence of this. She thinks that good conversations that lead to deep thinking are what facilitate successful PLCs.

However, more than the PLCs, Lynette believes that it is her work in co-teaching that can effect the most change:

We can talk about things, like we can sit at a table and talk about it. And I think that is what was good about this PLC is that we had a conversation, but we went out, we went out and we went right in and saw. So, we can say how great it is, how wonderful to do, but we need to see what it is like, because there are people from there who are like, ‘OK, I can do this, and it is not as hard as I thought it was, and I can try.’ I would say, I would put co-teaching maybe first, and the PLC it is a step up. (Interview, June 16, 2011)

Because of this, at least 50% of Lynette’s work is dedicated to co-teaching. It may, in fact, be more because she attempts to embed the co-teaching model in as many structures as she can, as evidenced by the PLC work done at Oakside School. Because Lynette believes that the “one-off” professional development days have the least impact at both effecting change and building capacity as the conversations do not continue, she spends very little of her time on this. While at the beginning of her work as a coach four years prior, she engaged in a great deal of this type of work, during the 2010 – 2011 school year, she only did one “one-off” professional development session.

Lynette feels that the conversations that occur are indicators of success in her work. She indicates that has met with success in her coaching when the teachers she works with approach her with ideas and comments about topics she has encouraged them to think about. She also feels her coaching work is successful when she overhears conversations about mathematics between teachers in the buildings in which she works. She believes that, if she can make the teachers she works with think about an idea, those types of conversations will be triggered between
colleagues. Lynette reports that she values having the opportunity to share ideas with others and that she thus hopes that the conversations will continue once she has left the building as teachers will continue to look for people to bounce ideas off of. In this way, she believes that her work can spread from the teachers with whom she has worked to other teachers in the school.

When talking specifically about her work with Nick and Ellen, Lynette says that:

I think I have met my goals with both of them because I know they are constantly thinking and I see it and the conversations that we are having […]. I know that conversations happen here. I know, even when I was working with Nick, [math teacher leader] would come over and be like, ‘Oh, you have not come to see me’ and he started asking about things, like, ‘What were you talking about, what are you guys doing here?’ And, I think to a certain extent it is the same thing with Ellen. […]. They are both always questioning and I feel like my goal has been met. (Interview, June 16, 2011)

When asked to describe more specifically how she felt the work she had done with the three specific teachers was successful, she reported that Nick had told her that he really enjoyed the process and that she had made him think. Lynette said that, “When I work with you, I want you to think about what you are doing, think about the questions you are asking, think about the impact on students. And he said that is exactly what happened” (Interview, June 16, 2011). With Ellen, whom she had known before this research study, Lynette indicated the work was successful because their conversations continued, before, during, and after the lessons. She pointed to a trust that developed throughout the course of the spring and the fact that working together became increasingly easier and pleasurable for Lynette as time progressed as another indicator of success.

Lynette worked the least with Sarah, and reported being unsure of how much impact or success her work had with Sarah. In fact, Lynette originally believed that, for Sarah, their co-teaching day was something that she was required to do rather than something she wanted to do. However, Lynette reflects back to comments that were made and issues raised by Sarah during
the school PLC sessions that made her think that their work together was more successful than she first thought it to be. For example, Lynette thought that Sarah felt excited about trying out new ideas, such as a KWC (Know, Want to know, Conditions) chart, with her students and Lynette believed she saw the beginning of a change in mindset about mathematics during follow-up sessions.

Describing the specific impact of her work on the practice of Sarah, Ellen, and Nick and their students, Lynette reports that she did not believe her work had any impact on Sarah. She indicates that she was therefore “surprised” when Sarah spoke at the next PLC meeting and shared some work she had done with the students (a math gallery walk) based on the debrief of their co-teaching session. Lynette says:

I was actually surprised, because I really did not feel like anything made a difference, that anything I did triggered anything in her, made her think. I did not feel that way, but when she was talking and showing the work I was like, ‘Oh, OK, good, I am happy.’ […] I think that it takes a little bit of time to build a relationship, but maybe I am wrong, maybe that little bit of time was enough to spark something, and she went with that, I do not know. But, it usually seems like it takes a little longer, but that is why I thought it was like, ‘we did it, check it off.’ (Interview, June 16, 2011)

Lynette believes that Sarah’s eyes may have been opened to new ways of teaching mathematics due to the co-teaching and the PLC and that may have triggered Sarah to try some new things. But ultimately, because there was no follow up, Lynette ended the year unsure as to what, if any impact she had on Sarah’s practice.

In reflecting on Nick, she comments again on his strength in mathematics, planning, and leading conversations. She also appreciates the fact that, when he considers his math lessons, he thinks about all of his students. She believes the greatest impact on his practice is that, during the conversations he has with his students about mathematics, he is trying to get everyone engaged. She says that he told her that there were a lot of little things she did that made the difference, but
one that stood out was using the prompt to, “turn to your partner and talk about it.” Lynette sensed an increased comfort amongst the children in responding to that task and found that more students began to actually talk about math. Moreover, Lynette says there was also a change in the way Nick structured the third part of his lesson to make it more purposeful:

Even just in the whole congress part where we are talking about the problem that they just worked on, again I think there is more of a willingness to talk, but even just the structure of that. Because, I think before it was more of just, ‘OK, let’s share your thinking,’ more just a sharing piece. I do not know if it was, I am not sure if it was purposeful sharing. So just the conversations that we had when they were working on problems, ‘OK, who do we want to share and why?’ […] I know having had a conversation with him about, ‘OK, let’s look at our whole group.’ Because, he has students in there who are really really high and high level thinking and then he has got those that are a bit lower, but there is a big middle ground in there. I think some of the time it is hard because the higher level students are more vocal and he is in that conversation and he is having a good conversation and it is a great conversation, we are forgetting about a whole big group. If our goal is to move the whole group, what are we sharing? Who are we asking to share and what questions are we asking? And, like I said, I have not been in there a lot, but I noticed a bit of a change there. (Interview, June 16, 2011)

With Ellen, Lynette points to a change in her questioning style. Specifically, Lynette felt that Ellen became more purposeful about her questioning. She reported that earlier in their work together, Ellen would simply ask a question during her lessons, but that began to change and Ellen would pause and look at Lynette at times to help with the wording of a question. Lynette spoke about conversations she and Ellen had together about the importance of framing good questions to get a good mathematical response. Ellen had reported to Lynette the difficulties she was having with asking questions, telling Lynette that it was “so hard” and that often Ellen felt her questions led to unanticipated responses that veered the lesson down a different path. Lynette says that, “over time I could see her questioning change a little bit to get a different response from them. I can tell that she is very mindful of how she asks the questions now, I think” (Interview, June 16, 2011).
Linking her work to student learning was a challenge for Lynette. She indicated this was difficult because Nick and Ellen were already using a three part lesson fueled by open, inquiry based problems and good questioning. Lynette indicated that, when she worked with Nick and Ellen the structure of mathematics class did not change, “it is nothing new for the [students]” (Interview, June 16, 2011). She says that the conversations may have changed slightly, but that the students were already having them before she began working with Ellen and Nick and that these conversations were able to occur because both teachers had already created a safe environment in which they could occur. In the end, Lynette pointed to the fact that, during her last visit to Nick’s classroom, every student was willing to share during the math congress, including one usually reluctant and disengaged student. But, Lynette says, “I do not know if that is a change” (Interview, June 16, 2011).

What is of note in Lynette’s responses about teacher change in practice is the hedging she employs when describing these changes. For example, when talking about Sarah, she indicated that she felt that forming a relationship would have been necessary, so that the changes she saw in Sarah meant that she “maybe [she] was wrong” about this. When discussing her work with Nick, she says, “It is hard to say because I did not see them a lot before” and “I do not know if it was.” Even with Ellen, who Lynette knows the best, she ends her statement about the fact that Ellen is asking more purposeful questions with, “I think.”

While Lynette feels that her work both at Oakside School in general, and with these three teachers in particular has been successful, she is less confident about describing any impact or change on their practice. Lynette describes her overall purpose as a coach to be primarily about student achievement and connects this to her ability to work with teachers and make changes in their practice. However, she has very little evidence, anecdotal or otherwise to indicate if teacher
practice is changing, let alone whether or not student learning is improving. Perhaps, one of Lynette’s most telling statements during both interviews was this: “You know you never know if you have [effected change]. I mean I talk to my literacy coach all the time. We are like, ‘I do not know if I am doing a good job...I do not know.’ I think I am sometimes, sometimes it is hard” (Interview, April 8, 2011).

4.3.6 Challenges confronting her work

The three main impediments to Lynette’s work revolve around her job description, scheduling, and professional development for the coaches in the school board. Lynette highlights the fact that the clarity of the role of the coaches in the district has improved over the four years since its inception, but that it is still something she struggles with. She says when the board first began the coaching initiative, “they did not really think things through before they actually had the jobs” (Interview, April 8, 2011), and that despite there being a job description on paper, the coaches did not really know what they were doing. Lynette also indicates that the fact that the coaches “belong” to each superintendent rather than to the math department adds to a lack of consistency in work across the board. For example, when coaches are invited to a professional development session offered by the math department, Lynette says that they try to go, but ultimately, the Superintendent and not the math department makes the decision.

As time has passed, Lynette feels that she, and the other coaches, have sorted things out and improved: “With every year, you kind of figure things out. You figure out the game, you change things around” (Interview, April 8, 2011). She credits some of her improvement to the fact that she has found a mentor in her Family of Schools. She considers herself fortunate to have an Instructional Leader who supports her in her work. She does not believe that all of the coaches have this. She also indicates that, while the lack of consistent message and cohesion has been a
frustration, she recognizes that everybody has good intentions and that the board has tried hard to work with the coaches by offering professional development such as a session on cognitive coaching during the first year of the coaching initiative. While the professional development has continued and the message that is being sent is growing more consistent, Lynette still finds the coaching work to be disjointed across the board.

A further challenge to Lynette’s job description is the title of “math coach.” While Lynette recognizes that this opens doors to her and gives her access to schools and classrooms, she also finds that it comes loaded with expectations. She particularly dislikes the fact that, due to the title, her colleagues consider her to be an expert. She finds this perception an impediment to her ability to build a trusting, non-evaluative relationship with her teachers and thus spends time when she first works with teachers dismantling this perception. She also reflects on the fact that, particularly when she began her work as a coach, principals felt that the title meant she would be able to come in and “fix” teachers who were struggling. Lynette says that when she began, many principals asked her to come in and rework aspects of their math programs and work with low-performing teachers. She says that, “there is not point in that, we are not going to get anywhere, build capacity, if we are working with those who are the naysayers” (Interview, June 18, 2011). From the beginning, Lynette was clear with her Superintendent about the teachers (the willing) with whom she wanted to begin her work.

As the coaching program progressed, Lynette began to provide professional development in numerous schools and to develop relationships with many teachers. Because of this, she says that now she has an extremely full schedule and even has to turn teachers away at times. She indicates that she has become better at scheduling as time has passed, but that the schedule can still block her work with teachers. She makes her own schedule, and says she has to make a
schedule that works for her and all of the competing demands for her time. However, a schedule that works for her, does not always work for the teachers. She points to Nick as an example of this. It took Lynette and Nick approximately two months to set up a time that was mutually convenient for her to visit his classroom for the first time after the PLC. As the school year draws to an end, she reflects on her work in Nick’s room by saying, “realistically, how many times did I actually go in, right? Like, I think we could have done that much more. And I think we were limited because of my schedule, because of his schedule, because of the school schedule” (Interview, June 16, 2011).

She jokes that she wishes she could clone herself so that she could do all of the work she is asked to do. Scheduling her work is not only challenging because of the large number of schools and teachers she serves, but also due to what Lynette describes as “politics” within the board and the Family of Schools:

It is hard though because I am only one person. Like I keep saying, we keep saying if we could clone ourselves it would be great. Because every school wants some help and it is hard to say no and sometimes you have to say no because you just can not physically be in a school and then there is some politics behind that: Why are you in this school, and why aren’t you in my school, and so, it is hard. That is when you end up doing a lot of the one offs, to appease everybody. That part is hard. I would say that is the biggest challenge in this role is trying to appease everybody to a certain extent. (Interview, April 8, 2011)

According to Lynette, the full schedules of the coaches and the politics also impact the coach’s ability to receive quality professional development. She says that, although the coaches are scheduled to meet once a month, she does not believe that even one of the professional development sessions was attended by all of the coaches during the 2010 – 2011 year. The PD days have become half day sessions with a large focus on administrative details and very little, if any, work done on mathematics. Lynette describes it as “a taste and then you have to go” (Interview, April 8, 2011). When the coaching began, Lynette felt the sessions were stronger and
that after she met with her coaching peers she left with some new ideas to try with her Family of Schools, but that she has not felt that way for the last while.

Part of the difficulty with the professional development sessions, says Lynette, is that the nature of the job is such that they have all become so busy they do not have the time to commit to the sessions. Furthermore, like scheduling in the Family of Schools, planning the professional days is difficult due to political issues such as in which part of the board the meeting will be, who will have to travel, where the session will be, how long it will last, and who will be running the session.

Again, Lynette recognizes that there are good intentions around the professional development of coaches, but laments the lack of professional network and reflection time she is given in reality.

It is just the nature of this job has gotten really really busy and there seems to be no time. I mean I do not get to talk to many of the coaches, the math coaches, like I used to before. We used to get together and… ‘What are you doing, what are you doing?’ And, everybody has great intentions. There is a wiki that is created and everybody can put things on and it is great, but I have no time to even go onto that. You know, everybody means well. I just think, it is like when I am working with teachers it is that reflective [piece]. That is what’s going to get change, time to reflect, and we are not really getting time to reflect. (Interview, April 8, 2011)

4.3.7 Aspirations

While Lynette will be returning, by her own choice, to the classroom for the 2011 – 2012 academic year, she identified two future long term aspirations she holds for the coaching work in her school board. The first is related directly to the teachers she worked with at Oakside School. She says that she would like to see the co-teaching occur between teachers without a coach in the school and states that ultimately, “That is what I want to happen. So that is when I know that my goal has been met because they can go on without me. So, when I am not needed anymore, I feel good about that” (Interview, June 16, 2011). She believes the groundwork has been laid at the
school as the full day kindergarten teachers have early childhood educators in their classrooms
and the teachers have already done some co-teaching together. She also observed that while they
do not co-teach, the junior teachers also get together informally and discuss their lessons and
their practice together.

In looking to the future for coaching in her board, she believes that improved professional
development and a professional network of coaches are necessary for the coaches to improve
their work:

I wish that was something that was built in [...]. I understand that we are so busy, but if
you took the whole day and said, ‘OK, first half of the day we will do what we normally
do [...].’ But then, maybe in the second half of the day, give us that time to sit down and
talk to one another and see what is going on so we are not re-inventing the wheel all the
time, because that seems to be what is happening. (Interview, April 8, 2011)

By providing the coaches with dedicated and mandatory professional development time in which
they all receive the same learning experiences and have the opportunity to share ideas with one
another, Lynette hopes that a consistent message and strategy will spread across the district. She
also believes that providing the coaches the time to have deep conversations about their work
with one another and to reflect on their own practice will help them to improve and strengthen
their work. She likens this belief to what she perceives is important for teachers: they must have
strong relationships to foster deep and difficult conversations that will effect change. Likewise,
she hopes that the coaches in the school board might be supported to build these relationships
through professional development in the future. For now, Lynette says, it is something she does
not get unless she seeks it out on her own.
4.4 Reflections of Lynette’s Teachers: Sarah, Nick, and Ellen

4.4.1 Views on coaching

All three teachers at Oakside School spoke positively about their experience engaging in mathematics coaching with Lynette. They all spoke about the purpose of Lynette’s role being to help them to improve their practice. Sarah says that a coach is someone who “is going to come in and assist the teacher” (Interview, March 31, 2011), Ellen believes that Lynette would “support what you are doing, and push you to try something a little bit different, push you in directions you have not gone” (Interview, April 29, 2011), and Nick said that while he does not really know what a coach’s job is formally, according to the school board, his experience tells him that a coach “is someone who supports teachers and helps them learn to become better teachers” (Interview, April 19, 2011). None of the teachers spoke directly about student learning in their responses except for Nick who was unsure if and how a coach’s work was or was not connected to student outcomes: “I do not know. I do not know if they have ownership over how students are doing, as a Family of Schools. I am not really sure if that is reflected on them or not” (Interview, April 19, 2011).

All three teachers also pointed out that working with Lynette did not seem evaluative or critical. They felt that her support was more collegial. Nick refers to the fact that working with Lynette felt as though he were working with another teacher in the school and he appreciated having someone in his room to provide a different perspective on how his students were working and to share ideas with, particularly around the consolidation part of his lesson. Despite this, Nick still referred to Lynette as an ‘expert’ at times during his interviews.

Nick’s understanding of the role of a coach was that a coach would be someone who would give the teachers new materials and techniques for teaching mathematics. He also felt that
a coach should be supportive of a teacher’s goal and help them to become better teachers. He expected to receive advice and feedback about his teaching from Lynette.

For Sarah, one advantage of a coaching program is that coaches have the time to study a subject (in this case math) in more depth than classroom teachers. Sarah speaks about the fact, that after spending a number of years teaching at one grade level, a teacher can end up “set in [his/her] ways” (Interview, March 31, 2011). She believes that a coach can encourage a teacher to explore new and creative ideas that a teacher had not considered or perhaps had the time to investigate due to the demands of teaching multiple subjects. She highlights the gallery walk as an idea that was introduced to her because of working with Lynette. Sarah also says that working with a coach provides her with confidence because in many ways it “validates” what she is already doing. She pointed to the consistency that a coach can provide a school since the coach works in multiple grade levels across the school. Because of that Sarah says the teachers are “all in the same boat of understanding” (Interview, March 31, 2011).

Ellen “loves” working with Lynette. She felt that working with Lynette enabled her to keep challenging herself to reach her full potential and provided her with an increasing sense of confidence about both her own mathematical knowledge and her ability to teach math. Ellen points to the personal connection she has with Lynette as a large part of why the coaching experience has been so positive for her. She calls this relationship “amazing” (Interview, April 29, 2011) and feels that she has found a mentor in Lynette. Like Nick and Sarah, Ellen appreciates the way Lynette provides her with new and different ideas to try in her math class. She says, “I find that really useful. Not confrontational. I don not ever feel like I have done something wrong. I may have done it differently, but that is OK” (Interview, April 29, 2011).
Ellen also believes that the coaching process helps her to think more deeply about mathematical practices and push boundaries with her students so that they are all trying new things.

Overall, the teachers at Oakside had a very positive view on the coaching process in which they engaged. They all considered it to be beneficial, successful, and could point to changes in their practice. Ellen describes it as a “Huge, huge opportunity” and says that she would tell all teachers to “Try it! What else can I say? I mean I really would really encourage all teachers to get to know their coach and not just have them in for one session. Have them in for a bunch of sessions” (Interview, June 16, 2011).

4.4.2 Goals

While Lynette elucidated some specific goals for each of the teachers with whom she worked, none of the teachers at Oakside listed specific goals for their work with Lynette. In fact, all three teachers spoke broadly about their aims to improve their practice and to become better teachers when describing their goals.

Sarah has “no personal goals” (Interview, March 31, 2011), but believes that any time she works with a coach, her program will improve. She speaks about the importance of being open to learning, trying new ideas, and assessing how her students do in response to the new ideas. Sarah indicates that, due to this openness, her math teaching will improve. She says that, “any time I work with a coach, I am expecting that my program will improve. Simple as that” (Interview, March 31, 2011). In speaking about her aim to “improve her program,” Sarah reflects that she believes her students will also improve. Notably, she does not connect student learning directly to Lynette’s role as a coach, but to her own evolving practice.

Ellen says that her goals “are just to become a better math teacher. Absolutely, simply” (Interview, April 29, 2011) and Nick says that, “a goal for me would be to pick up on...to learn to
become a better teacher” (April 19, 2011). While Lynette’s goals for Nick were the most broad, in the sense that they were focused on forming a relationship with him rather than on a specific mathematical concept or pedagogy, Nick is the only teacher who narrows down his goal by specifying what being a “better teacher” might be. He indicates that he would like to pick up on “tiny little things” and connects this thought to the co-teaching session he did with Lynette during the PLC. During that class, Lynette asked the students to turn to one another to explain what they believed the problem was asking of them. Nick had not done this before and began using this in future classes (Observation, April 19, 2011; Observation April 21, 2011). Nick says that, for him, “just that one ten second thing she had said was worth the whole lesson, the whole afternoon, or whatever it was we took because now I use that” (Interview, April 19, 2011).

Nick says that another goal for him would be to have discussions with Lynette about his lesson consolidation so that he could stay better focused at the end of the lesson. He also indicated that a goal he had for his students was to learn from another person and to hear a different perspective. He believes that his students will learn better if they can have the input of different teachers. Nick also reflected that he would like to spend time working on how to better assess his students since much of their work was done through conversation and explaining their mathematical thinking and that his emphasis was not on the right/wrong solution to a problem.

In reflecting on their goals at the end of the term, all of the teachers felt they had met them. Ellen felt she had become a better teacher who was more comfortable with math, but felt that she could also go farther. Sarah felt she met her goals during her time with Lynette as she was able to pick up new instructional strategies such as the gallery walk. Nick indicated that his basic goal was to improve and he felt he had done that due to some of the instructional strategies he picked up and the overall experience, which he defined as successful. He says, “I just kind of
wanted to learn more about my own teaching and my own students and I definitely feel like there
was an accomplishment there […] I do not know how you can measure how much of an
improvement, but I feel like I learned something and I feel like the kids benefited, so to me that
was success” (Interview, June 16, 2011). For Nick, it is not clear that setting specific goals for
coaching is necessarily a good idea. Reflecting on his goals during his final interview on June 16,
2011, he said that, “I guess I did not have really specific goals, which maybe in hindsight, would
have been a good idea” but later says, “So maybe it was kind of good that I did not have a
specific goal” in respect to the difficulty he and Lynette had with scheduling and the flexibility
required for them to get their work done.

4.4.3 Impact on practice

The teachers at Oakside School believed that working with Lynette did lead to changes in
their practice. Sarah pointed to specific structures in her classroom that she began to use as a
result of her co-teaching experience with Lynette. For example, Sarah had never used a gallery
walk as a way to consolidate a lesson. During the debrief of Sarah and Lynette’s lesson, the
conversation focused on ways to help Sarah’s students communicate their ideas more strongly.
Lynette raised the idea of a gallery walk and Sarah agreed to try one in her class (Observation,
March 9, 2011). This format was observed during Sarah’s March 31, 2011 math class. It was the
first time that Sarah used a gallery walk alone and she shared the results of the experience as well
as comments students made in written form on each others’ work during the following PLC
(Observation, April 6, 2011). This was the only time that Sarah used a gallery walk over the
course of the year. She reflects on the fact that she sees the sixth grade students using it
frequently, but that it takes a great deal of time to teach the students how to do it well and that,
while she felt positive about the experience, which she described as giving her a new picture of
where the students were in their understanding, she does not feel she has the time to dedicate to that type of instruction when she has so much content to cover before the provincial standardized test in May.

Sarah also spoke about the “KWC” (Know, Want to know, Conditions) chart that Lynette used with her students during the first part of their co-taught lesson. This was a new format for Sarah and one that she reported using with her students after the co-teaching experience. While this was not observed, the KWC chart did remain displayed as an anchor chart for a number of weeks following the lesson. Sarah explains that approximately one third of her students began to use the chart to organize their work and plan out what they knew, needed to know, and how they would try to solve the problem.

Sarah felt she changed the way that she presented problems to her students, “so that we could get those different ways of solving the problem” (Interview, June 16, 2011), which she felt helped the students think more deeply about their process for solving mathematical questions. She says that she began to ask the students “How did you solve it? What was your thinking?” more frequently when presenting these problems. Finally, Sarah talks about the three part lesson model, and specifically the first part, which is known in her school board as the “Minds On” part of the lesson. Lynette had modeled this during their co-taught lesson:

By just doing that quick, getting them interested piece, and by doing that and reviewing the knowledge they already knew, really got their minds set on the next step. It truly did work that way. So, I started doing all my lessons, before they went into their homework book, doing the same thing. Doing a review, but doing it through a mind set where they were able to then continue that thinking on into their work that they were doing. (Interview, June 16, 2011)

Like Sarah, Nick is specific about the changes he observed in his own practice. However, while Sarah’s related primarily to structural changes, Nick spoke more about small changes in his instruction. For example, he began to ask the students to turn to one another to explain what a
problem was asking before he sent them off to explore it by using a “think, pair, share”
technique. He felt this opened some doors for him as he began to realize that some of the
children did not understand what they were being asked to do, “Just by stopping and having them
paraphrase what I just said was huge because there were a few of them that were not getting it”
(Interview, April 19, 2011).

He says that it was the “little tiny things that you do not really think about” (Interview,
April 19, 2011) that made the biggest difference for him. Due to the fact that teachers get
comfortable teaching in a way that feels natural and works well for them, Nick reflects that they
do not often stop to think about why they are doing something. Nick adds that teachers rarely see
someone else teach. He and the other teachers in his school do meet to talk about their practice,
but do not often get the opportunity to observe one another. He says that some of the small
things he saw Lynette do seem “so obvious” and made him wonder “Why wasn’t I doing that?”
because they were really effective. Another example Nick gives of a “little tiny thing” he learned
from Lynette was that when a student did not have an answer, she held the student accountable
by telling him that she would be coming back to him. Nick said that those types of teacher moves
made a big difference for him.

At the end of his time working with Lynette, Nick spoke about another method she used
to hold his students accountable for their learning in which she asked non-presenting students to
paraphrase what a presenter had just said. He also described it as a “small thing” that had an
impact on his own work:

I would have them present and then discuss, but she made them not just agree or disagree,
but understand what that [student] was saying. So, it did not matter if you did not agree,
but the focus for the [students] that were listening was to understand and then they put it
back into their own words. I always found that that was a bit of a...When I was doing my
own lessons that was a bit of struggle, keeping everyone captivated with the presenters. It
was almost like they were really eager to present their own ideas and get up there, or they
would present their own ideas in discussion, but to get them to really learn from the people up there? I found it was really beneficial for the people that were presenting, but some people just were not into it. And that little tiny thing, she just kind of said it, that is something I will use in the future. (Interview, June 16, 2011)

For Ellen, the changes that she perceived occurred more at a personal level and resulted in increased confidence with mathematics itself and mathematics teaching.

Because of her work with Lynette, Ellen felt more empowered to take risks with her students and to try new and more creative tasks:

> I think she challenged me or encouraged me to try more or to try different things. I definitely feel that I have done way more than I might have. It was lovely. It was so much fun. It was fun for me to see what I could do. She was helping me as a coach, but I really feel she was helping me develop as a teacher. (Interview, June 16, 2011)

> I think my first two years I did a lot of what I knew and then also looking at the resources that we had in the class. Working with Lynette, I just totally tried really different things, like really different creative things, more. Things that I didn’t think they could do, I gave it a try, things that were more interesting. (Interview, June 16, 2011)

Ellen, who speaks openly of her math phobia before coming to teaching, feels that without Lynette she would have pushed herself to grow as a teacher in literacy, but probably not in math, where she believes she would have “stuck to [her] comfort zone” (Interview, April 29, 2011). She now feels much stronger in math than she did before and enjoys teaching the subject. In fact, she looks for mathematical connections across subjects and includes mathematics in her literacy, science, and art lessons.

For both Nick and Ellen, co-teaching was the model that had the most impact on their own work. Ellen says that having someone beside her telling her that she was doing a good job and encouraging her to try a new task was crucial in building her confidence. She does not believe that going to a professional development session or reading a book would give her as much support as having a person with her, in the moment, in her own classroom. She also describes this model as useful because it is able to span time and progresses with her as she
develops as a teacher to meet her evolving learning and because it encompasses planning, teaching, and reflecting on a lesson.

For Nick, the benefits of having a co-teacher in the room include the fact that he is able to hear a different perspective on how his students are doing and to step back from being in the moment of teaching from time to time to observe both the practice of an effective teacher and how his students are responding:

You are looking at the class from a different perspective. It is nice to see someone else teaching your class because you get to see how they are reacting to it. Sometimes you are up presenting a problem or explaining, it is hard to realize how they are really taking it in. There is one way, the way I think they are taking it in, but I am not sure. To see them react to a different teacher be it Lynette or anybody, it is just a different perspective. It makes you see which way they are learning or responding a little bit better and that is something I can focus on because I do not have to focus so much on the teaching of the lesson. (Interview, June 16, 2011)

Nick also finds the conversations that occur in the co-teaching model about both the lessons and the student work help him to better understand his students’ learning. He talks frequently to other teachers in the school, particularly the math teacher leader, but the fact that he and Lynette have both shared the same experience makes the discussions more powerful and useful for Nick.

For Sarah, who only engaged in one co-teaching session, the PLC had the most impact on her work. She found the open ended questions that were included in their shared book and the fact that the teachers had to choose one during each meeting to then try in their classrooms useful. It encouraged her to begin asking her students “How did you solve this? And what was your thinking?” (Interview, June 16, 2011) which she believes became an embedded part of their own mathematical work.

Conversely, both Ellen and Nick found the PLC to have the least impact. For Ellen, this was because kindergarten “is a whole different ballgame” (Interview, June 16, 2011). While there were some ideas that Ellen could take from the PLC she did not feel it was as beneficial to
kindergarten teachers as it was to teachers of older grades. She says she liked the PLCs, that they were helpful, and that she appreciated being included, but that the focus was on how to build the skills. For Ellen, the focus of instruction is on introducing the skills, and working with Lynette was more specifically aimed at that.

Nick thought it was “nice” that he got to plan with the other teachers in the junior division, “good” to see the other teachers co-teach, and “liked” talking about the problems (Interview, June 16, 2011). However, he felt that, as a staff, they were getting close to where they wanted to be. While talking is important, he started to feel that the conversations became repetitive and thus did not accomplish as much as engaging in the co-teaching. The reassurance he received from engaging in conversations with his colleagues was important, but it did not advance his teaching in any way, while co-teaching with Lynette did.

4.4.4 Impact on student learning

The teachers at Oakside School had more difficulty pointing to specific changes in student learning as a result of coaching than they did discussing changes in their practice. Sarah found her students “seemed to be more confident” (Interview, June 16, 2011) and believed that the problem solving questions she presented were responsible for that. She felt that she saw this particularly during the provincial testing where every student was able to at least start the problems and that no one was “totally stumped” (Interview, June 16, 2011). She also believes that the line of questioning she began to use that focused on how they solved problems led to students thinking that way about math problems on their own, which to her “was a big difference” (Interview, June 16, 2011).

Likewise, Ellen found the students gained confidence with mathematics and became more eager to engage in mathematics problems. She reports that the students began to ask when
Lynette would come in so that they could “play math” with her (Interview, June 16, 2011) and asked to do more in mathematics. She believes they are starting to see math differently, and to engage in more spontaneous mathematical activities. For example, during one of Lynette’s visits, the students started using their fingers to skip count by fives and tens, and began to consider the number of groups of five that they had. According to Ellen, Lynette not only helps push her, but also her students beyond where they are. However, while Ellen says that while she thinks the students’ learning has changed by stretching their thinking about mathematics and their excitement for it, she also indicates that, “We will not know for many years” (Interview, June 16, 2011). Similarly, she reports her students are “more comfortable, happy, and willing to try new things” (Interview, June 16, 2011) in mathematics and believes that some of that can be attributed to her work with Lynette. She also thinks some of that is attributed to the fact that this group of students has had full day kindergarten.

For Nick, there are no “groundbreaking” changes in his students’ learning (Interview, June 16, 2011). He reports that the structure of the lessons and the expectations have not changed since working with Lynette. He believes that their learning is better since there is an “expert” in the room (Interview, June 16, 2011) who was able to guide them, ask different questions, encourage them to try something in a different way, and expose them to new ideas. But for Nick there have been no “massive big changes” (Interview, June 16, 2011) in his students’ learning as a result of coaching.

4.4.5 Challenges

Broadly speaking, the challenges faced by Oakside teachers revolved around one theme, a lack of time. This led to struggles with communication, scheduling, and willingness to engage in both coaching and in implementing new ideas. Both Sarah and Nick had little communication
with Lynette prior to their first co-teaching session for the school-wide PLC on March 9, 2011. While they both communicated with Lynette via email, neither spoke to her in person until the day of the lesson. Sarah reports that while she felt it went well, “we basically winged it that morning” (Interview, March 31, 2011).

Nick also spoke about the difficulty of scheduling co-teaching sessions with Lynette. He found the timetable to be the most difficult aspect of utilizing coaching due to the fact that Lynette worked at so many schools. He also reflects that he has a busy schedule. Finding time to work together became a challenge. While they talked in person on days when Lynette was at Oakside to work with Ellen or for PLCs and via email, it took Lynette and Nick close to two months to arrange their first co-teaching session. Once they began, it became easier for these to be scheduled and they were able to conduct at least four sessions in the following month, but getting started took longer than they had both anticipated. Nick believes that one of the reasons they were able to make this work, despite the challenges, was the fact that they were both very flexible about making changes in their schedules, and that they continued to communicate over that time period, both in person and via email.

Sarah indicates that, because of the pressures of the provincial test, and the amount of topics to cover in her curriculum, she has limited time to work with a coach. Similarly, she feels that, while she is getting great ideas, such as the gallery walk, she does not have time to fit them into her math block and “complete the curriculum”:

So that extra time that I would love to spend on all of this: the gallery walks, and the problem solving, and the communicating, and the organizing, I do not have that time that I would like to spend on it. (Interview, March 31, 2011)

She talks about the struggle this causes her as she thinks that implementing the new ideas would help her students with communication and explaining their thinking on provincial testing, but she
struggles to find the time to do that and also finish the grade 3 curriculum. She asks, “how do you balance those out? That is tricky” (March, 31, 2011).

Sarah’s difficulty in implementing the changes suggested by Lynette also led her to feel stressed. She says that coaching can be “an extra stressor put on you” (Interview, June 16, 2011). For Sarah, there is a routine that teachers get into, and changing the routine can be difficult. This, in addition to the time pressure to cover the grade 3 curriculum before the provincial test, leads her to think, “I should be doing more of that” and “I am supposed to be doing it this way” and feel additional pressure (Interview, June 16, 2011). While she says she is doing “a little bit” (Interview, June 16, 2011), she feels she should be doing even more.

Both Ellen and Nick reflect that accessing a coach as a new teacher could be a challenge. Ellen says that she does not know that she would be confident enough to do that as a new teacher because having a coach in your room might be intimidating. The coaching role did not begin in the school board until Nick’s second year of teaching, but at that time he didn’t know who his math coach was, let alone how to connect with her.

4.4.6 Looking forward

While all teachers reported an overall positive experience with their coaching experience and felt that it was a beneficial practice, when asked how they might modify or design a coaching program to better meet their needs, each had suggestions. Sarah would like to see the coaching work as a team teaching approach so that a grade level team would work with the coach to do long term and immediate planning. The coach would then check in with the teachers on a consistent basis throughout the year to answer questions as they arise. Sarah felt that having Lynette in her classroom was a useful experience as was working with her in the PLC, but that once that was done, Lynette was gone. Sarah’s ideal coaching arrangement would include a
check in from the coach every month or two. This check in would include classroom visits so that the coach would know where the teachers were in the curriculum and what their practice looked like.

In Nick’s vision of a model coaching program, it would be mandatory for all beginning teachers. He struggles with this idea, because he believes that it would be good to make it mandatory for all teachers. He recognizes, though that if it is made mandatory, there would be resistance. He thinks the ideas and knowledge coaches have are helpful to all teachers for improving, and simplifying their practice, but does not believe it can be made a requirement for all. Instead, he thinks it should be mandatory for all beginning teachers, which he describes as teachers in their first five years of practice. In recognizing the time demands this would place on coaches, he recommends having more coaches in each Family of Schools. Likewise Ellen’s ideal coaching program would include more coaches so that there can be more coaching. From Ellen’s perspective, Lynette has been “super available” (Interview, June 16, 2011), but she describes herself as lucky as she does not expect that happens for everyone everywhere in the board.

All three teachers indicated that they would like to continue working with a coach in some capacity. Sarah pointed out that a deterrent to her, however, remains the time pressures of the grade three curriculum, especially in light of the grade three provincial testing that occurs in May. Nick also expressed concern that it can be difficult to take the initiative to schedule time to work with the coach. He speaks about having had the desire to work with Lynette for a while, but needing the ‘push’ of a researcher being present to take the leap of engaging with her. While he felt his work with Lynette was overall a successful and positive experience, he indicates that an impediment for working with a coach in the future would be organizing himself to find the time to schedule the work. If Nick continues to work with a coach, he would like to focus his attention
on working on assessment strategies when using a more reform-based mathematics teaching approach.

Ellen would also like to continue to learn and improve her practice. She feels she has already learned a lot, but that there is also always a great deal more to learn. Ellen also speaks about having gained the mathematical confidence to teach a different grade level. When she began teaching, she did not feel she could teach any grade above kindergarten because of the level of mathematics in higher grades, but now she aspires to teach a higher grade in the future to try out some of her new ideas with older students.

Both Ellen and Nick, however, cautioned that, since Lynette is leaving and they do not know who the new coach will be, they would first want to meet the new coach before agreeing to any work with her. They both feel that the relationship they established with Lynette – one in which they never felt judged, were encouraged to take risks, and were able to engage in deep, reflective, and open conversations – was crucial to their success. They imagine that working with a coach with whom a good relationship is not formed, who is negative, authoritative, or who holds a different teaching philosophy from them would not be worthwhile or successful.

4.5 Principal Reflections: Suzanne

Suzanne’s vision for good math teaching and learning aligns with Lynette’s vision. She wants to see students engaged in problem solving, in talking about mathematics, and in sharing different strategies. She wants to see the students in her school excited about math and points to the fact that some of the students in the school invite her into their classrooms to see their math work as evidence that this occurs in the school. She believes that a math coach is someone who is a good math teacher with numerous strategies that can be shared with teachers. Suzanne thinks it is important for coaches to be able to identify teachers’ strengths and weaknesses and to
provide them with actual tools to support their learning, rather than simply telling the teachers what to do. Suzanne also believes that a coach can play the role of consultant by helping the school to stay on track with new ideas, and by holding them accountable for trying new initiatives. She points to the work done at Oakside’s PLC as evidence. Since Lynette’s time at the school was limited, teachers had to try new ideas before she returned. Suzanne indicates that Lynette also helped them in planning between PLCs and in long term planning for the following year.

Suzanne feels that the greatest impact on changing mathematics teaching and learning at her school is the common text that Oakside teachers read during the PLC. She reports that having common language and a common vision amongst the teachers is very important, and that, while it does not have to be a book, she finds a book to be an easy way to do this. In addition, Suzanne feels that having Lynette’s follow-up support for teachers who wish to pursue it is useful and that she would not want to lose that piece as it impacts the teaching of those who choose to work with Lynette.

Suzanne says that she can already see the benefits of Lynette’s work in her school. She senses more confidence in both Ellen and Nick and thinks that other teachers in the school are beginning to see them as math leaders with whom they can discuss issues surrounding mathematics teaching and learning:

Individually, I believe the teachers who had her in the class [...] their confidence has grown tremendously. And, I think partly it is, much of it is their own work, but having someone there saying, ‘Yes, you are on the right track’ and ‘Here would be the next steps’ and ‘Try this.’ Truly as a coach in that role of a coach and cheerleader kind of thing has really, really helped those people who have had her in. Their confidence has just soared and they are leaders in the school now, outside of what they do in their classrooms. And, they are perceived that way too by other teachers so that when we are having those conversations, they will say, ‘Oh let’s ask Nick, he has been doing a lot of that’ or ‘We will go visit Ellen’s class.’ Or if I am talking to other principals and I am saying that we are trying to work on this, I will say, ‘Oh, come see this class’ because my
perception, and their perception and the staff’s perception is that they are the leaders because they have been working on this with a focused specific goal and with the guidance of an expert. Yeah, it has been good, it has been really good. (Interview, June 16, 2011)

She also reports that the work the whole staff has done in the PLC is evident in the school. While it is not “fully contagious” (Interview, June 16, 2011), she sees that teachers are sharing ideas about strategies from the book that worked and are trying out some of the structures discussed during the PLC sessions such as gallery walks. She also senses a renewed interest among the staff to get a math resource room in order and fully equipped with text resources and manipulatives.

However, Suzanne is not able to point to evidence, anecdotal or otherwise that the work these teachers have done with Lynette has any impact on student learning. She believes it has and is hoping that this will be reflected on the provincial standardized test scores. Suzanne feels that if the school commits to good practice, she will eventually see improved student test scores.

Suzanne reports that she is instrumental in setting up Lynette’s work in the school, by both arranging the PLC and helping point Lynette and/or her teachers toward one another. She is clear that not all teachers are ready or willing to work with a math coach, but that when she senses they are she discusses the idea with them to encourage them to seek out that support. For Suzanne, the greatest challenge of working with a math coach is the limited time that the coach can spend in the school. She talks about the fact that, due to the number of schools with which Lynette is responsible for working, Lynette often “flies” in and out of the school and misses the mathematics that happens “incidentally.” In her ideal world, Suzanne would like to have more continuous contact with the coaches by having both a math and literacy coach in each school. When coaches know the staff, they are able to make recommendations about program scope and planning: “When you work with them regularly and they become temporarily part of your staff,
they get to know your people as well so you make your decisions together. Or, they make recommendations to me. So, it is really good for them to get to know your people” (Interview, April 29, 2011).

However, Suzanne also believes that math coaching can and should take place at Oakside without an outside math coach. Like Lynette, she would like her teachers to do more co-teaching with each other and, in essence, coach each other through reflective conversations about the lesson. Suzanne still sees a role for an outside math coach to come in so that things don’t get stuck and so that new ideas and information can consistently enter Oakside.

Her greatest aspiration for the math coaching program in the district is that it extend to special education. She is very clear that she does not want a special education coach or consultant, but that there should be a math (and literacy) coach whose work includes special education teachers. In addition, she sees a real need for coaches to work with classroom teachers who have identified and not identified special education students in their classrooms to help them to differentiate instruction specifically for these students and to ensure that they are also learning mathematics at an appropriate level.

4.6 Summary of Coaching at Oakside School

The coaching experience of all participants at Oakside School is described as positive, beneficial, and successful. While each teacher and the coach experienced challenges that impeded the ability to engage in their work as fully as they may have wished and with ease, all of the teachers would continue to work with Lynette in the future. Each teacher highlighted ways in which their practice had changed. Interestingly, the changes in practice were across different dimensions of mathematics teaching and learning for each teacher. Of note is the fact that when Lynette considered the impact her work had with each teacher her responses echoed the teachers
to a strong degree. While spending limited time with the teachers, she recognized Sarah’s willingness to try new approaches, particularly the gallery walk and the KWC, but was concerned about her returning to her old ways of teaching. Lynette noticed the change in classroom participation and student accountability in Nick’s classroom and commented on the small aspects of her practice, such as the questions she had asked and Nick adopted. She also was aware of Ellen’s growing confidence in mathematics and her willingness to try new ideas. This enabled her to push Ellen into trying more open-ended problems as the year progressed.

Suzanne also noticed a change in the teachers practice, but for her it was more general in the way the teachers were perceived and presented themselves at the school.

Nick and Ellen, who spent the most time with Lynette, agreed with Lynette that the co-teaching model had the most impact, and felt that engaging in the PLC had less impact for them. Sarah felt differently and believed that the PLC had the most affect on her teaching. This may be due partly to the fact that the PLC is what she experienced the most. In reflecting on changes she would make in the future, Sarah mentioned having more consistent contact with a coach in her classroom.

For all participants, time was an impediment that challenged their ability to engage in coaching to the extent they wanted. This was a challenge too for Lynette and Suzanne. All participants, with the exception of Sarah, wanted more coaches to be available in the Family of Schools. For Lynette, another large struggle was the lack of professional development and support network she had as a coach.

Although coaching is to be considered a professional development strategy that is used to improve student learning through teacher change, little evidence of that is perceived by the participants in the study. All teachers felt it benefited their students, but spoke more broadly
about confidence and affinity towards mathematics than about specific learning outcomes. Similarly, Suzanne could not report on any observed impact to student learning beyond a sense of increased confidence. There appears to be limited, if any, methods of measuring student learning at Oakside school beyond the provincial testing that occurs at grades 3 and 6.

4.7 Maple Downs School

There are over 330 students in grades Junior Kindergarten through 6 at Maple Downs School. In the 2010 – 2011 school year, Maple Downs was designated a “School in the Middle” based on results from provincial testing. “Schools in the Middle” are schools with average provincial test results. The school board supports these schools in their efforts to improve student achievement. At Maple Downs School 76% of the students speak a first language other than English and 13% of students have been in Canada for less than five years. Like Oakside School, Maple Downs is located in the south-western area of the school district. While it is also in a suburban area of the district, it is located closer to the central urban area of the school board.

There is currently no school-wide initiative based around either literacy or numeracy in Maple Downs School. Heather, the principal, does support her teachers engaging in such initiatives at the Family of Schools level by providing them with funding (if necessary), release time, and paying for substitute teachers.

Because Maple Downs was one of the schools that received full day kindergarten, a new initiative in Ontario in 2010, the kindergarten teachers from the school engaged in a four-part PLC led by their mathematics coach, Natalia. This PLC occurred once a month from February through May. The meetings occurred in the morning and included all of the teachers from the four schools in the Family of Schools that had full day kindergarten classrooms. The location shifted so that each of the four schools hosted once. Each PLC included a model lesson taught by
one of the kindergarten teachers at the school. Natalia worked with the teacher to plan it, but it was not a co-taught lesson. Natalia took pictures of student work to document the lesson and posted it on a blog she keeps for all the teachers in the Family of Schools.

During the PLCs, Natalia introduced the lesson and led a debriefing session with all of the teachers afterward. The PLCs also included work done on topics such as using a three part lesson design, forming inquiry-based mathematics problems, assessment of children’s work, forming success criteria, and creating a common language. Natalia brought in documents from the Ministry for the teachers to refer to as well as manipulatives for them to explore. As support for the work on using an inquiry-based problem in a three part lesson design, Natalia modeled this for the teachers during the PLC.

The PLCs also always included time for the teachers to work together to plan a three part inquiry-based lesson. They could do this as school-based groups, as partners within the same school, or as cross-school groups, and the topic was always pertinent to the mathematical strand they were in the midst of teaching. During each PLC, the teachers were asked to bring in samples (or photos) of student work and were provided time to share their lessons and the student work with other teachers.

Two of the four Kindergarten teachers from Maple Downs School participated in my case study, David and Kim. David began his work with Natalia two years earlier when Kim was on maternity leave. During his first year of work with Natalia, their time spent together was primarily in his classroom where Natalia modeled, and/or they co-taught together. David’s first year working with Natalia was also her first year in the role of a coach. The following year, David’s teaching partner returned and David had very little, if any contact with Natalia. He and Kim began working with Natalia again during the 2010 – 2011 year and invited her into their
classroom for a few visits before the PLC began in February. They also each had Natalia in their room once in the spring of 2011 in addition to engaging in the PLC with the other two Kindergarten teachers from their school.

4.8 The Case of Natalia

4.8.1 Background information

The 2010 – 2011 academic school year was Natalia’s third year working as a coach in her school board. She was hired in the second year of the initiative when the board doubled their coaching staff from 12 coaches to 24 so that each Family of Schools had its own elementary mathematics coach. The Family of Schools in which Natalia works includes 21 schools. Similar to Lynette, Natalia’s journey into the role of coach came about through her own initiative and interest. Prior to becoming a mathematics coach, Natalia spent eight years teaching in elementary school. She was a grade 3 teacher for three years, a grade 2 teacher for three years, and a grade 4 teacher for two years. She refers to the fact that, when she began teaching math in her first year of teaching, “something did not feel right” (Interview, April 5, 2011). She started to read teacher guides, board documents, and texts from her time at teachers’ college to help her improve her teaching. She also sought out professional development around mathematics, specifically the Additional Qualifications courses, which her board was subsidizing.

While taking the three AQ courses necessary to become a “math specialist,” she was also exposed to different opportunities in her school, her Family of Schools, and the board itself. She became the curriculum leader at her school, which was an “Early Years Numeracy School.” She also became a lead teacher for a board level initiative around mathematics, engaged in a Ministry-led initiative, and partnered with a local teachers’ college on a project based around
experiential learning. All of these opportunities provided Natalia with professional development and mathematics knowledge, which she brought back into her classroom.

Natalia speaks of this exposure as getting her “out of the school level” (Interview, April 5, 2011) and this experience as well as her designation as a curriculum leader in her school led her to begin to plan school-based initiatives with her principal. When the coaching position was posted the first year, Natalia did not feel ready to apply, despite the encouragement of her principal. Instead she took a second year to teach grade four, increasing her time teaching at a junior level and applied for the coaching position the following year. At the point that Natalia applied, she had been in her school for eight years and she felt ready for an opportunity outside of her school. She says, “I felt that I was at a different place than my colleagues were, and I really wanted more professional learning for myself to push my thinking and so I saw the coaching role as an opportunity for me to grow, and also to share some of the things that I had learned” (Interview, April 5, 2011).

Natalia’s own experience as a student was that math “was always easy” (Interview, April 5, 2011) until she took finite mathematics in grade 13. Finite was the first class in which she had to study for math tests. Prior to that, her success came from being able “to go to class, sit, listen, apply, and got it” (Interview, April 5, 2011). For her university major in chemistry, she had to take calculus. For her this course was abstract, and disassociated from anything she had learned in mathematics before. She felt that she had no strategies with which to approach the problems and so she did “the bare minimum” (Interview, April 5, 2011) required for her major and dropped math once the calculus courses were done.

Like Lynette, Natalia holds a view of teaching and learning mathematics that is constructivist in nature and focuses more on the process and the understanding than on the result.
For Natalia, it is important for her students to engage in inquiry-based problem solving in a collaborative way. In looking for evidence of understanding mathematics at a deeper level, Natalia wants to see multiple approaches to problem solving, reflection, various forms of representation, and an explanation of thinking. She feels that this approach to teaching and learning of mathematics has also informed her work as a mathematics coach:

I always approach the learning and teaching of mathematics through a constructivism model. Really spending time figuring out where the kids are at and then building up that prior knowledge and helping them construct knowledge; so, a lot of problem solving, a lot of open ended tasks, a lot of collaboration with each other as well. And so that has been the model that has emerged in my coaching as well, kind of embracing the reform mathematics way of teaching where it is focusing on the process and the collaboration, as a group work kind of component of it, and the assessments have been very similar as well to reflect the process and not necessarily the right answer. That has been my approach as a teacher and a coach. (Interview, April 5, 2011)

4.8.2 Natalia’s teachers: Background information

Both of the full day Kindergarten teachers at Maple Downs school who worked with Natalia did so in very similar ways. David and Kim work very closely together as teaching partners. They plan all of their lessons together and implement the same lessons on the same days. They reflect on their lessons together and share outcomes before planning their next series of lessons. While there are two other full day kindergarten teachers in the school with whom they are friendly, they do not plan with them, nor work as closely with them as they do with one another. For example, during the planning time provided at the PLCs, David and Kim planned their lessons together and the other two teachers from Maple Downs planned a separate lesson with one another.

There are some slight variations in the lessons when they are taught in the classrooms, particularly in the way that the students are put into pairs or groups, and in the consolidation (third) part of the lesson, but these variations are minor. Thus, when David and Kim are
planning, they come to Natalia with the same questions on the same topics, and when Natalia visits them, she works with them both in planning one lesson. She then works with each teacher individually in his/her classroom.

David has been teaching for five years, all in kindergarten at Maple Downs School. Kim is in her sixth year of teaching. In addition to teaching kindergarten, she has taught grades 1 and 2. She did not begin her teaching career at Maple Downs. David began working with Natalia during her first year as a coach. Kim was on leave that year and he saw a flyer advertising the mathematics coach. He decided to contact Natalia and had her into his room a few times over the course of the year. This work involved Natalia modeling some lessons, and some co-teaching between David and Natalia. He enjoyed the experience and when Kim returned he told her about it. However, their work with Natalia was minimal during her second year of coaching. During Natalia’s third year, both David and Kim invited her into their classrooms for a few visits in the fall. They both took part in the PLC, but neither offered to do the model lesson co-planned with Natalia for the other teachers. They did, however, invite Natalia back into their room for a visit in the spring.

When David was a student he disliked mathematics. He described himself as “scared” (Interview, May 3, 2011) of it. He took math in high school through grade 10 and then dropped it the following year when he was failing. When he began teaching Kindergarten, he preferred teaching literacy, and remained “scared” of math. His disposition towards math has changed so that he is equally comfortable teaching both. He credits his work with Natalia for changing this view. He says that the repeated experiences with her, the opportunity to see her teach, to explore manipulatives, and to try out problems has helped him to view mathematics more positively.
Conversely, Kim always enjoyed math as a student and took it through grade 13 calculus where she qualified for a mathematics award. While she still likes math, and liked it through high school, she did not take it in university. When she reflects on her learning experience, she says that, “I just used to memorize the formulas and just...you know, you just stick the numbers in the formulas and it is like you do not really understand” (Interview, May 3, 2011). It was during teachers’ college that Kim was first asked to explain why she used a certain procedure, and she could not do so.

Both David and Kim use a three part lesson to teach math. They base their lesson around a problem, which they would like their students to investigate. They typically use a congress, or class discussion, to close the lesson, but David tried using a gallery walk during one class (Observation, May 3, 2011). During every lesson that I observed, both Kim and David used a three part lesson, but they both report this as something new. They only began using it during the 2010 – 2011 year as a result of their work with Natalia. Before this year, they relied heavily on the textbook and on lessons found on the Internet. Both David and Kim have numerous manipulatives available to their students. During free play time and centre activities, the students have open access to these. During their lessons, David and Kim generally distribute the manipulatives that students would be using to the different table groups instead of having the students access them themselves.

In the “Attitudes and Practices Survey for Teaching Mathematics,” David scored a 5.6 and Kim a 5.11 as an overall score. David received a six for “Manipulatives and Technology,” “Students’ Mathematical Communication,” and “Teacher’s Attitude and Comfort With Mathematics.” His lowest score, a 5.2, came in “Student Tasks” and “Constructing Knowledge.” Kim’s overall score was a 5.11. She also received a six for both “Manipulatives and
Technology” and “Students’ Mathematical Communication.” However, she only scored a 5.2 for “Teacher’s Comfort with Mathematics.” Kim’s lowest score was a 3.8 in “Constructing Knowledge.” The only other dimension in which she scored below a five was in “Program Scope and Planning” in which she gave herself a 4.67. David and Kim’s average scores for each dimension and their overall average scores on the “Attitudes and Beliefs for Teacher Practice” Survey are shown in Table 3.

Table 3

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<th>Attitudes and Practices for Teaching Mathematics: Maple Downs School</th>
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<td><strong>Dimension</strong></td>
</tr>
<tr>
<td>Program Scope and Planning</td>
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<tr>
<td>Meeting Individual Needs</td>
</tr>
<tr>
<td>Learning Environment</td>
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<td>Student Tasks</td>
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<td>Constructing Knowledge</td>
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<tr>
<td>Communicating with Parents</td>
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<tr>
<td>Manipulatives and Technology</td>
</tr>
<tr>
<td>Students’ Mathematical Communication</td>
</tr>
<tr>
<td>Assessment</td>
</tr>
<tr>
<td>Teacher’s Attitude and Comfort with Mathematics</td>
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<tr>
<td><strong>OVERALL SCORE</strong></td>
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4.8.3 Defining her role

Like Lynette, Natalia’s role as a coach has evolved from when she began coaching three years ago. In the beginning, Natalia found she spent most of her time in a “consulting” (Interview, April 5, 2011) role. Natalia describes her first year of working as a coach, the second year of coaching in the district, as a time when people were still trying to figure out exactly what a coach did. Natalia says that when she started, “I really had that vision that OK, the coach is kind of like; lead the workshop, expose people to different resources, provide them with websites and things like that. It was more kind of a consultant role where people would consult with me
and I would just provide information” (Interview, April 5, 2011).

There are times when Natalia is still asked to fill that role and to provide specific
information to her teachers, but as time progressed, Natalia began to situate herself as a co-
learner along with the teachers with whom she was working. Now, Natalia views herself not as
an expert, but as a facilitator of a learning experience in which she engages in the learning
herself. She collaborates with her teachers by investigating mathematics topics and planning and
implementing lessons together. Natalia also speaks about a learning continuum that both she and
her teachers are on. They journey down the continuum together, but there is no end point where
all the learning has been reached. Natalia’s view is that the coaching piece of her work is moving
teachers along the learning continuum.

For Natalia, this is a major shift in her approach to coaching. Instead of taking on the air
of an expert trying to convince teachers to change, she instead works to provide teachers with
ideas to consider. She does not believe it is the job of a coach to “change” a teacher. Instead:

My mentality is not to convince people that this is the best way to do it or this is the right
way to do it. But, really get them to figure out where they are at and give them some
options to help them decide what is the next step for them to move their thinking forward,
rather than saying, ‘OK, wherever you are at is wrong, this is where you should be.’
There is none of that. (Interview, April 5, 2011)

Similar to Lynette, Natalia does not want to be viewed as an expert coming in to “fix”
teachers. She believes that there are no “good” teachers and “bad” teachers, but all teachers are
working to learn, and she is learning alongside them. Natalia talks about the need for coaches to
“check their egos at the door” and “get messy” (Interview, April 5, 2011) with the teachers. She
explains that when she refers to getting messy, she means that she and the teachers are working
together to sort through issues that arise:

So through the planning process, through the reflection process, and actually teaching a
lesson together, and actually having that conversation, ‘Was this a good lesson? Did it
actually work? Would you do it again? Would you change anything? Did the [students] learn anything?’ So, I think the purpose now, the way I see it is that it is more, just having that other person with you collaborating together. It is more a collaborative piece rather than a consulting piece. (Interview, June 15, 2011)

As her conception of her role as coach has changed, so has the structure of her work.

When Natalia began, most of her work was done individually with teachers in their classrooms. Natalia says that a lack of funding for PLCs contributed to this choice. Now, she has increased funding and she focuses her work more on PLCs or what she deems as “Professional Learning Experiences” similar to the one that David and Kim participated in during the winter and spring of 2011. She believes that close to two-thirds of her time is spent engaged in the professional learning pieces, but admits that this is hard to judge because she, like Lynette, aims to include a classroom observation component in as many of the PLC meetings as she can. The observation piece closely mimics the work she does with the demonstration teachers in her Family of Schools and includes co-planning, and sometimes co-teaching. She intentionally does this with her teachers so that they can have the same co-teaching experiences as the demonstration teachers and so that they can see what that structure might look like if they choose to pursue it. The remaining 35% of Natalia’s time is spent doing co-teaching and work in individual classrooms.

While Lynette shifted away from professional development done at the Family of Schools level since she felt it was not as effective at meeting needs and bringing about change, Natalia’s rationale for incorporating more PLCs at this larger level is almost opposite:

If we can have Family of Schools PD then we are meeting different groups of teachers’ needs and they are building networks with each other. They have the opportunity to go to another school that they would not necessarily get to when they are only getting in school PD. This is the piece that we are finding, is that if they are only doing in school PD then they are not seeing what else is out there, they are not building connections with other people as well. And so taking them out of their schools for half days, they can see what other... […]. One of the feedbacks [Natalia received] was that they loved connecting with other kindergarten teachers and just seeing different classrooms and being in different schools and they do not get that opportunity. (Interview, June 15, 2011)
4.8.4 Coaching goals

Natalia delineates two separate goals she has for her coaching work with the kindergarten teachers at Maple Downs. She has one set of goals for the PLC in which they are engaged. The second set is specifically related to David and Kim’s own teaching. In regards to the work done in the PLC, her first goal is related to her larger goal for teachers across grade levels in the Family of Schools. Each year, Natalia, with the guidance of her Superintendent targets certain grade levels with whom to focus her work. From the beginning, the work with the grade level PLCs has been focused on establishing a common language across the Family of Schools. Thus, in her professional development she wants to ensure that all teachers have the same understanding of mathematical terms such as “three part lesson,” “math investigation,” “math inquiry,” and “constructivism.” Natalia says that whether she is working in a classroom or with a PLC she focuses on this idea constantly and is conscious of embedding it in her planning for the kindergarten PLC in which Kim and David took part.

Another goal she has for the teachers engaged in the PLC is to “expose them to what teaching through problem solving looks like at the kindergarten level” (Interview, April 5, 2011). Natalia reports some resistance from kindergarten teachers in her Family of Schools as they believe that providing students with the open, unstructured problems is not appropriate for kindergarten-aged students. She feels that there is a general sense amongst the teachers that children that young would not be able to meet with success when given inquiry-based questions and hopes to provide them with opportunities to observe and try out this type of teaching.

Finally, Natalia would like to help the kindergarten teachers build relationships with one another, across the Family of Schools. She hopes that, by including the observation pieces in her lesson, in addition to seeing problem-solving done in kindergarten classrooms, the teachers will begin to
see what is happening at various schools in the Family of Schools and “give them an understanding of where they are at in their schools” (Interview, April 5, 2011).

The long term goal that Natalia holds for both David and Kim is the same. She would like them to gain more comfort and confidence in their mathematics teaching. She describes this as a “huge goal” (Interview, April 5, 2011). She believes that they are both very strong, but shy teachers. In the past, she asked David to be a demonstration classroom teacher but he declined because he was uncomfortable being observed by other teachers. Similarly, when Natalia was looking for teachers to open up their classroom for an observation during the kindergarten PLC, neither David nor Kim volunteered.

Natalia describes both Kim and David as being open to trying any new idea and of never saying that their students are unable to do something. Natalia says that “they are very open-minded about the format, about the ideas, about exposing their students to math inquiry, investigations, and making it open-ended” (Interview, April 5, 2011). She believes they have a very positive attitude about trying out new ideas, and if they are hesitant that an activity may be too challenging, they are still willing to see how it goes with their students. She wants them to share their practice with others because:

I think both of them have a lot to offer to other full day kindergarten teachers and others would benefit by seeing them, just teaching, and seeing their classrooms, and seeing the way that their students engage and interact with each other as well. So, that is the ultimate goal. (Interview, April 5, 2011)

Because both David and Kim find the idea of teaching in front of others anxiety-inducing and daunting, Natalia recognizes that there are many steps that they will need to take along the way to reaching that ultimate goal. In the more immediate future, she would like to see them start to plan more inquiry-based three part lessons on their own, and take on more of an
active role when she visits their classroom. She senses that they perceive her as an expert and thus prefer to observe what she is doing when teaching in their classrooms:

Even though I have worked with them a couple years now, they are still like, ‘But you are the expert, you do it and we will observe you and we will do it together.’ They are still not seeing themselves as being the expert as the classroom teacher. I see them as being the expert, but they do not see themselves as that. (Interview, April 5, 2011)

When Natalia models and co-teaches in their classroom, she always tries to pull them into the work by having them choose partners, shadow her when she is assessing the work, and by discussing student learning with them. Natalia is sure that they learn from these experiences and refers to the notes they take and the comments they make afterwards as evidence of this. However, she feels that, in order for their confidence to grow, they need to begin to switch the dynamic so that she is supporting their lead in both planning and co-teaching.

Once they have become more comfortable taking on the expert role in their own classroom, Natalia feels the next step with them would be to plan a lesson with the other two kindergarten teachers at their school and then try out co-teaching that lesson with them, and without Natalia’s presence. She believes that they may be getting close to this, but are not yet in a place where they are comfortable having even their school-based colleagues in their classroom.

4.8.5 Defining success

In reflecting on her work for the year, Natalia feels that the work she did with the full day kindergarten group was something that she felt proud of and that was successful. She describes it as a highlight of the year as this was a group that worked very well with one another, built connections with one another across schools, and from which she learned a lot from, both during conversations and classroom observations.

Natalia believes that the benefits of participating in coaching include the deep and reflective conversations that occur and having the opportunity to share ideas with others. What is
important about the coach, and sets him or her apart from school-based colleagues is the fact that the coach is removed from the day-to-day school environment and can thus provide an outside perspective. Additionally, Natalia points out that a coach helps to bring information from the Ministry of Education and from the school board and connects that information to school and classroom-based instruction. Natalia recognizes that the consulting part of her work is appreciated by teachers, since they are able to go to her for ideas and resources, “but they also like time to just sit down and talk things through and think things through as well. That has been the feedback that I have gotten from the teachers that I work with. It is just the time with another person to plan and to think and talk and work things out together” (Interview, April 5, 2011).

Collaboration as a tool to mitigate against teacher isolation, and as a way for teachers to be able to try out new ideas and ask questions is an important factor in the success of Natalia’s coaching program.

When considering the full day kindergarten PLC that she deemed so successful, Natalia believes that there were two structures embedded within it that had the most impact:

The first one for sure would be the classroom observation piece. I think, just going into each other’s classes and observing the three part lesson with actual kids and seeing that in practice, and seeing the classroom environment, and seeing the teacher questioning piece. I think that had an impact in terms of, maybe addressing any fears or reservations they may have had about the three part lesson working with kindergarten kids. (Interview, June 15, 2011)

Natalia finds this structure impacts her other PLCs as well because she feels it encourages personal reflection amongst the teachers. Even when there are things that are not intended to cause reflection, Natalia feels that, when teachers are observing one another, they automatically “go into comparison mode” (Interview, June 15, 2011). Natalia says that reflection has the most impact on teacher practice.
In addition to the classroom observation, Natalia felt that the fact that she gave the teachers “homework” had impact on their learning. Instead of simply talking about an idea or observing it in another class, Natalia asked her teachers to return to their schools and apply the idea in their classroom. For the kindergarten teachers, this homework was planning and teaching a three part lesson around an inquiry-based problem. Natalia gave them time during their PLC meetings to plan collaboratively and held them accountable for this assignment by asking them to share their lessons and the resulting student work with each other. She believes that providing them with both the planning time before teaching the lesson and reflecting time afterwards was important to the learning as it gave them time to analyze their thinking about the lesson. Also key to the impact of this structure, Natalia believes, is that she gave the teachers the opportunity to design a lesson around any topic they wished, and was not telling them what to do. Instead, “it was practical, it was completely job-embedded, it was completely related to what they were doing, because it was all their choice” (Interview, June 15, 2011). This opportunity to apply the teachers’ learning made the work they were doing in the PLC relevant to their own teaching and helped them to see how their own students engage in such an activity.

Natalia says that the activity that had the least impact on teacher learning is when she is talking. She feels that, particularly during the first PLC meeting, she spoke a great deal about the common language she was trying to establish, pedagogy, philosophy, and work that was going on at the board and Family of Schools level. She believes that this has the least impact as the teachers wanted to be able to speak to one another.

Outside of the PLCs, Natalia feels that she gets positive feedback when she models lessons and co-teaches with teachers. However, this can also be of limited impact when a teacher emails asking her to come in one day for one lesson without any follow up. She believes that the
teacher is asking for her support as it is something he or she has been required to do and it becomes a “one-off” learning experience. When these occur, Natalia finds that she does the lesson planning and teaching, and that there is rarely any depth in her conversations with the teacher. While she had a few of these in the third year of her coaching role, their frequency is decreasing as over time the teachers, principals, and Natalia better understand the purpose of the coaching role.

Broadly speaking, Natalia notices that the teachers she works with are beginning to incorporate the three part lesson planning model in their classrooms, are trying out ideas like gallery walks and math congresses or discussions to consolidate their lessons, and are displaying student work more often. Principals tell her that teachers are using manipulatives more often, and she is aware of them accessing Ministry of Education documents, such as “The Guide to Effective Instruction.” She also is having more frequent conversations about mathematics teaching and learning with these teachers, who seek her out when she is in their building to talk to her about the work they have been doing in math. David and Kim also show some of the same changes in their practice.

Natalia believes that her coaching experiences with both David and Kim were successful this year and that they both met her goal of becoming more comfortable with teaching math using a three part lesson. In particular, she points to David who, on their final co-teaching lesson (Observation, May 17, 2011) of the year, took the lead throughout the entire lesson. Thus, Natalia operated solely in a support role. When asked what she felt most contributed to this growing sense of comfort in teaching, Natalia indicates that she thinks that it is the time she has been able to spend with them. Not only did she spend the four half days working with them during the PLCs, she also visited their classrooms three or four times over the course of the
academic year. She had also spent some time in David’s room two years earlier. Natalia felt that
the fact that she did not push them into taking the lead and teaching in front of her allowed them
to grow gradually over time. She also feels that she was responsive to their needs and requests
since she was willing to model lessons for them when they asked for that. At the beginning,
when David and Kim only wanted to observe Natalia’s teaching and take notes, she welcomed
that fact and engaged them in the lessons by having them group students together and observe
what their children were doing. Later, when they began to co-teach together, Natalia was always
willing to take the lead on the parts they wanted her to lead. She says:

They knew that it was OK to watch initially and take that time to get comfort with it, but
also there was our release where they had to do it on their own. They did it, they
obviously had success with it. And so, that last time when we co-taught it was like, ‘OK,
well I can do this part and this part, but can you do that part?’ (Interview, June 15, 2011)

In terms of changes in practice that Natalia observed in David and Kim, Natalia saw a
growth in the “instructional piece” (Interview, June 15, 2011) of their learning. She points to
their increased use of a three part lesson and to the fact that they were always planning using this
format and trying to incorporate inquiry-based problems as evidence:

Looking back since I first met them this year, they are trying more open-ended problem
solving questions with the [students]. I think the whole inquiry piece was new to them, so
they are trying to make sense of presenting a problem to the whole class and sending
them off to discover, investigate something, and then coming back. And even the coming
back piece, getting the kids to share whether it is with a partner or the whole group or
through an official congress, I think they are trying more of that stuff. So, the exploration
and the inquiry piece, I think is something that I notice that they are doing more of. Or
they see what it looks like through our work together and so I see that they are more
confident on their own in trying it. (Interview, June 15, 2011)

Natalia, who has spent more time in David’s classroom since she began her work with
him during the year that Kim was on leave, can track specific changes in his lesson planning.
When Natalia first worked with David, she reports that most lessons occurred in centres where
small groups of students worked on different activities, and that he stayed away from whole class
problems. Natalia calls this a “fear” of a whole class lesson (Interview, June 15, 2011). When Natalia first began working with David, every child worked either with a partner or alone, and all students did the same activity using the same strategy at the different centres. Now, the class works on the same problem, but is encouraged to solve the problem with their peers using whatever strategy they want. Each of David’s lessons is planned using a three part lesson model. David thinks purposely about creating questions that will encourage the students to problem solve and use different strategies or come to different solutions. Kim too uses these types of lesson plans, but Natalia is less familiar with what her lessons looked like before.

Natalia also talks about the fact that they have begun to ask their students the question, “How do you know?” in mathematics to push the children to describe their own mathematical thinking. This was a question that Natalia used during her first visit to their classrooms in the fall of 2010 and something they both picked up and implemented immediately.

Natalia credits both David and Kim for their learning as she finds both of them to be thoughtful in talking about their lessons afterwards. They are consistently talking with Natalia about what their next steps might be.

Like Lynette, Natalia hedges when she speaks about changes she has observed in David and Kim’s teaching practice, peppering her phrases with comments like, “I think.” She is even more hard pressed to describe changes in the student learning that has occurred in the classroom saying, “that is really hard” (Interview, June 15, 2011). Part of this difficulty lies in the fact that she considers both teachers to be very strong teachers who had already laid a strong foundation with their students by the time she first came in to work with them in the fall. She indicates that the students in Kim’s class were already able to articulate what they felt the correct answers to Natalia’s problems were. They also were able to respond to questions such as “How do you
know?” when Natalia first went in, even though they had not encountered a question like that before. Natalia believes that she “see[s] a continuation of that” (Interview, June 15, 2011) in her work with Kim. She has also noticed that the students in Kim’s class are improving in their ability to collaborate together and share their ideas. She speaks about being intentional about asking the students to talk to their partners about the math problem before handing out any materials. She describes Kim’s class now as a place where:

There is actually now focused talk on that. And, while they are solving the problem, we are writing things down, we can see that they are actually sharing that responsibility rather than one person doing all the work and the other person just sort of sitting there. (Interview, June 15, 2011)

She feels that there are similar changes occurring in David’s classroom. However, David started with a different class dynamic than Kim. At the beginning of the year, Natalia noticed that he had about four or five students, who participated more often than others. She feels that she now sees more students and different students participating in the lessons, particularly during the consolidation part of the lesson when students are asked to share their solutions with one another. While there remain some quiet students, Natalia believes that more students in David’s class are willing to take risks in front of the whole class.

4.8.4 Challenges confronting her work

Natalia finds herself challenged by the limited time she has to spend with each teacher. Because Natalia works with 16 schools in her Family of Schools, “it is very difficult to make sure that people get the time and attention that they want and that they need” (Interview, April 5, 2011). Beyond scheduling visits with individual teachers and ensuring their needs are being met, Natalia finds time management a challenge in the face of the different structures she has in place and running at any one time. She talks about the difficulty of finding time to meet with teachers and to plan for professional development days when she is leading full and half day workshops
back to back. In addition to the professional learning that Natalia facilitates, she still needs to schedule class visits, support individual teacher requests and needs within the Family of Schools, respond to principal requests for her support, co-plan and attend model lessons in demonstration classrooms, planning meetings and coaching meetings.

Conversely, Natalia feels challenged by the fact that there are teachers in the Family of Schools she believes would benefit from coaching who are not taking advantage of it. However, because she feels that teachers ultimately need to make the decision to engage in coaching on their own, she does not consider this a large barrier. She is clear that she will not “impose” herself on teachers in the Family of Schools, nor allow principals to make unwilling teachers work with her.

Like Lynette, Natalia’s greatest personal struggle, and biggest frustration is the lack of professional development she receives as a coach. Also like Lynette, she has found herself a mentor and has made some personal connections with coaches. She considers herself incredibly fortunate in this regard as she can use the mentor as a sounding board when she has questions. Natalia describes the professional development that occurs for coaches as a “one size fits all” approach not targeted at individual needs. She says, “there are times where I wonder, is this the right thing to do? Is this the right structure?” (Interview, June 15, 2011). She feels that there is an assumption made that, because coaches provide professional development, they have become experts and need no more professional learning of their own. Natalia finds this the most frustrating aspect of her job and says that she knows “some coaches who have chosen to go back to the classroom because they are just tired of fighting this battle on their own without the support” (Interview, June 15, 2011).
Furthermore, she feels there is a lack of cohesion across the district with coaching. She wants to know how other coaches in the district are approaching topics such as moderated marking with their Family of Schools. Natalia reflects that, because they each work for their own Superintendent, they are often doing different things in their Family of Schools. At other times, they are working on similar structures in different ways. She believes that the lack of professional development means that they do not have opportunities to learn from one another and support each other. While Natalia considers coaching to be an isolating position, she does not think it needs to be, since there is a potential network of teacher leaders for them to draw on. Natalia believes that, if a network could be developed then the coaches could work together. She describes this as working “smarter rather than harder” (Interview, June 15, 2011).

4.8.5 Aspirations

When looking at her continuing work with David and Kim, Natalia hopes to continue to build their confidence in teaching. She would like to continue co-planning and co-teaching with them so that they are increasingly and continuously taking the lead in the lessons. She would also like to embed more time for deep debriefing conversations about the lessons that were taught into their work together. She reflects that this might be difficult as it has to come out of their planning time, but believes it would be useful.

During the next academic year, the two other kindergarten teachers from Maple Downs will be leaving. Natalia sees this as an opportunity for David and Kim to begin to collaborate and co-teach with others besides her. She would like to be there to help co-plan with the team, but would like for David and Kim to open up their classroom to the new teachers as a way to build their confidence and share their strong practices with new teachers. She recognizes how closely
the two work together and would like to see that spill over to other teachers so that co-teaching can occur without her.

On a personal level, Natalia strongly believes that the professional development for coaches in the board needs to change and that emphasis needs to also be placed on developing a peer network for the coaches. She would like to see the professional development differentiated so that various presentations might occur at one time in different places. Coaches could then choose the professional development piece that was most relevant to them at that moment in time. She envisions this professional development to be set up so that each month the groups change depending on interest, comfort, and needs. She believes that different structures should be employed at different sites, led by different facilitators.

Natalia feels that she has reaped many benefits as a coach. Among the most important to her are the relationships she has formed and the knowledge she has gained from being in so many different classrooms. She does not feel that she is ready to leave coaching as she is “still learning a lot and still building” (Interview, June 15, 2011). However, at some point, she would like a year’s sabbatical from coaching so that she can return to the classroom, perhaps to a new grade level, to try out some of the new ideas she has learned. She would then want to return to coaching with that new and enhanced perspective.

4.9 Reflections of Natalia’s Teachers: David and Kim

4.9.1 Views on coaching

Both David and Kim speak positively about their work with Natalia. David repeatedly says that he loves working with Natalia, and Kim refers to her as “the math guru” (Interview, May 3, 2011). David first took the initiative to contact Natalia because he wanted to learn. When reflecting on what made him reach out to her he says, “Why not? It is good to learn, and since
then I have gotten more comfortable with math” (Interview, May 3, 2011). To David, a math coach is a person who works with you, collaboratively, in your classroom. He explains that this person would work with you on planning and teaching a lesson, and would have resources for the teacher to look at and consider. He says “a math coach is somebody who helps you and guides you in math and is there so you can be with them, you can teach together. They can lead a little bit, you can lead a little bit. It is a whole partnering, and they help you with resources and ideas and they keep coming back to check on the class so it stays constant” (Interview, May 3, 2011). David believes a coach should be someone who will help through modeling, providing lesson ideas, and who is available to answer questions via email. He also believes a coach needs to be flexible, but come prepared for the work that is being done.

Kim’s definition of a coach is very similar. She defines a coach as someone “to help guide you with your lessons” (Interview, May 3, 2011). When reflecting on what her vision of working with a coach is, Kim talks about having Natalia come in to work on a specific topic area. They will spend time talking and planning a lesson together and then Natalia will ask Kim what parts of the lesson Kim wants the coach to focus on. This willingness to model is also important to Kim. While Kim says she helps Natalia when she visits Kim’s classroom, she feels that Natalia is there as her teacher and thus does most of the guiding of the lessons.

Another important aspect of Natalia’s role for Kim is the fact that Natalia is able to provide them with resources and tools that they need to better teach math. Kim provides the example of Natalia replacing broken balance scales in her classroom after Kim emailed her about the problem. Ultimately, Kim says, “it is like she is right there to help make our teaching and our class better. She is there to help our teaching and our class” (Interview, May 3, 2011).
Natalia’s attitude and personality are key to the success of David and Kim’s work with Natalia. They describe her as knowledgeable and approachable. They feel that the rapport she has developed with the staff and students at the school is important. The time that Natalia has spent building relationships has made a difference to both David and Kim who describe themselves as nervous and shy. If they had felt that Natalia was unapproachable or intimidating they would not have continued to work with her. Kim indicates that, while Natalia is an expert in math, she never makes them feel as if they do not know what they are doing. Kim feels that Natalia values their work and both David and Kim speak of the collaborative or partnership piece of coaching as important. Kim says that their strong relationship with Natalia means that when they see she is offering a workshop they are quick to sign up. They know it will be relevant to their teaching and that Natalia will engage them in hands on learning. As they have spent time with her they have gotten to know her and have developed a comfort with her that they feel translates into an increased comfort in their math instruction.

In addition to the comfort they feel with Natalia personally, Kim speaks about the fact that philosophically she agrees with much of what Natalia does. She says that she really likes the way Natalia approaches mathematics, particularly the fact that Natalia works to make things hands on and encourages exploration, both with teachers and students. Natalia also sends follow up information to teachers and posts information and resources on a blog which teachers can access.

4.9.2 Goals

Similar to the teachers at Oakside School, David and Kim’s goals were very large scale and somewhat vague. David’s purpose for working with Natalia is to “learn more about math” (Interview, May 3, 2011). This includes learning about what he might look for in assessment,
ways to provide access to math to his students, picking up new ideas, finding out what he is
doing well and what he needs to work on, and generally learning how to become “better” at
teaching math.

Kim would like to get ideas from Natalia that she can use in her classroom. She believes
that working with Natalia is getting her closer to being a better math teacher and wants to
continue to have the opportunity to ask Natalia questions, gather ideas, and learn from her.
Working with Natalia keeps Kim from getting stuck in a routine with her teaching. Kim reports
that her ideal classroom would be one in which the students engage in mathematics not just
during their math class, but also during activity time when they would make the choice to do
math centres on their own. She would like to get ideas from Natalia that would help her get her
students to become more independent learners of mathematics.

Kim also believes that her students will benefit from having Natalia in the classroom
teaching them. Like Nick at Oakside School, Kim points out that exposure to different teachers is
important. Kim believes that Natalia’s enthusiasm and excitement about mathematics is
important for the students to see, and that this type of attitude towards mathematics will spill
over to them from repeated exposure and that having Natalia work with them is a positive
experience for the students.

4.9.3 Impact on practice

David counts two changes in his practice that he attributes to his work with Natalia. He
has changed the way he structures his lessons so that they are always based around a three part
lesson model. He says, “Before [working with Natalia], I did not know what a three part lesson
was” (Interview, June 13, 2011). He began implementing this structure at the beginning of the
school year when Natalia modeled it in his classroom and has been working to include it ever
since. During my observations, it was the exclusive model of teaching I saw. After learning the model from Natalia in the fall of 2010, he practiced it over the course of the year. He speaks about needing notes to refer to when he first started because he could not remember the different parts, but now he says he has internalized those parts so he uses them innately. He refers to it as a sort of “recipe” that he uses. He begins the planning around an inquiry-based problem, and also is careful to plan for a consolidation of learning in every lesson.

Natalia also taught him strategies to use within the three part lesson. Examples of strategies he has learned to embed in his math lessons include using group work, manipulatives, “think, pair, share”, consolidating lessons, and asking the students “How do you know?” when they answer math problems.

The second major contribution that Natalia has made to David’s teaching is an increased comfort around mathematics teaching and learning. David talks about the fact that he used to prefer teaching literacy, but now is equally comfortable with both subjects (Interview, June 13, 2011). He explains that his math teaching is getting “better and better” (Interview, June 13, 2011) and talks about “Kumbaya math moments” that he now has in his classroom. He provides the example of a consolidation piece that occurred during a lesson observed on June 13, 2011 when both his junior and senior kindergarten students were able to engage in a conversation about ways to make five cents and seven cents. The students were able to justify their answers to one another and David says that when this happened he was happy. He states that this came from having the opportunity to practice the structures and strategies Natalia has taught him.

David’s increased comfort means that he is incorporating mathematics across the curriculum. He speaks of the way he taught mathematics when he began as very fragmented: “I would do that maybe a couple of years ago, have a unit on graphing and then forget about it and
then maybe come back to review if I had time. But now, it is more fluid, there is more always throughout” (Interview, May 3, 2011). He provides examples of using patterning in literacy when students are singing the alphabet song and of incorporating graphing into other parts of the curriculum, even when the math unit they are studying is not graphing. He incorporates number sense in tasks during circle time and lining up. He describes his own learning as a progression of being able to teach math differently, and believes that his students are learning more because of it.

Kim also talks about learning to use the three part lesson as a key change in her practice. When Kim began teaching, she used math worksheets and the textbook that Maple Downs has at the school. She says, “I was pretty much doing what I was taught” (Interview, May 3, 2011). She began incorporating manipulatives into her teaching when she moved from her previous school to Maple Downs because of the guidance and support of an experienced colleague. Working with Natalia began to open Kim up to using ideas outside of the textbook, or modifying lessons in the textbooks to meet her students’ interest and needs and to fit the three part lesson model. Kim says that she and David have more fun with math now that they are choosing their own problems and designing them to be relevant to the students. It was working with Natalia that gave Kim the freedom to do that.

Kim feels that the three part lesson provides her with a strong understanding of where each of her students are in their understanding of a topic and she finds that this has changed the way she formatively assesses her students. Instead of calling students over individually to solve a problem while she observes and takes notes, Kim now circulates around the classroom while all of the students are working on the same problem and records notes about what she observes them doing and hears them discussing. She also believes that the consolidation part of the lesson on
the class sharing carpet allows her to hear where her students are and helps her to plan for future lessons based on what they demonstrate they do or do not understand at that time. According to Kim this method of assessment saves her a great deal of time over what she did previously.

Like David, Kim speaks of using the “How did you know?” question with her students, and is able to pinpoint exactly when she first heard it. It occurred during the first term of the 2010-2011 academic year when Natalia came in to model a lesson on counting. Kim describes the lesson this way:

When she said, ‘How do you know?’ You know when she did it? When I heard her, she had that dinosaur number line where we were doing the counting and the numbers. And it has 1,2,3,4,5,6,7 and so she flipped over, let’s say a three and she goes, ‘This is a three. If I told you a seven was over here, would you agree with me?’ And they are [the students] like, ‘No. And she is like, ‘How do you know?’ So it was, ‘Well, it is supposed to be a four.’ ‘Well, how do you know?’ ‘Well, four always comes after three.’ (Interview, June 13, 2011)

David and Kim both agree that having Natalia in their classroom to model and co-teach has the most impact on their teaching. David talks about one of the first times Natalia came into his classroom:

I will never forget. She came in for patterning, and that is when we did these pattern frames. And it was very good. That is what I will always remember from her, that you start off with a problem. You know, that you start off with a problem that the [students] could solve. That is the first time that I got it and I understood for the three part lesson it is good to start with a problem, and then you have the [students] explore, and then consolidate all their learning by doing the sharing at the carpet. (Interview, June 13, 2011)

Kim’s most memorable coaching moment also came when Natalia worked in the classroom with her. Prior to that experience, Kim says that David had talked about the three part lesson with her. However, it was when Natalia came into her own classroom and modeled a three part lesson on measurement in which the students were asked to determine which stuffed animal had the most mass that Kim felt she understood it.
When Natalia is in their classrooms, Kim and David appreciate the fact that they are in the room working together with her and that they can see her implement a strategy or structure. They like that they can talk to Natalia about the moves she is making and ask her questions while the lesson is occurring. They can also hear the questions Natalia asks the students. They take notes on what occurs in their room and then work to replicate it on their own. This has more impact than the PLCs because they are able to engage in the idea immediately. David says that he forgets a lot when they only talk about an idea, but when he is able to do it, he remembers.

They also prefer seeing Natalia teach than seeing another classroom teacher model a lesson because they feel that Natalia is an expert and that they can take more ideas from that experience. While they say that the PLC was useful, they do not feel that it had the same impact as having Natalia in her room. When they attended the PLCs, it meant that they had to take a whole morning out of the classroom. David says that because they were not actually doing the work, they had to write a lot down, and then remember it to learn instead of actively engaging in the learning. Kim feels that if she is missing a whole morning, she wants to be able to take away ideas and information that she can use in her classroom. She gets more of this when Natalia is actually in her classroom without having to leave the classroom.

4.9.4 Impact on student learning

David’s growing comfort with mathematics has had the most impact on his students’ learning. He says that, since he is more comfortable, the children are better understanding the mathematics and using more math language. He speaks specifically about including the question “How do you know?” into his mathematics lessons and says that the students “are able to say how they know by thinking about it and putting it into math language” (Interview, June 13, 2011). Kim agrees that she is using the same question and that this leads to her students thinking
internally about how they know a solution as they are working. David adds, “If we keep it up, if we start it from September right away. From that time until now, then they would be even stronger than they are now, knowing to think about how they are thinking. It is a very important tool” (Interview, June 13, 2011).

Kim believes that math has become easier for the students, particularly students who are learning English since she has started working with Natalia. Prior to this, she was heavily reliant on a textbook which she felt was very language intensive. This left some ELL students struggling with what to do. Now that she uses the text less often and thinks more in terms of a three part lesson, she feels that more of her students are engaging in math problems and exploration.

However, while David says that he sees a change with his students in that they understand more mathematics, and while Kim agrees with this and adds that they are now also able to “use their thinking and say what they are doing and why they are doing it” (Interview, June 13, 2011), they are not sure how much of that is attributable to their work with Natalia and the changes in their practice. They believe that Natalia’s work has had an impact on them and on their students’ learning, but Kim also points out that this is the first year kindergarten students have been at school for a full day. This is likely also contributing to the students’ increased understanding and ability to communicate.

4.9.5 Challenges

For David and Kim, there is only one challenge in their work with Natalia. The lack of available time Natalia has due to the fact that she works at so many schools means that scheduling time to work is very difficult. In fact, they speak about being pleased with the amount of times they were able to have her in their classrooms this year. This was either 3 or 4 visits, they cannot be quite sure, but that is more than they had expected and they are happy to have had
that many visits in one school year. David talks about the fact that, when he and Kim are planning, they will ask Natalia to come in and support their work at the beginning of a unit, but that, because Natalia is already scheduled at another school, they cannot work with her when they want or feel they need it. Natalia is often fully booked months in advance, which means that David and Kim would have to anticipate their needs and the pacing of their lessons eight or more weeks ahead of time.

Kim agrees that scheduling is the only negative aspect of working with Natalia. She finds the scheduling means that she has not worked with Natalia as often as she would have liked. She talks about having to get Natalia early in order to book her time since she has to work at many schools. Kim speaks about the unit they taught on money. They struggled to find resources and lessons that were appropriate to use with kindergarten-aged students. Kim and David adapted many of the lessons they found since they were not based on Canadian currency. Both David and Kim agree that they really wanted to have Natalia in their classroom to help them at the beginning of that unit, but she was not available at the time. While Kim anticipates that having a coach who did not share the teacher’s philosophy or who was intimidating would present a challenge, in her own experience the only negative aspect of coaching was the difficulty of finding time to schedule classroom visits.

4.9.6 Looking forward

In looking ahead, both Kim and David want to continue working with Natalia. If they could make any changes to the way the coaching works, they both agree that they would like to see more coaches in the district. David would like there to be one math coach in each school, while Kim thinks that one coach for a couple of schools would be fine. This would provide them with the time that they feel they are lacking with Natalia, whose schedule makes planning time to
visit their classroom so difficult. Kim and David jointly talk about the fact that, if Natalia were in their classroom more often, then as they grew their needs might change, and at that point they might not need her as frequently. They are not sure about that, as Kim feels that there will always be more work to be done, and David can not anticipate the change in their needs until they have more time with her. He states simply, “We need more time with her” (Interview, June 13, 2011).

Kim also speaks about some specific goals she has for her classroom that she would like to work with Natalia on over the course of the next year. She would like help from Natalia in finding ways to set up math centres where students choose to go and explore during activity time. She says that Natalia speaks about it frequently, but that “I have not quite mastered it yet” (Interview, June 13, 2011). Kim feels that when she sets these types of centres up very few, if any, children choose to go to them. David speaks of having the same challenge in his classroom.

Kim believes in the inquiry-based approach to teaching mathematics, and speaks about using a three part lesson model that includes manipulatives and hands on engagement in problem solving. She wants her classroom to be more like that model, and thus wants to keep having Natalia into her classroom. Kim feels her classroom is still a work in progress and that with Natalia’s support and vision, she can continue to work towards that type of classroom.

Kim also speaks about wanting to work on the way she frames questions to students, particularly when the response they give is incorrect. She believes that observing Natalia in her classroom will help her find questions she can ask instead of simply saying that the answer is incorrect. She finds that Natalia’s questions make the students think deeply and she would like to learn to ask more of those types of questions.
4.10 Principal Reflections: Heather

Heather brings to her principalship a background as a secondary school mathematics teacher. She thus holds a deeper level of mathematical knowledge than many of her teachers. She feels strongly that most of the teachers with whom she works, particularly those in the junior grades, have a weak understanding of mathematics, both content and pedagogy. Due to this, Heather finds that many of the teachers depend on their textbook for teaching, and lack the ability to problem solve and think flexibly about math teaching and learning. She also thinks that this lack of in depth knowledge contributes to student difficulties with mathematics as the teachers do not have alternate ways to teach or approach a situation when students are struggling. She feels that, because of this lack of knowledge and comfort, many teachers unintentionally do a disservice to their students in their mathematics learning. Heather would like all math teachers, even those in elementary schools to hold a “math specialist” designation.

Heather defines a math coach as a person who comes in and supports the school improvement plan in numeracy. This is done through “facilitating the teachers’ skill set” (Interview, May 3, 2011) by modeling and coaching towards specific strategies. At times in her interview, Heather refers to Natalia as an “expert.” Heather supports the work of Natalia in her school. She welcomes whatever support her teachers can receive in mathematics teaching and learning and says that the teachers at her school feel very lucky to work with Natalia who has built up a strong and trusting relationship with her staff. Heather says that they “love the expertise and the resources” (Interview, May 3, 2011) that Natalia brings with her.

Heather believes that teachers who work with Natalia will begin to improve their practice and that this, in turn, will lead to improvement in student learning:

Ultimately, hopefully, it is leading towards student achievement, student success, improved numeracy skills, and numeracy understanding and building that solid
foundation that [students] need to continue to be successful in math and areas of mathematical concepts. And also building teachers’ capacity and their skill sets and their confidence to be able to deliver the curriculum and to have the skills to provide the intervention; that is my hope. (Interview, May 3, 2011)

She highlights the fact that the school is still in the early stages of their work with Natalia, which makes it difficult to determine what, if any, long term benefits have come from coaching. She feels that overall coaching has been successful and “probably” (Interview, May 3, 2011) resulted in changes in David’s and Kim’s practice. In particular, she points to the fact that David and Kim are using a three part lesson model, which they learned from Natalia. She also draws attention to the use of the question “How do you know?” that David and Kim began to use after seeing Natalia use it in their class.

The modeling that Natalia does has the most impact on her teachers’ learning, according to Heather. Because teachers have few experiences to see one another teach due to the isolated nature of the profession, Heather feels that they learn from being able to see a strong teacher model. Her teachers report back to her that this is the coaching structure they favour most. Any opportunity to see others teach is useful, according to Heather who also highlights observations done in demonstration classrooms and co-teaching with Natalia as high impact structures. The model of professional development with the least impact are the one day professional development sessions where teachers are asked to come back and train other teachers in their schools.

Although Heather hopes that engagement in coaching will ultimately lead to improvement in student learning, she indicates that it is very hard to determine if this is currently happening. She says that the coaching Natalia does “is very effective in building teacher capacity and filters down to improving student achievement” (Interview, June 13, 2011).
She has noticed, anecdotally, that the students in David’s and Kim’s classes appear to be more prepared for grade 1 and are reaching academic milestones earlier that kindergarten students in previous years. But, as this is also the first year of full day kindergarten, Heather cannot say what part coaching may have played in this development.

Heather does not get involved with the scheduling of the coaching process, letting those teachers who are interested work it out with Natalia directly. However, she does speak about the fact that she once had a teacher who she felt had a high need. She asked the coach at the time to work with this teacher to improve her teaching. Generally speaking, though, Heather remains distanced from the coaching and spends little time planning and debriefing with Natalia. While she thinks that this may be beneficial and that philosophically they should be meeting, she cites a lack of time as making this quite difficult.

Heather indicates that her biggest challenge with coaching is the limited time Natalia has to commit to each school since she works with all of the schools in the Family of Schools. Heather explains that coaching in the Family of Schools is allocated to schools based on need. Natalia does not mention this in her discussion of scheduling, but according to Heather, more coaching time was allocated to Maple Downs during the 2010 – 2011 school year. This was because Maple Downs had been deemed a “School in the Middle,” based on their performance on the provincial test. Prior to this “School in the Middle” designation, Maple Downs was not labelled and thus received less coaching. Heather thinks that coaching could be improved if each school had their own coach. She is certain that if her school had a coach dedicated solely to her teachers, they would fully make use of the coach’s time.

Heather, like Suzanne, would very much like to see the coaching role extend to students involved in special education. She feels that intervention strategies are missing at her school.
Teachers are able to identify when students are struggling, but lack appropriate remediation strategies. She would like the assistance of a coach to work with teachers in assessing the students’ strengths and weaknesses, and in implementing support structures. However, due to the limited time that Natalia has at each school, it is not currently possible for her to become involved as deeply and consistently as necessary to support the remediation of individual students.

4.11 Summary of Coaching at Maple Downs

Coaching at Maple Downs is viewed in a positive light. All of the participants in the study found engaging in coaching to be beneficial and to impact teacher practice and student learning. The two teachers that took part in this study would willingly engage in coaching again, in fact their biggest challenge is the lack of time they have to spend with their coach and they would happily spend more time with her.

When considering the ways in which practice has changed, the teachers, coach, and principal all speak about a growing comfort and confidence with mathematics as well as the adoption of a three part lesson model aimed at encouraging exploration and inquiry in mathematics. Natalia felt she met her goals for her work with David and Kim as they became noticeably more comfortable using a three part lesson model in their classrooms and with taking the lead on various aspects of the co-taught lessons. Kim, however, still has a specific goal that she would like to work on. She wants to be able to create and run math centres that encourage students to engage willingly in mathematics on their own time. David agrees that he struggles with this too.

The teachers believe that their students are better able to think about and describe their mathematical thinking and are generally more knowledgeable about mathematics. Natalia
noticed that students in Kim’s class became stronger at working collaboratively in mathematics while more students in David’s class began to participate in math discussions. For the principal, Heather, there is no current evidence that coaching has impacted student performance. Anecdotally she sees that the kindergarten students are better prepared for grade 1, but like her teachers she believes some of that is likely attributed to the implementation of full day kindergarten during the 2010 – 2011 academic year.

Natalia felt that the PLCs she ran with her teachers were the most successful and had the most impact on her teachers, particularly because they included an opportunity to plan and practice ideas and because the teachers were able to observe one another teach. However, David and Natalia did not find this the most useful and much preferred to have Natalia come into their own classroom where they could learn by doing and by observing someone they considered an expert. Heather also believes that the co-teaching structure of coaching had the most impact.

While everyone agrees that scheduling and time is the greatest challenge to the coaching program, Heather would like to see coaching extend to encompass remediation and special education for students struggling in mathematics. For Natalia, the biggest obstacle to her continued coaching is a lack of professional network and appropriate professional development.
Chapter Five: Cross Case Analysis, Interpretation, and Discussion

5.1 Introduction

A discussion of the research will occur in four parts. First, I will discuss the case studies in relation to the original five research questions. This will be linked to current research. Major findings of the study will then be presented. Implications of these findings and suggestions for future research will then be considered. Finally, suggestions for stakeholders involved in elementary mathematics coaching programs or considering implementing such a program will be provided.

5.2 Research Questions

The guiding research questions for this study, as presented in chapter one were:

1. What are the mathematics teachers’ perceptions of the impact of coaching on their practice?
2. What are the mathematics coaches’ perceptions of the impact of coaching on teachers’ practices?
3. How do the teachers experience the coaching process?
4. How does coaching affect elementary mathematics teachers’ beliefs about the teaching and learning of mathematics?
5. What are the challenges that impede and the elements that enable a coaching program?

I will discuss each of these questions in relation to the information presented in the case studies in the previous chapter and will further explore the implications of each of the findings in relation to existing literature on professional development, coaching, teacher change, and the ten dimensions of mathematics education.
5.2.1 Research questions

1. What are the mathematics teachers’ perceptions of the impact of coaching on their practice?

While the literature has found mixed evidence of coaching leading to changes in teacher practice (for example, Black, Molseed & Saylor, 2003; Costa & Garmston, 2004; Olson & Barret, 2004), evidence from this study shows that coaching is a form of professional development that can lead to teacher change. Every teacher and coach in this study could point to specific aspects of teacher practice that changed.

For Ellen, this change came in her willingness to try out different problems with her students that, in the past, she would have considered too difficult for such young children. Her work with Lynette also inspired her to integrate mathematics into other curricular areas such as art, literacy, and science. Likewise, David moved from seeing math as a stand alone subject to one that could be integrated throughout the day. His work with Natalia helped him to include mathematics in subject specific areas such as literacy, but also in non-curricular parts of the day such as morning meeting and lining up.

David and Kim both adopted the three part lesson structure that Natalia modeled as their sole structure for mathematics classes. Sarah indicated that she started using a “minds on” activity at the beginning of her lessons after seeing Lynette model it with her students. This is the first part of a three part lesson.

David and Kim spoke about changing the way they assess students so that assessment occurs throughout the lesson as David and Kim move around the classroom instead of pulling students aside individually. All three of the kindergarten teachers spoke about the increased level of confidence that they had gained by working with a mathematics coach. They reported that this...
increased confidence level enabled them to try out new and different ideas with their students, some of which they previously would have considered too difficult for their students. Kim felt that working with Natalia gave her permission to move away from dependency on the textbook and the comfort to create open problems more closely related to her students’ own experiences.

Sarah indicated that she was working on having her students justify their thinking through written explanations. She tried a gallery walk with her students once as a way for them to share their mathematical justifications and to learn from one another. Although she thought it was useful, she felt that it took too much time to organize and did not return to that format again.

Nick found that one change in his practice was that he became more purposeful in the third part of his lesson when the consolidation occurred. He began to choose the students more intentionally based on the strategies they had used to solve problems. Nick also learned some question techniques from Lynette that he felt held his students more accountable for learning. These included asking his students to turn to one another to explain the math problem and having students explain what another student had said. Similarly, Kim and David spoke at length about learning question techniques, in particular the question “How do you know?” from Natalia and using it extensively in their classroom.

While all of the teachers highlighted changes in their practice, in many instances the changes were individual: risk-taking for Ellen, organizing a consolidation for Nick, and justification of student thinking for Sarah. Even when the changes that occurred were shared, they were never uniform across all of the teachers. For example, David and Kim adopted a three part lesson, while David, Kim, and Nick implemented new questioning strategies, and the kindergarten teachers spoke of gaining confidence. This speaks to the differentiation of professional development that can occur through a coaching model. Through coaching, each
teacher was able to receive individual attention focused on those aspects of practice that the teacher and/or the coach felt most needed support.

All of the teachers felt positive about the coaching experience and about changes they made. However, most of the changes reflected the goals of the coaches and not the goals of the teachers. All of the teachers had one broad goal – to become a better teacher. This was the only goal for both Ellen and David. All teachers reported that they felt that this had happened in their work with their coaches. As evidence of becoming a better teacher, the five teachers in this study spoke about some of the changes they had made in their practice. For example, Ellen, spoke about an increased confidence and willingness to take risks and try out open questions as evidence of improved teaching. Sarah felt she had done a better job of incorporating a “minds on” activator into her lessons and of asking her students to think about how they know something and to justify their work. Nick adopted techniques to engage more of his students, such as asking them rephrase what another student had said or to turn to one another to explain a problem. Both David and Kim felt their confidence in math teaching had increased to the point that David was willing to take the lead during Natalia’s final visit. By the end of the year, both David and Kim had exclusively adopted a three part lesson model.

However, Nick, Sarah, and Kim mentioned specific goals that were not addressed through coaching. It is likely that these were never discussed between the coaches and the teachers. While the three teachers ended the year content with the changes and improvements they had made in their teaching, they still had outstanding goals that their coaches did not know about.

Nick, Sarah, and Kim’s unmet goals are from differing dimensions (McDougall, 2004). Nick wants to work on assessment in a reform-based classroom, which is fully incorporated in
the “Assessment” dimension. He spoke about this goal during both the first and second interviews. Sarah would like to better integrate manipulatives into her mathematics lessons, an aspect of the “Manipulatives and Technology” dimension. Kim’s goal is related to the “Learning Environment” dimension as she is hoping to better implement centre work that incorporates mathematics into her classroom.

This study does little to further our knowledge about if and how coaching impacts student learning. The research that exists on this topic has mixed results. Some, such as Blount and Singleton (2008), Brady (2007) and Miles-Grant and Davenport (2009) found increases in standardized test scores among students who were in classrooms that participated in coaching. However, Murray, Ma, and Mazur’s (2008) study contradict these findings as student scores did not improve. While this study took a more qualitative approach to examining changes in both teacher practice and student learning, the information gathered does not support nor dismiss the idea that coaching improves student learning.

Neither principal could speak specifically about changes they had seen in student learning. They felt there were changes, but were unable to define what those changes were. Heather suggested the kindergarten students in Kim and David’s classrooms had increased knowledge and were better prepared for grade 1, but she also admitted that since the study was conducted during the first year of full day kindergarten, it was impossible to say what role coaching played in that change. Suzanne was hoping to see improvements on the provincial testing, despite the fact that the two teachers that worked most closely with Lynette, Ellen and Nick, did not teach a grade level that was tested by the province.

Similarly, the teachers spoke about changes they felt that they had seen, but they could not be confident about them. Nick noted that none of the changes he saw were significant
changes. All three kindergarten teachers spoke about their students being more confident learners and about being more prepared for grade 1. All three also recognized that this may have been due to the implementation of full day kindergarten. Likewise, Sarah felt her students had become more confident and more willing to try to answer problems before asking for help. Nick believed that his students became better at listening to one another explain their mathematical reasoning. He also noticed an increase in the number of students participating in his mathematics class.

While these reports point to some changes in student learning, this study was not focussed specifically on students. It appears that the impact of coaching on student learning can be viewed as positive based on the participant interviews in this study. However there is not enough concrete evidence to prove this claim.

**2. What are the mathematics coaches’ perceptions of the impact of coaching on teachers’ practices?**

Both of the coaches spoke about changes in the practice of the teachers with whom they worked. Natalia and Lynette highlighted different changes for each teacher. However, unlike the teachers, both Natalia and Lynette hesitated and hedged when describing the changes. They talked about “hoping” something had occurred or “thinking” that it did, but also of not being really sure if and how their work ultimately impacted teacher practice.

Most of the changes that were noted by Lynette and Natalia echoed the teachers’ own responses to the questions about changes in practice. For example, Lynette felt that Ellen began to become more purposeful and open in posing questions, that Nick included more students in the math lesson, particularly the consolidation part of the lesson, and that Sarah was willing to listen to and consider new ideas. Meanwhile, Natalia felt that both David and Kim had become more comfortable and confident in their teaching, were consistently using a three part lesson
model to drive instruction around inquiry-based problems, and that David was more willing to take the lead in the co-taught math lessons. In addition, both coaches noted other changes that did occur, such as the fact that Sarah attempted a gallery walk, that Nick started using some of the questions that he had heard Lynette use, and that both David and Kim began asking, “How did you know?” However, the coaches knew about these changes because the teachers had told them directly that they were incorporating those practices and not because they had observed them.

While the literature cites the importance of teachers taking ownership for the changes that are being made (Day, 1999) and of valuing teachers own ideas about the change process (Sikes, 1992) in order to implement and sustain change it appears the coaches’ goals for the teachers is what implicitly drives the work that is done between coaches and teachers. I did not witness nor hear about conversations that occurred between the coaches and teachers about their goals, however, many of the changes that did occur were related specifically to the coaches’ goals. The teachers remained happy with the work they were doing with their coach and felt positive about the experience, but, at the end of the study, some teachers still had unmet goals that they wanted to work on with a coach. The coaches never spoke about teachers’ goals, either in terms of the changes they saw in the teachers’ work or in terms of plans for future work with the teachers. It seems likely the coaches did not know about the goals and thus the work the teachers and coaches engaged in was not aimed toward addressing those aspirations, but toward the teacher needs as identified by the coaches.

Within this study, the coaches worked with teachers to address many, but not all of the Ten Dimensions of Mathematics Education (McDougall, 2004). “Teacher’s Attitude and Comfort with Mathematics” was evident in the increased confidence the coaches noted in David,
Kim, and Ellen as well as in Sarah’s openness to considering new mathematical approaches. Lynette’s work with Sarah during their co-teaching session, and Sarah’s work afterward was targeted toward “Students’ Mathematical Communication.” Lynette worked with both Nick and Ellen on “Constructing Knowledge” through a focus on questioning techniques. Lynette also worked with Nick on “Meeting Individual Needs” so that all of his students began to engage in mathematics.

Natalia and Lynette embedded many of the dimensions, particularly “Student Tasks,” “Learning Environment,” and “Program Scope and Planning” in much of the one-on-one work they did with the teachers. These dimensions were evident in the pre-planning conversations as well as during the lessons themselves. Natalia and Lynette carefully modeled lessons that reflected reform-based learning environments around open ended student tasks. They then engaged in conversations with the teachers during and after the lessons about aspects of these dimensions they were noticing. The conversations included reflection and discussion of alternative methods of planning or facilitating the class and what the next steps for particular students and the whole class might be.

Natalia included “Program Scope and Planning,” “Student Tasks,” and “Manipulatives and Technology” in her PLC by including a time for teachers to plan lessons and tasks for upcoming units with her support. Natalia also modeled mini-lessons in these sessions and these modeled lessons included the use of manipulatives. The final full-day PLC that Natalia facilitated was focused on the dimension of “Assessment.”

The PLCs that Lynette co-facilitated with Suzanne included time for “Program Scope and Planning” and “Student Tasks” when time was provided for lesson planning. The text-based discussions that occurred in these PLCs were around a book focussed on creating open questions
and differentiating instruction. This supported teachers in the dimension of “Constructing Knowledge” and “Meeting Individual Needs.” Finally, the debriefing sessions that Lynette facilitated around the classroom observations included reflection and discussion around “Students Mathematical Communication,” “Learning Environments,” “Meeting Individual Needs,” “Student Tasks,” and “Program Scope and Planning.” While this did not occur during my observations, the teachers at Oakside were hoping to continue their PLC work the following year by engaging in moderated marking of mathematics assignments, thus addressing the “Assessment” dimension. Only the “Communicating with Parents” dimension was not addressed in some way by either the teachers or the coaches.

In relation to student learning, Lynette felt that students in Nick’s class were more engaged in math class and that more of them were participating. Natalia felt the same about students in David’s class. Lynette felt that Ellen’s students were becoming more confident and more comfortable answering open questions. Natalia believed that the students in Kim’s class were becoming better at thinking through problems and at working with their peers to solve them.

While the literature on coaching describes the various structures coaching may take and the multitude of tasks coaches perform and roles coaches fill, none of it looks specifically at the type of structure that has the most impact on bringing about teacher change. The results from this study suggest that co-teaching is the most beneficial to changing teacher practice, although this is not universally agreed upon by all participants in this study. Four of the five teachers felt that having their coach in the classroom to model or co-teach had the most impact on their practice. Heather, the principal at Maple Downs and Lynette, the coach at Oakside agreed. Hargreaves and Shirely (2009) cite model lessons as one method to support teacher development and
Grierson and Gallagher (2009) found that many teachers found demonstration lessons the best professional development they had ever received. Most of the teachers involved in this study cited model lessons and co-teaching as the most beneficial structure because it allowed them to see how a lesson might be taught in a real setting, their own classroom. Grierson and Gallagher (2009) found that demonstration classrooms in Ontario had tangible effects on teacher practice, but that it was not supported over the long term. Coaching offers a model that both allows for demonstration lessons and for ongoing support.

The four teachers who favoured this structure and Lynette also spoke about it being powerful because it enabled dialogue around real events and challenges occurring in the classroom. While Sarah preferred the PLC structure to the in-class support of her coach, her rationale was similar: it gave her the opportunity to hear and discuss differing ideas and approaches to math instruction. Penlington (2008) highlights that it is through dialogue that subconscious reasoning can be changed. Males, Otten, and Herbal-Eisenmann (2010) suggest that, when a critical colleagueship, such as the one between teacher and coach or teachers in a PLC, can be built to focus on raising conflicting and challenging ideas, a culture of improvement will emerge. Mesler Parise and Spillane (2010) also highlighted the necessity of dialogue for effecting change as they found collaborative discussion to be the highest predictor of teacher change in practice in their investigation of formal and non-formal professional development.

Mesler Parise and Spillane (2010) determined that this type of collaborative discussion can occur in both formal and non-formal professional development scenarios, and that both types of professional learning can lead to changes in teacher practice. The authors suggest that a combination of both forms of professional development may be optimal for teacher learning. The study participants who did not choose one-on-one coaching through modeling and co-teaching as
their preferred structure echo this suggestion and instead like the combination of both PLCs and one-one one non-formal learning experiences. Suzanne felt that the text-based discussion used to drive the PLC in combination with co-teaching with Lynette was the approach to coaching with the most impact as it involved all teachers in the PLC and simultaneously enabled those who were ready to make more changes to do so with Lynette’s support. Natalia felt that the combination of PLC with model lessons and/or co-teaching embedded was the best structure. This allowed teachers to both come to a common understanding about expectations in the Family of Schools and to see real examples of classroom teaching and learning.

While Natalia felt that the one-on-one sessions such as those she did with David and Kim had impact on their teaching and learning, she did not feel as though she could reach as many teachers and build capacity if she only used this structure. Lynette, who favoured co-teaching, also recognized that this did not allow her to meet with as many teachers as she would like. She indicated that, when co-teaching is combined with a strong PLC, like the one at Oakside, then the combination can have impact on teacher practice. Therefore, like Natalia, she aims to embed co-teaching in the PLCs and large group sessions that she facilitates.

3. How do the teachers experience the coaching process?

Every teacher in this study was positive about their experience with coaching. All five of the teachers indicated that they would willingly and happily continue to engage in coaching, with the caveat that it would depend on who the math coach was. In fact, every teacher wished for there to be more coaches in the school board so that they could spend more time working with their coach. Four of the five teachers indicated that their preferred structure for coaching was when the coach spent time with them in the classroom, either modeling or co-teaching a lesson. Only Sarah preferred the work done in the school-based PLC over the work
done in her classroom. Unlike the other teachers in this study, however, Sarah only had her
classroom once and reported that in her ideal vision of coaching the coach would
spend time in her classroom about once a month.

All of the teachers reported a goal of wanting to become better teachers and felt that one
benefit of coaching was the new ideas they were able to pick up from working with their coach.
Sarah indicated that this acted as a stressor at times because she did not feel she had time to
implement all of the ideas, but appreciated being exposed to them. David, Kim, and Ellen
reported feeling more confident about their math knowledge and more willing to take risks in
their math teaching. For Nick and Kim, a benefit of coaching was that their students would be
exposed to different teachers and different methods of teaching. They felt it was important for
their students to be able to work with and respond to different mathematics teachers. For Nick,
the other benefit of coaching was that he had another teacher in his classroom that could observe
his students and provide him with information about how the various students were performing.
Additionally, having another adult in the room helped Nick to plan a more purposeful
consolidation to his lesson as he could get more feedback about various students’ work.

There appeared, however, to be a lack of clear understanding of the role of the coach in
the schools. All teachers and principals involved in the study described the coaches as experts,
which was a label both of the coaches eschewed. Further, while the principals and teachers felt
that the coaches would help the teachers improve their practices, the principals also hoped that
the coaches would improve standardized test scores and support special education. Meanwhile,
the coaches felt it was their job to form relationships that could facilitate deep conversations and
reflective thought amongst teachers without telling teachers how or what to do in their practice.
4. How does coaching affect elementary mathematics teachers’ beliefs about the teaching and learning of mathematics?

It may be that the self-selected nature of this form of professional development inherently draws in people who share a vision of teaching and learning mathematics with their coach, however no teacher, coach, or principal reported a change in the way that they felt mathematics should be taught in elementary school. There is no evidence from this study that engaging in elementary mathematics coaching results in a change in teacher beliefs about the teaching and learning of mathematics. All of the teachers in the study professed holding a reform-oriented view of mathematics before they began working with a math coach. The work done with a coach was initiated primarily by the teachers, with the exception of Sarah. The teachers chose to engage in coaching in part to strengthen their practice to match their convictions.

Sarah, who did not independently choose to work with Lynette, is an outlier to the other four teachers in the sense that, while she indicated a belief in using problem solving, open-questions, use of manipulatives, and wanted to focus more on student communication, this type of teaching was not particularly evident in classroom observations. Sarah spoke about this disconnect, however, when she indicated that a challenge for her with coaching was that there were numerous good ideas that were presented and that she would like to try, but which she did not have time to attempt due to the pressure of the provincial standardized test. In fact, she indicated that this was an additional cause of stress for her since she knew there were things she should be doing, but was not. It thus appears that her core beliefs about the teaching and learning of mathematics did not change, but that she is struggling to find a way to incorporate new
practices gleaned from her work with Lynette that match her previously held view of the
teaching and learning of mathematics.

5. What are the challenges that impede and the elements that enable a coaching
program?

The relationships that are formed between a coach and a teacher are an important aspect
leading to the sustainability of a coaching program. The necessity of forming a strong
relationship between teachers and coaches was confirmed in this study. Lynette in particular
spoke about the importance of taking time to build up trusting relationships with her teachers.
She did not feel that she could get into the deeper conversations that affect change until this had
happened. As McGatha (2008) found in her case studies of coaches, it can take months for
coaches and teachers to define their relationship with one another and to enter into deeper
conversations.

It was important for both Natalia and Lynette that they not be viewed as an expert whose
job it was to fix teachers. Instead, they wanted to be seen as a colleague or peer whose job it was
to work together with teachers to learn collaboratively. Many authors highlight the importance of
collaborative relationships in bringing about teacher change. Attard (2007), Day (1999),
Hargreaves and Shirley (2009), and Grimmett and Crehan (1992) all point to collaboration as
being a key factor in teacher growth and increased knowledge. This collegiality can not be
“contrived” (Hargreaves & Shirley, 2009). When trusting relationships are built, increased
knowledge about teaching and learning can result from collaboration (Fullen & Hargreaves,

Both Lynette and Natalia spoke about the importance of creating trusting relationships
with their teachers. They both indicated that it is not their job to force change, to evaluate, or to
tell teachers how to do something. Instead, they hope to engage in deep conversations about the teaching and learning of mathematics that will cause teachers to reflect and question their own practice. To both coaches, this meant that they had to be willing to engage in the messiness of learning openly with the teachers. They felt that if a relationship between a coach and teacher were to take on a more hierarchical approach, such as that of expert and learner, then their efforts at coaching would not work.

All five teachers in the study echo the importance of the relationship between coach and teacher. It was because they felt comfortable with their coach that they were willing to take risks and try new ideas out in their classroom. Ellen spoke about Lynette as a mentor and about the importance of having someone beside her to tell her she was doing a good job. David and Kim did not feel “scared” of Natalia and trusted her because of her demeanour, the respect she showed them, and her willingness to support them in the way they asked. For Nick, the fact that he and Lynette shared a similar philosophy about teaching and learning mathematics meant that he trusted in the feedback she gave him about what was occurring in his classroom and was willing to try out pedagogical moves he had seen her model.

The research on coaching and teacher change speaks about the need for collaboration (Grimmett & Crehan, 1992; Hargreaves & Shirley, 2009), reflection (Attard, 2007; Day, 1999), and trust (Penlington, 2008). McGatha (2008) shows that coaching relationships evolve and deepen over time so that more difficult conversations can occur. However, no research speaks directly about the necessity of developing a close and trusting relationship between a coach and his or her teachers in order for teachers to willingly continue to work collaboratively with others and to the take risks to make changes in their practice. From this study, it appears that relationships such as these are essential to keeping teachers engaged in coaching over time.
All five teachers in this study indicated that the relationship that they formed with their coach was important to their continued engagement in coaching. Although all said that they did not have this problem, they imagined that a big challenge to coaching, and one that would keep them from participating in it, would be if they could not form a strong relationship with their coach. Important to the teachers in this study were a shared vision of teaching and learning between teacher and coach, a coach who is knowledgeable, supportive, friendly, non-evaluative, collaborative, and trustworthy.

Munoz-Catalan, Carillo Yanez, and Climent Rodriquez (2010) found that it took time for the novice teacher in their study to begin to recognize that dissenting opinions about her teaching were not personal attacks, but opportunities for her to improve her practice. It was not until she recognized this fact that she became willing to consider alternate ideas. Teacher change cannot be anticipated immediately upon engagement in coaching, but the teachers in this study indicate that they will continue to work with their coach if they feel the coaches can trust and support them. It takes time for this type of relationship to develop (McGatha, 2008; Munoz-Catalan, Carillo Yanez, & Climent Rodriquez, 2010) and thus time must be provided for teachers and coaches to establish strong relationships before they begin to engage in the risky tasks associated with changing practice.

Both of the principals in this study agreed that the relationships that their coaches formed with teachers were important to the coaching work in the school. While neither Heather nor Suzanne spent significant time with their coach, they both spoke about the approachability of their coach as an important factor in teachers’ willingness to work with a coach.

The support of the principals is another aspect of the coaching program that enables it to continue. Both Heather and Suzanne provide their teachers with release time from the classroom
in order to engage in the PLCs that are being offered. This also requires financial support for hiring substitute teachers. In Suzanne’s case, coaching has been coupled with a school-based PLC which she facilitates through the use of a common text. Suzanne employed the support of Lynette to model co-teaching lessons for her teachers and to help facilitate conversations around the observed lessons, the sharing of student work, and the text. Because of this, all teachers in Suzanne’s school had some contact with Lynette. She then supports those teachers, such as Nick, who choose to move forward with more individual coaching. Both principals are challenged, however, by the fact that mathematics coaching, as it is currently implemented, does not extend to special education.

Every participant in this study cited one major impediment to the coaching program: the lack of time. The pressure of time meant that the teachers and principals did not have the mathematics coach in their classrooms or schools as often as they wanted and for the coaches it led to the inability to work with all of the teachers who were requesting their support. The limited time that the coaches had available led to difficulties with scheduling such that David and Kim were often not able to see Natalia when they most wanted to and felt that they had to anticipate their need for Natalia’s in-class support weeks, and sometimes months, in advance. For Nick, the difficulty of finding a convenient time to begin his coaching with Lynette meant that he had to wait almost two months after deciding to engage in coaching to have Lynette in his room. During these two months, numerous rounds of communication occurred between Lynette and Nick via email, phone, and in person. Nick indicated that, if it were not for the study that I was conducting, he likely would not have been pushed to contact Lynette. He further reflects that it was his own and Lynette’s flexibility that made their first meeting possible. Both Sarah and
Nick co-planned the lessons they co-taught with Lynette as a part of the PLC over email since they were unable to schedule time to meet with Lynette for this task.

In this study, time repeatedly came up as a challenge facing all of those engaged in coaching. Every principal, coach, and teacher cited time as an impediment in some way. This resonates with the professional literature that has been done on coaching. Brady (2007), Bruce and Ross (2008), and Murray, Ma, and Mazur (2008) all highlight time as a struggle facing coaching programs. In particular, Bruce and Ross (2008) and Murray, Ma, and Mazur (2008) point to the challenges associated with scheduling and finding free time for coaches and teachers to meet to discuss lessons while Brady (2007) points to a coaches’ own time management as a challenge. In closely examining the reflections made by participants in this study, it appears that the challenges associated with time can be further broken into three subcategories.

The first is the difficulty related to not having enough time with a coach. This was raised by both principals and every teacher except for Sarah. Because the teachers felt positive about their experiences with their coach, they all wished to spend more time working with her. This time challenge was not one that kept the teachers from engaging in coaching, but emerged as a wish for the future of coaching, or as a vision for an improved coaching program. Likewise, Lynette and Natalia both felt that they did not spend as much time as they would have liked with their teachers. This relates to Brady’s (2007) notion of coaches struggling to manage their time with all of the competing demands for their attention. Ultimately, all of the teachers, including Sarah, Lynette, and the principals remarked that they would have liked to have had more coaches in their Family of Schools so that they could spend more time engaged in coaching.

The second challenge associated with time is that of scheduling. As Bruce and Ross (2008) and Murray, Ma, and Mazur (2008) indicated in their research, scheduling times for
coach and teacher to work together is difficult. This is a challenge that was raised by every teacher. While the PLCs that occurred were not affected by the challenges of scheduling, all of the teachers had difficulty gaining access to the coach for one-on-one support when they wanted it. Ellen had the least difficulty scheduling time with her coach, which may have been due to the fact that a solid relationship had already been formed between Ellen and Lynette, that coaching had been an ongoing process between the two, and that Ellen was willing to teach her math class whenever Lynette was available. That is a luxury not afforded to teachers in higher grade levels or split grade levels as the students are scheduled to work with different teachers at different times. For Sarah and Nick, this challenge meant presenting a demonstration lesson that was planned over email. For David and Kim, this meant that they could not have Natalia come in as much as they wanted during their unit on money, and that they had to continually approach her in order to solidify a time for her visit. At the end of the year, they felt lucky to have had Natalia in their room three or four times, which was more than she had visited in the past.

The literature on coaching and the challenges associated with time does not speak about how this challenge in scheduling time may keep teachers from engaging in the coaching process. However, results of this study indicate that this may be a potential consequence of coaches assigned to work with a large number of teachers. It takes a significant amount of initiative for teachers to connect with their coach. David, Kim, and Nick continued to reach out to their coaches, but it is not certain that all teachers would do so.

Finally, time presents a challenge for coaching when teachers feel that they have too much curriculum to cover leaving them with no time to work with a coach or to implement the changes suggested by a coach. Sarah, the most traditional mathematics teacher of those involved in this study and the only one teaching a grade level that takes the provincial standardized test,
highlights this fact. For Sarah, the provincial test was a looming presence and a cause of stress throughout the study. She did not believe that she had time to work with Lynette, even though she may have wanted to do so, because she had too much curriculum to get through before the test in May. Further, the ideas raised by Lynette’s one classroom visit and in the PLCs were interesting to Sarah, and ideas she felt she might want to implement. However, she did not believe she had the time to do this and prepare her students for the test. This resulted in additional stress for Sarah.

The other challenge confronting the coaching program studied in this district pertains strictly to the coaches. Both Lynette and Natalia describe the fact that, when they began coaching, there was no clear job description or vision of what a coach would do. Both indicate that with time the job has evolved based on the needs of their Family of Schools and the teachers in their schools. However, because each coach is responsible to a different Superintendent in the board, the role of coach across the district remains diverse with different coaches responsible for different aspects of teaching and learning.

Natalia and Lynette indicate that the lack of coaching network, professional development, and support system in the board is a source of great frustration. They both feel that they could learn from other coaches and would like to share practices and ideas, but that the professional development that is provided for coaches does not allow time for this. Nor do they feel they have an opportunity to learn or improve their own mathematical knowledge and practices. They believe that the isolated nature of the job and the high demands, coupled with limited time lead many coaches to leave the job.

Brady (2007), Pankake and Moller (2007), and Wong and Nicotera (2003) all indicated that professional development for coaches needs to be considered when implementing coaching
programs. These authors highlight professional development as an important structural support for coaches as they transition, as they typically do, from a classroom teacher role to that of coach. Brady (2007) also speaks about the need for a network of coaches to be developed to support coaches as they accomplish their work in an isolated position. When considering the rationale for this type of professional learning a focus has been on what coaches need to learn. Brady (2007) writes about the need for coaches to learn about adult learners and learning, deep content knowledge, and pedagogical information, and how to use data to guide their instruction.

This study shows that, even when professional development opportunities for coaches exist, if they are not carefully designed and implemented to meet the coaches’ needs, coaches are not gaining the desired knowledge. More importantly, coaches may in fact be leaving the role and returning to the classroom.

Although the school board involved in this study did provide monthly half day professional development days for the coaches, interviews with both Natalia and Lynette indicate that they face a lack of professional development and coaching network. They perceived this as a lack of support. Natalia overtly connects the fact that four coaches, one-sixth of the coaching staff in the board, left the role at the end of the year due to this lack of support. Lynette did return to the classroom in the year following the study. She did not explicitly draw the connection to the lack of support. However, this was raised repeatedly by her as one of her greatest challenges and frustrations. In looking ahead, she spoke of wishing for more and better professional development.

While this study only represents two coaches’ opinions, it is clear from their feedback that high quality professional development that is designed to meet the needs of coaches is fundamental to sustaining a coaching program. As noted above, building a trusting relationship
was an important aspect of coaching for both teachers and coaches. It was only when the teachers trusted the coach that the deep conversations that led to reflection and change occurred. It takes time to form these types of relationships. If coaches continue to leave due to a lack of support in the district, it is likely that the change process will be interrupted as time will once again be spent building new relationships with new coaches. While the literature suggests professional development is necessary to improve and solidify coaches’ skills, I suggest further, that without support and professional development, a coaching program cannot sustain itself. It is critical to support the coaches if they are going to continue in their roles long term.

5.3 Major Findings

Based on the data collected from the five classroom teachers, two coaches, and two principals in this study six major findings emerged related to coaching and teacher change:

1. Teachers, coaches, and principals in this study all indicated that engaging in coaching brought about change in the teachers’ classroom practices.

2. Teachers, coaches, and principals were not able to clearly define a change in student learning due to coaching. Teachers were most likely to speak about a change, followed by coaches, and then principals. However, none of the participants spoke confidently about this topic.

3. A trusting and collaborative relationship between teachers and coaches is important to teacher engagement in coaching. All five teachers indicate that they would not continue with coaching if they did not trust and feel supported by their coaches.

4. Co-teaching and model lessons are the coaching structure preferred to by most of the participants. Four of the five teachers, one coach, and one principal deemed this structure to have the most impact on changing teacher practice. The second coach and principal involved in the study preferred combining this structure with a form of PLC.
5. Time is a major barrier to coaching and was raised by all participants as a challenge to the work being done in the coaching program. The challenge of time can be broken down into three distinct categories: The challenge of not having enough time with a coach, the challenge of scheduling time to work with a coach, and the challenge of not having enough time in the mandated curriculum to work with a coach.

6. High quality professional development designed to meet the coaches’ learning needs and the existence of a coaching network to offer support are fundamental to sustaining a coaching program over time.

5.4 Implications of Findings for Future Research

This research study found an overwhelmingly positive response in perceptions of elementary mathematics coaching. The teachers, coaches, and principals who participated in this study uniformly found engaging in mathematics coaching to be beneficial and useful to the teaching and learning of mathematics. All of the stakeholders involved pointed to aspects of their thinking, knowledge, and confidence in mathematics that changed in addition to aspects of their practice.

However, each of the teachers involved in the study engaged willingly in coaching. Even these willing teachers highlighted challenges to engaging in coaching such as scheduling, pressure to change, and finding time to implement changes. Despite these difficulties, the five teachers studied here did persevere in the coaching in some form. Sarah, the most traditional math teacher of the five studied, did not choose to have Lynette into her classroom beyond the one time her principal asked her to do so. What are the reasons that hesitant teachers are choosing not to engage in what has been seen by their colleagues as useful? If the barriers mentioned above were removed, would more teachers willingly work with their coach or are
there other factors that are keeping them from participating in this form of professional
development? Are teachers who have already adopted a more-reform oriented practice more
likely to seek out a coach than a more traditional math teacher? Further research might look at
how the more reluctant teachers perceive their work with a coach. Do they find it as beneficial
and useful as those who took the initiative on their own and worked their way through the
barriers?

Sarah offers an interesting contrast to the other teachers in this study as she is the only
teacher working in a grade that takes the provincial standardized tests. She is also the teacher
who speaks the most often about the lack of time she has to both engage in coaching and to
implement the changes that are suggested because of the pressures of the standardized test.
While she recognizes that implementing the changes may, in the end, improve her students’ test
scores, she does not believe that she has time to both make the changes suggested and get
through the required curriculum before the test. Further research can be done on the demands of
provincial testing and teachers’ willingness to access coaching. Do other teachers of grade 3 and
grade 6, the provincial testing grades, avoid coaching for similar reasons? Do those who engage
in coaching despite the testing demands find a difference in their students’ test results? How can
coaching be made accessible to these teachers without adding additional pressure?

While this study indicates that the teachers, coaches, and principals involved can all point
to some aspects of teacher change, the evidence is self-reported and anecdotal. What type of
system might be created to monitor the impact of coaching on teacher practice without
evaluating either the teacher or the coach? What measures might exist or be created beyond the
results of provincial testing that occur in grades 3 and 6 to measure both teacher and student
growth?
Whether coaching should focus on the coach’s goal for the teacher, the teacher’s personal goal, or the Dimension(s) of Mathematics Education that is weakest for the teacher was not investigated in this study. However, it may be important to study this further as continued engagement, changes in teacher practice, and student learning are likely related to the goal(s) targeted, who chose them, and why they are, or are not important to a teacher and his or her practice.

Both coaches in this study reflected on the lack of appropriate professional development and the need for a stronger support system and network of coaches. While Natalia and Lynette had different suggestions for what form this might take, they were both clear that this was a major impediment to their work, and something that was creating high levels of burnout and turnover amongst the coaches in their school board. While the literature indicates that professional development for coaches is necessary for a strong coaching program, it can be argued that this school board was offering professional development, just not the kind that the coaches needed. Research might look at studying various types of professional development opportunities for coaches. Focus should be on determining which best support the learning and the work that coaches do. It is possible that new professional development programs may need to be designed explicitly for this purpose.

Both coaches focused on the usefulness of conversations and of being able to make their teachers think in different ways about the teaching and learning of mathematics. They focus not on changing the teacher, but on making the teacher think. Limited evidence of conversations about mathematics content was found in both case studies. Instead, most of the discussion focused on pedagogy. What types of conversations are the most useful for teachers in terms of changing their practice? Improving their knowledge of mathematics? Increasing their
Do the different aspects of teacher change require different types of activities, questions, and conversations?

Finally, the voices of one large group of stakeholders was absent from this study; the students. Principals, coaches, and teachers in this study struggled with varying degrees of difficulty to pinpoint if and how student learning was impacted by coaching. While there was an overall tendency to believe it was, and anecdotal examples of changes teachers felt they had seen, there is limited evidence that this is occurring. Currently, research is being done to measure the impact of mathematics coaching on student learning, but much of it is focused on standardized test results. Beyond test scores, how can districts measure student achievement that occurs due to coaching? A useful follow-up study to this one would be to include the voices of students in classrooms where coaches are working. What changes, if any, are they noticing in their own mathematical work? In the way their classes are organized? What is their experience in a classroom that includes a mathematics coach?

5.5 Suggestions for Stakeholders in Elementary Mathematics Coaching Programs

The information gathered from the teachers, coaches, and teachers at both Oakside and Maple Downs Schools indicates that all of the stakeholders who participated in this research study found elementary mathematics coaching to be beneficial. Specific aspect of the teachers’ practice that changed and/or improved included confidence in mathematics, both content and pedagogy, new approaches to designing lessons and tasks, more risk taking amongst students, and more equitable student participation in class discussions around mathematics. Thus, results from this study suggest that such a program can lead to positive perceptions about both the role of coaching as a form of professional development and about the teaching and learning of
mathematics. Specific suggestions can also be made to help with the implementation of a strong and successful coaching program:

1. An adequate number of coaches needs to be hired to meet the demands of the teachers they are responsible for working with. Assigning one coach to work with a smaller number of schools than the coaches involved in this study were working with might help to lessen the difficulties in scheduling as well as increase both the number of teachers who have easy access to working with a coach and the number of times a coach can visit each teacher’s classroom;

2. Coaches need more high quality professional development that is designed to meet their specific professional needs and to improve their own professional learning. This professional development time should not be optional nor viewed as an impediment to a coach’s ability to perform the duties that are expected of him or her;

3. School boards must consciously work to develop a support system for coaches within the district. This, coupled with the first two suggestions, must aim to mitigate the high turnover and burnout amongst coaches. As long as turnover remains high, sustainability of a coaching program and continuous change or progress amongst teachers will remain difficult. Coaches need time to build relationships before getting into the more difficult work of engaging challenging conversations. As new coaches come in every three or four years, this work must begin again which will inevitably interrupt the work done by the previous coach;

4. Coaching programs must be designed to maximize time for one-on-one coaching to occur in the teachers’ classrooms. While this may not always be feasible, it was described as the most powerful structure with the most impact, particularly when coupled with school-based or grade-level based PLCs;
5. Coaches should take time to discuss with their teachers their goals for the work they are doing and to hear the teachers’ own goals so that everyone is working together toward a shared vision. Opportunities to check in on how the work is progressing towards the various goals should also be given;

6. Similarly, the principal of the school should have a clear set of goals for the coach’s involvement in the school that are transparent to both coaches and teachers. As the principal operates in a support role for both teacher and coach, the principal must have some knowledge of the work the coach and teachers are doing, the goals they are working towards, and of any roadblocks to that work;

7. When implementing a coaching program, the school board needs to have a clear vision and rationale for the program as well as a transparent and widely shared job description in order to avoid a lack of understanding about the coach’s role among those schools, principals, teachers, and coaches participating in the coaching program;

8. A system needs to be created to help ease the burden that scheduling puts on both teachers and coaches. Teachers, who must persevere to get time scheduled, may give up if it becomes too much of an additional pressure, while coaches spend much of their time working at the clerical job of scheduling and responding to emails from teachers requesting time. Working for two months or more to find a time to meet is not an efficient use of either coach or teacher time. An online scheduling system might be created to support this;

9. A non-evaluative method of monitoring coaching would be useful. This might be something such as recording goals and checking in on them, teacher and coach reflections, and/or logs kept of work that has been done;
10. Schools and school boards can consider additional methods beyond standardized test scores to measure student achievement due to coaching;

11. Schools might consider collecting data about who is and who is not accessing the coach in the school, work to find out why teachers are hesitant to engage in coaching, and aim to remove those barriers.

5.6 Summary

This study has provided voice to the major stakeholders involved in coaching programs and an opportunity for them to share the ways in which coaching is and is not supporting the work that happens in elementary mathematics classrooms. The fact that all of the participants recognize that coaching is having a positive impact on the teaching practices of classroom teachers suggests that coaching is meeting its goal as an embedded form of professional development aimed at supporting reform mathematics pedagogy.

While the data collected in this study suggest that coaching is viewed as a positive form of professional development that can have impact on teacher practice, many issues surrounding the nature of the role of a coach remain outstanding. This study indicates that various stakeholders involved in coaching hold different and not always complementary goals for the work that is to be done with a coach. Many of the goals that were purported by teachers were vaguely centred upon improved practice, yet the notion of improved practice was left undefined. Thus, the coaches’ goals were what drove the work between the teacher and the coach. Cohesive goals that are related to both teacher and student growth and that can be measured will be necessary in order to assess how coaching is or is not impacting teaching and learning.

Both coaches remained hesitant to engage with teachers who were not actively seeking out coaching support and who were not already engaged in reform-based teaching to some
degree. The more reluctant teachers are not benefiting from coaching programs to the same
degree as the teachers who are pro-active in their approach to coaching. School boards will need
to consider how to better engage all teachers in coaching as they aim to build capacity across a
school and a district.

The issue of time will need to be addressed if the teacher change is to take root and
spread across the district. Furthermore, school boards will need to provide professional
development targeted to the needs of mathematics coaching. If they do not, they risk high
turnover of coaches and an ongoing system of forming relationships between teachers and
coaches, teachers beginning to implement changes, and an interruption to the change process as a
new coach is hired and the cycle begins again. Finally, as a coaching program begins to sustain
itself, investigation will need to occur about the impact of the changes made by teachers on
student learning.


Organisation for Economic Co-Operation and Development (n.d.). *OECD programme for international student assessment (PISA)*. Retrieved from http://www.pisa.oecd.org/pages/0,2987,en_32252351_32235731_1_1_1_1_1,00.html


APPENDIX A:


Instructions
Circle the extent to which you agree with each statement, according to the A to F scale below.
Then, use the charts at the top of the Attitudes and Practices for Teaching Math Survey Scoring Chart to complete the
score column for each statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Extent of agreement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I assign math problems that can be solved in different ways.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>2. I regularly have all my students work through real-life math problems that are of interest to them.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>3. When students solve the same problem using different strategies, I have them share their solutions with their peers.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>4. I often integrate multiple strands of mathematics within a single unit.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>5. I often learn from my students during math because they come up with ingenious ways of solving problems that I have never thought of.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>6. It’s often not productive for students to work together during math.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>7. Every student should feel that mathematics is something he or she can do.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>8. I plan for and integrate a variety of assessment strategies into most math activities and tasks.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>9. I communicate with my students’ parents about student achievement on a regular basis as well as about the math program.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>10. I encourage students to use manipulatives to communicate their mathematical ideas to me and to other students.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>11. When students are working on problems, I put more emphasis on getting the correct answer rather than on the process followed.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>12. Creating rubrics is a worthwhile exercise, particularly when I work with my colleagues.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>13. It is just as important for students to learn probability as it is to learn multiplication.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>14. I don’t necessarily answer students’ math questions, but rather ask questions to get them thinking and let them puzzle things out for themselves.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>15. I don’t assign many open-ended tasks or explorations because I feel unprepared for unpredictable results and new concepts that might arise.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>16. I like my students to master basic operations before they tackle complex problems.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>17. I teach students how to communicate their math ideas.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>18. Using technology distracts students from learning basic skills.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>19. When communicating with parents and students about student performance, I tend to focus on student weaknesses instead of strengths.</td>
<td>A B C D E F</td>
<td></td>
</tr>
<tr>
<td>20. I often remind my students that a lot of math may not be fun or interesting but it’s important to learn it anyway.</td>
<td>A B C D E F</td>
<td></td>
</tr>
</tbody>
</table>
For statements 1–5, 7–10, 12–14, and 17, score each statement using these scores:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

For statements 6, 11, 15, 16, 18, 19, and 20, score each statement using these scores:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

To complete this chart, see step-by-step instructions below:

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Related Statements</th>
<th>Statement Scores</th>
<th>Sum of the Scores</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Program Scope and Planning</td>
<td>4, 8, 13</td>
<td></td>
<td>= 3 =</td>
<td></td>
</tr>
<tr>
<td>2. Meeting Individual Needs</td>
<td>2, 6, 7, 15, 16</td>
<td></td>
<td>- 5 =</td>
<td></td>
</tr>
<tr>
<td>3. Learning Environment</td>
<td>3, 5, 6</td>
<td></td>
<td>+ 3 =</td>
<td></td>
</tr>
<tr>
<td>4. Student Tasks</td>
<td>1, 2, 11, 15, 16</td>
<td></td>
<td>+ 5 =</td>
<td></td>
</tr>
<tr>
<td>5. Constructing Knowledge</td>
<td>5, 11, 14, 15, 16</td>
<td></td>
<td>= 5 =</td>
<td></td>
</tr>
<tr>
<td>6. Communicating With Parents</td>
<td>19, 9</td>
<td></td>
<td>= 2 =</td>
<td></td>
</tr>
<tr>
<td>7. Manipulatives and Technology</td>
<td>10, 18</td>
<td></td>
<td>= 2 =</td>
<td></td>
</tr>
<tr>
<td>8. Students’ Mathematical Communication</td>
<td>3, 6, 10, 17</td>
<td></td>
<td>= 4 =</td>
<td></td>
</tr>
<tr>
<td>9. Assessment</td>
<td>8, 11, 12, 19</td>
<td></td>
<td>= 4 =</td>
<td></td>
</tr>
<tr>
<td>10. Teacher’s Attitude and Comfort With Mathematics</td>
<td>4, 7, 13, 15, 20</td>
<td></td>
<td>= 5 =</td>
<td></td>
</tr>
</tbody>
</table>

**Total Score (All 10 dimensions)**

**Overall Score (Total Score ÷ 38)**

**Step 1:**
- Calculate the Average Score for each dimension:
  1. Record the score for each Related Statement in the third column.
  2. Calculate the Sum of the Scores in the fourth column.
  3. Calculate the Average Score and record it in the last column.

**For example:**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Related Statements</th>
<th>Statement Scores</th>
<th>Sum of the Scores</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Program Scope and Planning</td>
<td>4, 8, 13</td>
<td></td>
<td>= 3 =</td>
<td></td>
</tr>
</tbody>
</table>

**Step 2:**
- Calculate the Overall Score:
  1. Calculate the Total Score of the sums for all 10 dimensions in the fourth column.
  2. Calculate the Overall Score by dividing the Total Score by 38.

**For example:**

<table>
<thead>
<tr>
<th>Total Score (All 10 dimensions)</th>
<th>152</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Score (Total Score ÷ 38)</td>
<td>4</td>
</tr>
</tbody>
</table>

**Step 3:**
- Interpret the results:
  - **Average Score for Each Dimension**
    - Average scores will range from 1 to 6. The higher the average score, the more consistent the teacher’s attitude and teaching practices are with current mathematics education thinking, with respect to the dimension. A low score indicates a dimension that a teacher might focus on for personal growth and professional development.
  - **Overall Score**
    - The overall score will range from 1 to 6. The higher the overall score, the more consistent the teacher’s attitude and teaching practices are with current mathematics education thinking and the more receptive that teacher might be to further changes in his or her practice.
Appendix B:

Semi-Structured Interview Questions for Coaches

Before Observations

1. Describe the way you believe mathematics should be taught and learned in an elementary school and explain why.
   - If necessary ask probing questions about: student errors, collaborative work, multiple strategies, mathematical arguments/reasoning/proof, procedural and rote learning, conceptual understanding

2. Describe what you think a mathematics coach does. Why did you become a mathematics coach?
   - If necessary prompt for information about background/experience with mathematics as a student and as a teacher

3. Describe your goals for your work with [Teacher A and Teacher B]. What do you see as [Teacher A and Teacher B]’s greatest strength in teaching mathematics? What do you see as [Teacher A and Teacher B]’s greatest challenge in teaching mathematics? What do you expect to happen when you work with [Teacher A and Teacher B]?

4. Tell me about your relationship with the teachers you are working with (in particular Teacher A and Teacher B). Can you think of a time when your relationship helped or hindered your work with a teacher?

5. What do believe the benefits of a coaching program are?
   - If necessary prompt for a story (“tell me about a time when that happened…”)

6. What do you find to be challenges or drawbacks of a coaching program?
   - If necessary prompt for a story (“tell me about a time when that happened…”)

7. What changes, if any, do you perceive occur in the practice of the teachers you work with?

8. Is there anything else you would like to share about coaching and mathematics teaching and learning?
After Observations

1. What changes, if any, have you perceived in [Teacher A and Teacher B]’s practice?

2. What changes, if any, have you perceived in [Teacher A and Teacher B]’s students’ mathematics learning?

3. In what ways did you and did you not meet your goals for your work with [Teacher A and Teacher B]? What factors do you believe influenced that?
   - If necessary prompt for information about relationship, time, structure, etc.

4. What do believe the benefits of a coaching program are? Can you tell me about a time when you felt your work was successful?

5. What do you find to be challenges or drawbacks of a coaching program? Can you tell me about a time when you felt your work didn’t go the way you had planned?

6. If you could wave a magic wand to make the coaching program exactly how you wanted it to be, what would you do?

7. Is there anything else you would like to share about coaching and mathematics teaching and learning?
Appendix C:

Semi-Structured Interview Questions for Former Instructional Leader

1. Describe the way you believe mathematics should be taught and learned in an elementary school and explain why.
   - If necessary ask probing questions about: student errors, collaborative work, multiple strategies, mathematical arguments/reasoning/proof, procedural and rote learning, conceptual understanding

2. Describe the history and the structure of the coaching program in your former district.

3. What do you think a mathematics coach does? How did you become involved with the board as a mathematics instructional leader?
   - If necessary prompt for information about background/experience with mathematics as a student and as a teacher

4. What do you believe the goals of a mathematics coaching program should be and why?

5. Describe an instance (or a couple of instances) of change in mathematics teaching and/or learning that occurred as a result of the coaching program in your former district.

6. Tell me about your relationship with the teachers and coaches you worked with. Can you think of a time when your relationship helped or hindered your work with a teacher or coach?

7. What do you believe the benefits of a coaching program are?
   - If necessary prompt for a story (“tell me about a time when that happened...”)

8. What challenges confront the coaching program in your former district?
   - If necessary prompt for a story (“tell me about a time when that happened...”)

9. Is there anything else you would like to share about coaching and mathematics teaching and learning?
Appendix D:

Semi-Structured Interview Questions for Teachers

Before Observations

1. What are your feelings about teaching mathematics?
   - If necessary prompt for information about background/experience with mathematics as a student and as a teacher

2. Describe the way you believe mathematics should be taught and learned in an elementary school and explain why.
   - If necessary ask probing questions about: student errors, collaborative work, multiple strategies, mathematical arguments/reasoning/proof, procedural and rote learning, conceptual understanding

3. Describe what a mathematics coach is. How do you feel about having a mathematics coach work with you?

4. What do you expect will happen when you work with a coach? Describe your goals for your work with [coach’s name].

5. Tell me about your relationship with [coach’s name]?

6. What benefits do you think you will receive from working with [coach’s name]?

7. What challenges or drawbacks do you anticipate as a result of working with [coach’s name]?

8. Is there anything else you would like to share about coaching and mathematics teaching and learning?
After Observations

1. What are your feelings about teaching mathematics?

2. Describe the way you believe mathematics should be taught and learned in an elementary school and explain why.
   - If necessary ask probing questions about: student errors, collaborative work, multiple strategies, mathematical arguments/reasoning/proof, procedural and rote learning, conceptual understanding

3. How do you feel about having a mathematics coach work with you?

4. What changes, if any, do you perceive occurred in your own mathematics learning due to coaching?

5. What changes, if any, do you perceive occurred in your students’ mathematics learning due to coaching?

6. In what ways did you and did you not meet your goals for your work with [coach’s name]? What factors do you believe influenced that?
   - If necessary prompt for information about relationship, time, structure, etc

7. What benefits did you receive from working with [coach’s name]? Can you tell me about a time when you felt your work with (coach’s name) went well?

8. What challenges or drawbacks did you face as a result of working with [coach’s name]? Can you tell me about a time when you felt that your work with (coach’s name) did not go as planned?

9. If you could wave a magic wand to make the coaching program exactly how you wanted it to be, what would you do?

10. Is there anything else you would like to share about coaching and mathematics teaching and learning?
Appendix E:

Semi-Structured Interview Questions for Principals

Before Observations

1. Describe the way you believe mathematics should be taught and learned in an elementary school and explain why.
   - If necessary ask probing questions about: student errors, collaborative work, multiple strategies, mathematical arguments/reasoning/proof, procedural and rote learning, conceptual understanding

2. Describe what you think a mathematics coach is and what he or she does.

3. How do you feel about having a mathematics coach work in your school?

4. Describe your goals for the coaching program in your school.

5. How do you decide which teachers work with [coach’s name] and why?

6. How do you support your teachers who are working with a coach?

7. What benefits do you believe your school, your staff, and your students have received as a result of participating in a coaching program? Can you think of an example?

8. What, if any, changes in mathematics teaching have you perceived since your school began participating in coaching? What factors do you think contributed to that?

9. What, if any, changes in mathematics learning have you perceived since your school began participating in coaching? What factors do you think contributed to that?

10. What challenges or drawbacks do you believe your school, your staff, and your students face as a result of participating in a coaching program?

11. Is there anything else you would like to share about coaching and mathematics teaching and learning?
After Observations

1. What changes, if any, in mathematics teaching have you perceived in [Teacher A and Teacher B]’s practice since [Teacher A and Teacher B] began participating in coaching?

2. What changes, if any, in mathematics learning have you observed in [Teacher A and Teacher B]’s classroom since [Teacher A and Teacher B] began participating in coaching?

3. What benefits do you believe [Teacher A and Teacher B] received as a result of participating in a coaching program? Can you think of an example that highlights that?

4. What challenges or drawbacks do you believe [Teacher A and Teacher B] faced as a result of participating in a coaching program? Can you tell me a story that highlights that?

5. Is there anything else you would like to share about coaching and mathematics teaching and learning?
Appendix F:

Classroom Observation Protocol

Date:
Location:
Start Time:
End Time:
Coach:
Teacher(s):
Topic:

Research context (i.e. classroom set up, number of students, organization of desks, etc.)

Observation content:

Describe evidence of transfer from previous work done with the coach (i.e. pre-conference planning, previous lessons observed, lesson modeled by coach?):

Participation patterns (i.e. who speaks, when, who does not, when, etc.):

Describe the structure of the mathematical work (i.e. individual, pair, group, written, oral, manipulatives, etc.):

Describe the teacher talk around mathematics (i.e. what types of questions are being asked, what is the response to students’ mathematical ideas and/or mathematical errors, how is the mathematical work described, etc.)

Describe the teacher’s actions (i.e. where does the teacher stand, how does the teacher move around the room, how does the teacher respond to struggling students, etc.)

Describe the tools the teacher uses in the classroom, and how they are used (i.e. what manipulatives are used, by which students, and how are they accessed, are calculators available, etc.)

Describe the coach’s role in the classroom (i.e. co-teaching, observing, interacting with students, etc.)

Observer questions, comments, statements (i.e. for follow-up or reflections, etc.):
Appendix G:

Coach/Teacher Meeting Observation Protocol

Date: 
Location: 
Start Time: 
End Time: 
Coach: 
Teacher: 
Topic: 

Research context (i.e. pre-observation lesson planning, post-observation feedback, unit planning, etc.):

Observation content:

Participant patterns (i.e. who leads the discussion, who chooses topic, etc.):

List the topics that are discussed:

What types of questioning occurs in the meeting? (i.e. what questions are asked, what types, and by whom):

What, if any, mathematical pedagogies are discussed?

What, if any, mathematical content is discussed?

What, if any, mathematics strategies for teaching are discussed?

What, if any, mathematics tools are discussed?

Observer questions, comments, statements (i.e. for follow-up or reflections):
Appendix F:

Information Letters and Consent Forms

Study Information and Invitation Letter for Principals

My name is Shannon Larsen and I am a PhD Candidate at the Ontario Institute for Studies in Education, University of Toronto (OISE/UT). I am conducting a study entitled, “Elementary School Mathematics Teachers’ Perceptions of Coaching.”

Mathematics coaching is a growing form of professional development, yet limited research currently exists on its efficacy. The purpose of this study is to determine teachers’ perceptions of elementary mathematics coaching on their practice. More specifically, the aim of the research is to establish the ways in which the classroom practice of a teacher does or does not change when that teacher works with an elementary mathematics coach. I would like to invite you and your staff to participate in my research.

This is a qualitative study of changes in teaching practices. As such, the data for this study will be gathered by me through a series of ongoing classroom observations, observations of meetings that occur between coaches and teachers, and two one-hour interviews with each teacher, coach, and principal. In total, I plan to work with approximately three coaches and six teachers across the district. Each participant will be asked to sign his or her own written consent form before any research begins.

Should you decide to participate in the study the obligations of your staff members would be as follows:

Teachers

a) Take the “Attitudes and Practices for Teaching Math Survey.” This survey should take about 20 minutes. Teachers will share the results of the survey with their coach to help them decide upon a goal for their work together.

b) Be observed by me teaching mathematics classes. These observations will include lessons that are taught by the teacher while the coach is in the classroom and without the coach’s presence, lessons that are modeled for the teacher by the coach, and lessons that are co-taught by the teacher and the coach. The observations will occur approximately once per week over the course of three - four months.

c) Be observed by me during meetings between the teacher and the coach, including professional development that teachers may be involved in. These observations will occur approximately once per week over the course of three - four months.

d) Engage in two one-hour tape-recorded interviews with me. The first interview will occur at the beginning of the study and the second interview will occur at the end.
Coaches

a) Review the “Attitudes and Practices for Teaching Math Survey” taken by the teachers in order to help them decide upon a goal for the work together.

b) Be observed by me during work with two teachers. These will be observations of the coach’s work in each teacher’s classroom and will include lessons that are taught by the teacher in the coach’s presence, lessons that are modeled by the coach in the teacher’s presence, and lessons that are co-taught by the coach and the teacher. The observations will occur approximately once per week with each teacher over the course of three - four months.

c) Be observed by me during meetings between the coach and each teacher in the study, including professional development that the coach may provide. These observations will occur approximately once per week with each teacher over the course of three – four months.

d) Engage in two one-hour tape-recorded interviews with me. The first interview will occur at the beginning of the study and the second interview will occur at the end.

Principal

a) Engage in two one-hour tape-recorded interviews with me. The first interview will occur at the beginning of the study and the second interview will occur at the end.

The attached information letter and consent form provides further information about your rights as a participant, confidentiality, withdrawal, and my use of data, as well as a request for signed consent.

I would be more than happy to discuss this project with you further if you have any questions. I can be reached at [phone number] or [email address]. You can also speak to my supervisor, Dr. Douglas McDougall at [phone number] or [email address]. If you have questions regarding your rights as a research participant, please feel free to contact the Office of Research Ethics at either [phone number] or [email address].

Thank you so much for your consideration. I greatly appreciate it.

Sincerely,
Shannon Larsen
Information Letter (Parents/Guardians)

My name is Shannon Larsen and I am a PhD Candidate at the Ontario Institute for Studies in Education, University of Toronto (OISE/UT). I am conducting a study entitled, “Elementary School Mathematics Teachers’ Perceptions of Coaching.”

The purpose of this study is to determine teachers’ perceptions of elementary mathematics coaching on their practice. More specifically, the aim of the research is to establish the ways in which the classroom practice of a teacher does or does not change when that teacher works with an elementary mathematics coach. I would like to invite you to participate in my research.

I will be collecting data for this study through a series of ongoing classroom observations, observations of meetings that occur between coaches and teachers, and two one-hour interviews with each teacher, coach, and principal.

I would like to conduct some of my observations in your child’s classroom. Children are not the focus of my study, but they will be present during classroom observations and I will be recording information about the types of questions or comments students make, the ways in which they work (for example, individually or in small groups), and other ways in which they interact with their teacher and the math coach during mathematics lessons.

All identifying information will be masked and pseudonyms will be used to ensure anonymity. The names and information of individual students and their schools will not be revealed in any future reports or publications. All data will be kept in locked and encrypted files on my computer. I will be the only one with the password to these files. Any data that is obtained in hard copy will be kept in a locked file. All data will be used for research purposes only and will be destroyed 5 years after the research has been completed.

If you have any questions about the study, I would be happy to answer them for you. I can be reached at [phone number] or [email address]. You can also speak to my supervisor, Dr. Douglas McDougall at [phone number] or [email address].

Sincerely,
Shannon Larsen
Information Letter and Consent Form (Principals)

My name is Shannon Larsen and I am a PhD Candidate at the Ontario Institute for Studies in Education, University of Toronto (OISE/UT). I am conducting a study entitled, “Elementary School Mathematics Teachers’ Perceptions of Coaching.”

The purpose of this study is to determine teachers’ perceptions of elementary mathematics coaching on their practice. More specifically, the aim of the research is to establish the ways in which the classroom practice of a teacher does or does not change when that teacher works with an elementary mathematics coach. I would like to invite you to participate in my research.

The data for this study will be gathered by me through a series of ongoing classroom observations, observations of meetings that occur with coaches and teachers, and two one-hour interviews with each teacher, coach, and principal.

If you agree to participate in the study, you will be asked to engage in two one-hour tape-recorded interviews with me. The first interview will occur at the beginning of the study and the second interview will occur at the end.

If you agree to participate all identifying information will be masked and pseudonyms will be used to ensure anonymity. The names and information pertaining to individual coaches and their schools will not be revealed in any future reports or publications. All data will be kept in locked and encrypted files on my computer. I will be the only one with the password to these files. Any data that is obtained in hard copy will be kept in a locked file. All data will be used for research purposes only and will be destroyed 5 years after the research has been completed. You will be provided with copies of transcripts of observations and interviews in which you were involved and will have the right to make any comments about those transcripts. At the end of the study, I will provide you with a report of significant findings. If, at that time, you have further questions regarding your individual case that you feel are not addressed in the report, I will be available to speak with you either in person or by phone to discuss them.

Participation in this study is voluntary. Should you agree to be involved in the study, you will have the right to withdraw at any time without penalty and all data pertaining to you will be destroyed upon withdrawal from the study. You also have the right to decline to answer any questions that you do not want to answer at any time in the study. There are no known risks to participating in this study.

If you would like to participate in this study please sign the consent form below. If you have any questions about the study, I would be happy to answer them for you. I can be reached at [phone number or [email address]. You can also speak to my supervisor, Dr. Douglas McDougall at [phone number or [email address] If you have questions regarding your rights as a research participant, please feel free to contact the Office of Research Ethics at either [phone number] or [email address].

Thank you so much for your consideration. I greatly appreciate it.
Sincerely,
Shannon Larsen

Name: _______________________________

School: _______________________________

Date: ________________________________

Signature: _____________________________
Information Letter and Consent Form (Teachers)

My name is Shannon Larsen and I am a PhD Candidate at the Ontario Institute for Studies in Education, University of Toronto (OISE/UT). I am conducting a study entitled, “Elementary School Mathematics Teachers’ Perceptions of Coaching.”

The purpose of this study is to determine teachers’ perceptions of elementary mathematics coaching on their practice. More specifically, the aim of the research is to establish the ways in which the classroom practice of a teacher does or does not change when that teacher works with an elementary mathematics coach. I would like to invite you to participate in my research.

The data for this study will be gathered by me through a series of ongoing classroom observations, observations of meetings that occur with coaches and teachers, and two one-hour interviews with each teacher, coach, and principal.

If you agree to participate in the study, you will:

a) Take the “Attitudes and Practices for Teaching Math Survey.” This survey should take about 20 minutes. You will share the results of the survey with your coach to help you decide upon a goal for your work together.

b) Be observed by me teaching your mathematics class. These observations will include lessons that are taught by you while your coach is in your classroom and without your coach’s presence, lessons that are modeled for you by your coach, and lessons that are co-taught by you and your coach. The observations will occur approximately once per week over the course of four months.

c) Be observed by me during meetings between you and your coach, including professional development that you may be involved in. These observations will occur approximately once per week over the course of four months.

d) Engage in two one-hour tape-recorded interviews with me. The first interview will occur at the beginning of the study and the second interview will occur at the end.

If you agree to participate all identifying information will be masked and pseudonyms will be used to ensure anonymity. The names and information pertaining to individual coaches and their schools will not be revealed in any future reports or publications. All data will be kept in locked and encrypted files on my computer. I will be the only one with the password to these files. Any data that is obtained in hard copy will be kept in a locked file. All data will be used for research purposes only and will be destroyed 5 years after the research has been completed. You will be provided with copies of transcripts of observations and interviews in which you were involved and will have the right to make any comments about those transcripts. At the end of the study, I will provide you with a report of significant findings. If, at that time, you have further questions regarding your individual case that you feel are not addressed in the report, I will be available to speak with you either in person or by phone to discuss them.
Participation in this study is voluntary. Should you agree to be involved in the study, you will have the right to withdraw at any time without penalty and all data pertaining to you will be destroyed upon withdrawal from the study. You also have the right to decline to answer any questions that you do not want to answer at any time in the study. There are no known risks to participating in this study.

If you would like to participate in this study please sign the consent form below. If you have any questions about the study, I would be happy to answer them for you. I can be reached at [phone number] or [email address]. You can also speak to my supervisor, Dr. Douglas McDougall at [phone number] or [email address]. If you have questions regarding your rights as a research participant, please feel free to contact the Office of Research Ethics at either [phone number] or [email address].

Thank you so much for your consideration. I greatly appreciate it.

Sincerely,
Shannon Larsen

Name: _______________________________

School: _______________________________

Date: ________________________________

Signature: _____________________________
Information Letter and Consent Form (Coaches)

My name is Shannon Larsen and I am a PhD Candidate at the Ontario Institute for Studies in Education, University of Toronto (OISE/UT). I am conducting a study entitled, “Elementary School Mathematics Teachers’ Perceptions of Coaching.”

The purpose of this study is to determine teachers’ perceptions of elementary mathematics coaching on their practice. More specifically, the aim of the research is to establish the ways in which the classroom practice of a teacher does or does not change when that teacher works with an elementary mathematics coach. I would like to invite you to participate in my research.

The data for this study will be gathered by me through a series of ongoing classroom observations, observations of meetings that occur with coaches and teachers, and two one-hour interviews with each teacher, coach, and principal.

If you agree to participate in the study, you will:

a) Review the “Attitudes and Practices for Teaching Math Survey” taken by your teachers with them in order to help you decide upon a goal for your work together.

b) Be observed by me during your work with two teachers. These will be observations of your work in each teacher’s classroom and will include lessons that are taught by the teacher in your presence, lessons that are modeled by you in the teacher’s presence, and lessons that are co-taught by you and the teacher. The observations will occur approximately once per week with each teacher over the course of four months.

c) Be observed by me during meetings between you and each teacher in the study, including professional development that you may provide. These observations will occur approximately once per week with each teacher over the course of four months.

d) Engage in two one-hour tape-recorded interviews with me. The first interview will occur at the beginning of the study and the second interview will occur at the end.

If you agree to participate all identifying information will be masked and pseudonyms will be used to ensure anonymity. The names and information pertaining to individual coaches and their schools will not be revealed in any future reports or publications. All data will be kept in locked and encrypted files on my computer. I will be the only one with the password to these files. Any data that is obtained in hard copy will be kept in a locked file. All data will be used for research purposes only and will be destroyed 5 years after the research has been completed. You will be provided with copies of transcripts of observations and interviews in which you were involved and will have the right to make any comments about those transcripts. At the end of the study, I will provide you with a report of significant findings. If, at that time, you have further questions regarding your individual case that you feel are not addressed in the report, I will be available to speak with you either in person or by phone to discuss them.
Participation in this study is voluntary. Should you agree to be involved in the study, you will have the right to withdraw at any time without penalty and all data pertaining to you will be destroyed upon withdrawal from the study. You also have the right to decline to answer any questions that you do not want to answer at any time in the study. There are no known risks to participating in this study.

If you would like to participate in this study please sign the consent form below. If you have any questions about the study, I would be happy to answer them for you. I can be reached at [phone number] or [email address]. You can also speak to my supervisor, Dr. Douglas McDougall at [phone number] or [email address]. If you have questions regarding your rights as a research participant, please feel free to contact the Office of Research Ethics at either [phone number] or [email address].

Thank you so much for your consideration. I greatly appreciate it.

Sincerely,
Shannon Larsen

Name: _______________________________

School: _______________________________

Date: _______________________________

Signature: _____________________________
Information Letter and Consent Form (Former Coach)

My name is Shannon Larsen and I am a PhD Candidate at the Ontario Institute for Studies in Education, University of Toronto (OISE/UT). I am conducting a study entitled, “Elementary School Mathematics Teachers’ Perceptions of Coaching.”

The purpose of this study is to determine teachers’ perceptions of elementary mathematics coaching on their practice. More specifically, the aim of the research is to establish the ways in which the classroom practice of a teacher does or does not change when that teacher works with an elementary mathematics coach. I would like to invite you to participate in my research.

The data for this study will be gathered by me through a series of ongoing classroom observations, observations of meetings that occur with coaches and teachers, and two one-hour interviews with each teacher, coach, and principal.

If you agree to participate in the study, you will be asked to engage in one hour long tape recorded interview with me.

If you agree to participate all identifying information will be masked and pseudonyms will be used to ensure anonymity. The names and information pertaining to individual coaches and their schools will not be revealed in any future reports or publications. All data will be kept in locked and encrypted files on my computer. I will be the only one with the password to these files. Any data that is obtained in hard copy will be kept in a locked file. All data will be used for research purposes only and will be destroyed 5 years after the research has been completed. You will be provided with copies of transcripts of observations and interviews in which you were involved and will have the right to make any comments about those transcripts. At the end of the study, I will provide you with a report of significant findings. If, at that time, you have further questions regarding your individual case that you feel are not addressed in the report, I will be available to speak with you either in person or by phone to discuss them.

Participation in this study is voluntary. Should you agree to be involved in the study, you will have the right to withdraw at any time without penalty and all data pertaining to you will be destroyed upon withdrawal from the study. You also have the right to decline to answer any questions that you do not want to answer at any time in the study. There are no known risks to participating in this study.

If you would like to participate in this study please sign the consent form below. If you have any questions about the study, I would be happy to answer them for you. I can be reached at [phone number] or [email address]. You can also speak to my supervisor, Dr. Douglas McDougall at [phone number] or [email address]. If you have questions regarding your rights as a research participant, please feel free to contact the Office of Research Ethics at either [phone number] or [email address].

Thank you so much for your consideration. I greatly appreciate it.

Sincerely,
Shannon Larsen

Name: _______________________________

Date: ________________________________

Signature: ___________________________